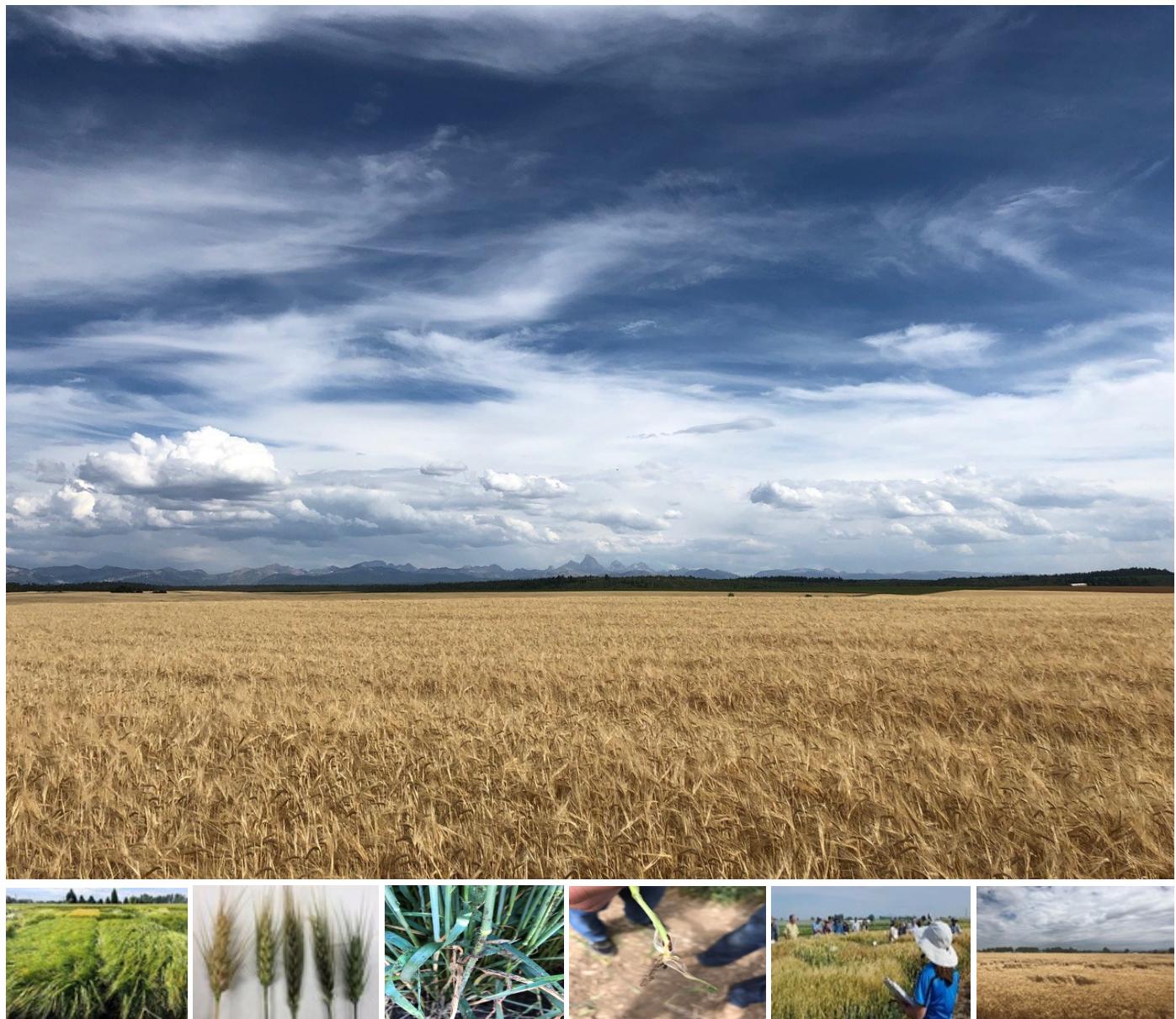


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2019 Small Grains Report

Southcentral and Southeast Idaho Cereals Research & Extension Program

Juliet Marshall, Belayneh Yimer, Tod Shelman, Linda Jones, Suzette Arcibal, Jon Hogge, Margaret Moll, Chad Jackson and Katherine O'Brien

Cover Images:

Top: Wheat field in the Squirrel area outside of Ashton, Idaho.

Bottom left to right: Idaho Falls Spring Nurseries, Fusarium Head Blight (*Fusarium graminearum*) on wheat and barley, Aphids on wheat, Hessian fly pupae on wheat, 2019 field demonstration day at Aberdeen R & E Center, Idaho, and lodged wheat field near Shelly, Idaho. Photo credit: Juliet Marshal.

Southcentral and Southeastern Idaho Cereals Research and Extension Program

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Kyle Wangemann and Scott Brown - Soda Springs
Mark, Craig and Jake Ozburn - Soda Springs
Gilbert and Carl Hofmeister - Rockland
Trevor Davey - Ririe
Duane Grant and Taylor Grant - Rupert
Alan Baum - Ashton
Luke Adams - Rupert
Marc Thiel - Idaho Falls

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Disclaimer Statement

This report represents research in progress and results may change with additional testing. Recommendations for use or non-use of any variety tested in these trials is not stated or implied. Inclusion of a variety in these trials cannot be construed as recommending that variety over varieties not included in the trials.

ALWAYS read and follow the instructions printed on pesticide labels. The pesticide recommendations in this UI publication do not substitute for instructions on the label. Due to constantly changing pesticide laws and labels, some pesticides may have been cancelled or had certain uses prohibited. Use pesticides with care. Do not use a pesticide unless both the pest and the plant, animal, or other application site are specifically listed on the label. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock. Trade names are used to simplify information; no endorsement or discrimination is intended.

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2019 Small Grains Report for Southcentral and Southeastern Idaho

***Juliet Marshall, Belayneh Yimer, Tod Shelman, Linda Jones, Suzette Arcibal, Jon Hogge,
Margaret Moll, Chad Jackson and Katherine O'Brien***

Additions and Changes:

The Soda Springs spring malt and feed barley nurseries were expanded from single rep demonstration plots to having some varieties replicated. The six-row spring barley nurseries were discontinued but a few six-row barley varieties were included in the two-row spring feed barley nurseries. The 2018 quality data for SRC (Solvent Retention Capacity) was included in this report.

Introduction

Increases in cereal grain yields result from a combination of genetic improvements in varieties and from improved agronomic practices. Studies have shown that genetic improvements have contributed more than 50 percent of the total improvement in yield over the past 30 or 40 years. The objective of the University of Idaho Small Grain Performance Trials is to provide an unbiased appraisal and evaluation of currently available varieties and advanced experimental lines over multiple locations and years. This information will assist Idaho producers in comparing and selecting varieties best suited to their particular area and growing conditions. Variety selection is an important part of the economic viability of Idaho crops, and crop enterprise budgets are available at the Department of Agricultural Economics and Rural Sociology website <https://www.uidaho.edu/cals/idaho-agbiz/crop-budgets>.

Varietal development programs strive not only for greater yield potential, but also for improved end-use quality, better disease and insect resistance, yield stabilization through improved winter hardiness, better straw strength, etc. Bringing a new variety

to the market place is a cooperative effort by many individuals.

Varieties are best evaluated by comparing performance over a number of locations and preferably over more than one year. Varietal performance can change in response to both environmental and cultural/management conditions. This report summarizes small grain (wheat and barley) trials conducted throughout Southcentral and Southeastern Idaho that were harvested in 2019, as well as milling and baking data from trials harvested in 2018.

Materials & Methods

Locations

Cereal trials were established at six winter and five spring locations throughout SC and SE Idaho during the fall of 2018 and the spring of 2019. For location details, please see the descriptions on pages 5 to 11. The Ririe, Rockland & Soda Springs winter and spring trials were grown under dryland conditions and all other trials were grown under irrigation. The trials at Aberdeen and Kimberly were grown at UI Research and Extension Centers, and the remaining trials were grown in producers' fields.

Agronomic Practices

Treated seed was planted at the following rates:

- Irrigated Wheat: 1,000,000 seeds per acre or approximately 95 pounds per acre.
- Irrigated Barley: 800,000 seeds per acre or approximately 80 pounds per acre.
- Dryland Wheat: 700,000 seeds per acre or approximately 65 pounds per acre.

- Dryland Barley: 600,000 seeds per acre or approximately 60 pounds per acre.

Row spacing was set at 7 inches using double disk openers for all irrigated locations and the Soda Springs winter and spring dryland locations. The Ririe dryland location used a 7-inch row spacing and no-till disk openers and the Rockland location used a 12-inch row spacing with shanks preceding double disk openers. Plots at all winter locations except for Aberdeen were planted 5 feet wide by 14 feet long then reduced back to 10 feet long using glyphosate herbicide or tillage. Aberdeen plots were planted 5 feet wide by 13.3 feet long then sprayed back to 9.3 feet long. Spring locations were planted 5 feet wide by 20 feet long then sprayed or tilled back to 16 feet. All entries were replicated 4 times at each location in a randomized complete block design. Except for planting and harvest operations, nitrogen fertilization, and miscellaneous maintenance, trials established in producers' fields received the same "grower management" or cultural operations as applied to the surrounding commercial wheat or barley field.

Nitrogen fertilizer in irrigated locations was managed according to the following methodology: Yield goals (bu/A) were set for each class at each location using historical yield data. These yield goals were used to calculate optimal fertility amounts according to the following methods: Soft white winter wheat, soft white spring wheat, and winter barley; lbs/acre nitrogen needed = 2 times yield goal. Hard winter and hard spring wheat; lbs/acre nitrogen needed = 2.5 times yield goal, plus 40 lbs nitrogen/acre topdressed at flowering. Spring 2 row and 6 row barley: lbs/acre nitrogen needed = 1.7 times the yield goal. Hard wheat nurseries received the remaining balance of nitrogen in urea (46-0-0) topdressed at heading using hand broadcast spreaders. Fertilizers and pesticides applied are listed on pages 6 to 11. Planting and harvesting operations by

university personnel were timed to approximately coincide with corresponding cooperator operations. All nurseries were harvested with Wintersteiger Classic small plot combines using Harvestmaster 800 Classic GrainGage systems and Mirus software.

Description of Agronomic Data

Each entry at each location was measured for grain yield, test weight, plant height, heading date, and lodging (when present).

- Yield is calculated at 60 pounds per bushel for wheat, and 48 pounds per bushel for barley.
- Test weight is reported in pounds per standard bushel.
- Plant height is reported in inches from the soil surface to the tip of the heads, awns excluded.
- Heading date is reported as the date when 50 percent of heads are fully emerged from the boot.
- Lodging is reported as the percent of the plot area that was not standing straight prior to harvest.

Description of End-use Quality Data

Grain protein for each variety in 2019 was analyzed with a Foss 6500 NIR grain analyzer. Protein data are found in conjunction with the agronomic data noted above in tables 4 to 64. These protein values are best utilized in comparisons between varieties within a nursery.

Due to the time necessary to complete milling and baking evaluations, test results from the Idaho Wheat Quality Laboratory are not available for the 2019 harvest in this report. Data are given for these characteristics from the 2018 harvest and are found in tables 65-78.

Milling and baking tests and plump seed evaluations use standardized testing methods and are described below:

- Flour protein: this is the flour protein content, measured on a fixed 14 percent moisture basis.

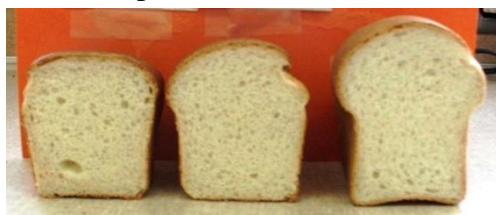
Lower numbers are better for soft wheat; higher numbers are preferred for hard wheat.

- Break flour yield: represents ease of milling or kernel softness; higher numbers are preferred.
- Flour yield: the percent of flour obtained from a sample of wheat; higher percentages are better.
- Whole grain protein percent: protein content of the whole grain on a 12 percent moisture basis. Lower percentages are preferred for soft wheat; higher percentages are preferred for hard wheat.
- Hardness value: a measure of kernel hardness; generally soft white wheats are below 45, hard wheats are above 45.
- SRC (Solvent Retention Capacity): a measure of the flour performance in absorbing water and flour quality.

Additional evaluations include the following:

Hard Wheats

Bake volume: This is the volume of an experimental loaf of bread measured in cubic centimeters and reflects protein quality per unit of protein; higher volume is preferred.



Soft Wheats

Cookie diameter: Diameter of a cookie in centimeters; larger numbers are better.



Barley

- Plump: Percent plump is the percent of a sample that stayed on top of a 5.5/64" x 3/4" slotted screen after shaking and consists of the 6/64" and 5.5/64" percentages combined. Both screen percentages are included in the report for increased precision.
- Thins: the percent of a sample that passed through a 5.5/64" x 3/4" screen after shaking.

Statistical Analyses

Data from each nursery were analyzed using SAS 9.4 software with the PROC GLM procedure. Fisher's protected LSD ($\alpha=.05$) was used for mean comparisons.

Statistical Interpretation

Most tables have a least significant difference (LSD) statistic at the bottom of the table. This statistic is given at the 5 percent error level and is an aid in comparing varieties. If the measured values of any two varieties within a table differ by the LSD value or more, they may be considered different with a confidence level of 95 percent. If the measured values are less than the LSD value, the differences may be due to random error rather than real differences. Coefficient of variation (CV percent) statistic is a general measurement of the precision of each experiment. Lower CV values indicate less experimental variation and greater precision. Most tables that do not have the LSD and CV statistic are averages over locations or years where specific statistical analyses were not run on the combined data or are from data obtained from only one replication or are from a composite sample of all replications (e.g. quality data). Most tables from individual locations also contain yield data from two previous years. The average, LSD, and CV for these data represent the original data set,

not just the selected varieties presented in these tables. The Pr>F value shows the validity of the LSD value above it; if the Pr>F value is equal to or greater than .05 (e.g. .1504; .6250), then the LSD value is void. This does not mean there are not differences between the varieties, it simply means differences cannot be determined at the 95% confidence level we set.

Varieties Tested

A list of released varieties tested in 2018-2019 is given in Table 1. Included in this table are seed weight (thousand kernel weight), number of seeds per pound and the adjusted seeding rate. Information is also given on the year of release and the releasing agency or company. A short description of selected varieties is given in Table 2. Additional information is available from the releasing agency or company.

Seasonal average measurements of several plant growth characteristics from the variety trials are shown in Table 3 for the time period of 2009-2019.

Southcentral & Southeast Idaho Cereal Variety Trial Locations

Winter Locations

Kimberly	Irrigated
Rupert	Irrigated
Aberdeen	Irrigated
Ririe	Dryland
Rockland	Dryland
Soda Springs	Dryland

Spring Locations

Rupert	Irrigated
Aberdeen	Irrigated
Idaho Falls	Irrigated
Ashton	Irrigated
Soda Springs	Dryland



Location Descriptions

Kimberly Winter Irrigated:

Kimberly Research & Extension Center
3825 N. 3600 E. Kimberly, ID

Coordinates: **42°33'9.52"N 114°20'59.19W**

Elevation: **3892 ft.**

Soil Type: **#86 Portneuf silt loam, 0 to 2 % slopes**

Previous Crop: **2018 fallow, 2017 was potatoes**

Planting Date: **September 25, 2018**

Harvest Date: **August 6 & 7, 2019**

Chemicals applied: **Huskie 15 oz./A, AxialStar 16 oz./A**

Fertility:

	Organic matter	pH	Free Lime %	Hard winter wheat N#/A	Soft white winter wheat N#/A	P	K	S
12" soil test results (N & S= 0-24")	2.3	7.9	1.8	269	269	37 ppm	549ppm	25ppm
Fertilizer applied (lbs/A)				120	10	50#		50# S
Total	2.3	7.9	1.8	389	279	37+ ppm	549+ ppm	25ppm

Rupert Winter Irrigated:

Cooperator: Luke Adams
Located at junction of Meridian Road and 500 N. Rupert, Idaho

Coordinates: **42°41'31.36"N 113°39'55.26"W**

Elevation: **4182 ft.**

Soil Type: **#24 Portneuf silt loam, 1-4% slopes**

Previous Crop: **Winter Barley**

Planting Date: **September 28, 2018**

Harvest Dates: **July 31 & August 1, 2019**

Chemicals applied: **Brox-M 1 pt./A, AxialStar 16 oz./A**

Fertility:

	Organic Matter	pH	Free Lime %	Hard winter wheat N#/A	Soft white winter wheat & winter barley N #/A	P	K	S
12" soil test results (N & S= 0-24")	1.2	7.7	2.2	115	115	31 ppm	380 ppm	63 ppm
Fertilizer applied (lbs/A)				245 (150+60+40)	150	70#	8#	78#
Total	1.2	7.7	2.2	360	265	31+ppm	380+ ppm	63+ppm

Location Descriptions

Aberdeen Winter Irrigated:

**Aberdeen Research & Extension Center
1693 S. 2700 W. Aberdeen, ID**

Coordinates:	42°57'34.46"N, 112°49'18.49"W							
Elevation:	4405 ft.							
Soil Type:	DeA Declo loam, 0-2% slopes							
Previous Crop:	Green Manure Oats							
Planting Date:	September 24, 2018							
Harvest Dates:	August 9, 12 &13, 2019							
Chemicals applied:	Brox-M 1 pt/A, Starane Ultra 6 oz/A							

Fertility:

	Organic Matter	pH	Free Lime %	Hard winter wheat N#/A	Soft white winter wheat & winter barley N#/A	P	K	S
12" soil test results (N & S= 0-24")	.9	8.0	8.0	230	230	18 ppm	251 ppm	48 ppm
Fertilizer applied (lbs/A)				185	75	50#	20#	50#
Total	.9	8.0	8.0	415	305	18+ppm	251+ ppm	48+ppm

Ririe Winter Dryland:

Cooperator: Trevor Davey

Approximately 3 miles south of Ririe Reservoir Dam on Meadow Creek Rd Ririe, ID

Coordinates:	43°32'53.49"N 111°42'41.84"W							
Elevation:	5616 ft.							
Soil Type:	#42 Ririe silt loam, 4-12% slopes							
Previous Crop:	Fallow							
Planting Date:	October 3, 2018							
Harvest Date:	September 3, 2019							
Chemicals applied:	Huskie 15 oz./A, AxialStar 16 oz./A							

Fertility:

	Organic Matter	pH	Free Lime %	Hard winter wheat N#/A	Soft white winter wheat N#/A	P	K	S
12" soil test results (N & S= 0-24")	1.4	6.2	<1.0	86#	86#	35 ppm	360 ppm	18 ppm
Fertilizer applied (lbs/A)				6	6	30 #		
Total	1.4	6.2	<1.0	92	92	35+ppm	360 ppm	18 ppm

Location Descriptions

Rockland Winter Dryland:

Cooperators: Gilbert and Carl Hofmeister

1.5 mile west of Rock Creek Rd on Deeg Rd, Rockland, ID

Coordinates:

42°39'42.98"N, 112°57'29.42"W

Elevation:

4640 ft.

Soil Type:

#51 Newdale silt loam, 4-12% slopes

Previous Crop:

Fallow

Planting Date:

September 20, 2018

Harvest Date:

August 1&2, 2019

Chemicals applied:

No Herbicide Application

Fertility:

	Organic Matter	pH	Free Lime %	Winter wheat N#/A	P	K	S
Fertilizer applied (lbs/A)				50#			25#

Soda Springs Winter Dryland:

Cooperators: Mark, Craig, and Jake Ozburn

1 3/4 miles west of Govt Dam Rd on Sorensen Rd Soda Springs, ID

Coordinates:

42°46'43.92"N, 111°41'53.20"W

Elevation:

6208 ft.

Soil Type:

485BB Foundem - Kackley complex
1 to 8% slopes

Previous Crop:

Fallow

Planting Date:

October 1, 2018

Harvest Date:

September 16, 2019

Chemicals applied:

Huskie 15 oz/A, Axial Star 16 oz/A

Fertility:

	Organic Matter	pH	Free Lime %	Winter wheat N#/A	P	K	S
12" soil test results (N & S= 0-24")	2.1	7.2	<1.0	137	28 ppm	390 ppm	19 ppm
Fertilizer applied (lbs/A)							
Total	2.1	7.2	<1.0		28 ppm	390 ppm	19 ppm

Location Descriptions

Rupert Spring Irrigated:

Cooperator: Grant 4-D Farms
Approximately 825 E. 700N., Rupert, ID

Coordinates: **42°43'14.46"N, 113°30'29.98"W**
Elevation: **4253 ft.**
Soil Type: **#36 Sluka silt loam, 1 to 4% slopes**
Previous Crop: **Sugar Beets**
Planting Date: **March 26, 2019**
Harvest Dates: **August 14&15, 2019**
Chemicals applied: **Brox-M 1 pt/A, AxialStar 16 oz./A**

Fertility:

	Organic Matter	pH	Free Lime %	Hard Spring wheat N#/A	Soft white spring wheat & spring barley N#/A	P	K	S
12" soil test results (N & S= 0-24")	1.3	7.9	1.3	60	60	19 ppm	197 ppm	21 ppm
Fertilizer applied (lbs/A)				332	222			61#
Total	1.3	7.9	1.3	392	282	19+ppm	197 ppm	21 ppm

Aberdeen Spring Irrigated:

Aberdeen Research & Extension Center
1693 S. 2700 W., Aberdeen, ID

Coordinates: **42°57'24.58"N, 112°49'27.12"W**
Elevation: **4404 ft.**
Soil Type: **DeA Declo loam, 0-2% slopes**
Previous Crop: **Green Manure Oats**
Planting Date: **April 19, 2019**
Harvest Date: **August 23 & 26, 2019**
Chemicals applied: **Brox-M 1 pt/A, Starane Ultra 6 oz/A**
Fertility:

	Organic Matter	pH	Free Lime %	Hard Spring wheat N#/A	Soft white spring wheat & spring barley N#/A	P	K	S
12" soil test results (N & S= 0-24")	0.9	8.0	8.1	147	147	49 ppm	326 ppm	65 ppm
Fertilizer applied (lbs/A)				210	100	50#	20#	100# S, 30# SO ₄
Total	0.9	8.0	8.1	357	247	49+ppm	326+ppm	65+ppm

Location Descriptions

Idaho Falls Spring Irrigated:

Cooperator: Marc Thiel

Approximately 2834 S. on 35th West Idaho Falls, ID

Coordinates:

43°28'16.97"N, 112°6'17.44"W

Elevation:

4693 ft.

Soil Type:

#22 Pancheri silt loam, 0-2% slopes

Previous Crop:

Alfalfa

Planting Date:

April 29, 2019

Harvest Date:

August 27, 2019

Chemicals applied:

Huskie 15 oz/A, AgriStar D-638 6 oz/A

Fertility:

	Organic Matter	pH	Free Lime %	Hard Spring wheat N#/A	Soft white spring wheat N#/A	P	K	S
12" soil test results (N & S= 0-24")	1.4	7.4	2.3	46	46	18 ppm	172 ppm	65 ppm
Fertilizer applied (lbs/A)				165	70	30#		36#
Total	1.4	7.4	2.3	211	116	18+ppm	172+ ppm	65 + ppm

Ashton Spring Irrigated:

Cooperator: Alan Baum

Approximately 3750 E. 1200 N. Ashton, ID

Coordinates:

44°3'25.27"N, 111°24'17.17"W

Elevation:

5330 ft.

Soil Type:

#76 Marystow Robinlee-Rexburg, hard pan substratum silt loams, 1 to 4 % slope

Previous Crop:

Potatoes

Planting Date:

April 30, 2019

Harvest Date:

September 4, 2019

Chemical applied:

Brox - M 16 oz/A, Axial Star 16 oz/A

Fertility:

	Organic Matter	pH	Free Lime %	Hard Spring wheat N#/A	Soft white spring wheat & spring barley N#/A	P	K	S
12" soil test results (N & S= 0-24")	1.8	5.9	<1.0	77	77	23 ppm	230 ppm	23 ppm
Fertilizer applied (lbs/A)				260	170		40#	20#
Total	1.8	5.9	<1.0	337	247	23 ppm	230+ ppm	23+ ppm

Location Descriptions

Soda Springs Spring Dryland:

Cooperators: Kyle Wangemann and Scott Brown

11 miles north of Hooper Springs on Government Dam Road, Soda Springs, ID

Coordinates:

42°46'48.41"N 111°38'31.40"W

Elevation:

6149 ft.

Soil Type:

#485BB - Foundem - Kackley complex,
1 to 8 % slopes

Previous Crop:

Spring Barley

Planting Date:

May 10, 2019

Harvest Date:

September 16, 2019

Chemicals applied:

Huskie 12 oz/A, Axial Star 16 oz/A

Fertility:

	Organic Matter	pH	Free Lime %	Hard Spring wheat N#/A	Soft white spring wheat N#/A	P	K	S
12" soil test results (N & S= 0-24")				NA	NA			
Fertilizer applied (lbs/A)	10# Zn			50	50	80#		10#
Total				50	50			

Temperature and irrigation/precipitation totals for all locations, recorded with on-site weather stations provided with financial support from the Idaho Wheat Commission.

Variety Trial Site	Dates of station recording range	Maximum temperature °F	Minimum temperature °F	# of days above 90°F	# of days below 50°F	# of days below 40°F	Spring & Summer Precipitation and Irrigation
Kimberly	April 23 - August 8, 2019	114.9	24.4	26	75	22	19.35
Rupert winter	April 25 - August 1, 2019	109.6	21.4	24	71	32	13.94
Ririe	June 5 - September 3, 2019	97.6	28.1	23	48	9	1.37
Rockland	June 7 - August 2, 2019	104.3	26.4	25	37	8	0.56
Soda Springs winter	June 6 - September 16, 2019	98.9	26.2	17	102	56	3.31
Rupert spring	May 14 - August 15, 2019	107.7	30.6	31	62	8	17.57
Idaho Falls	June 5 - August 27, 2019	97.9	8.9	49	79	76	15.11
Ashton	June 20 - September 4, 2019	97.9	29.1	18	62	12	6.24
Soda Springs spring	June 6 - September 16, 2019	93.8	25.0	15	101	47	3.26

Table 1. Released varieties tested in 2018-2019 with seed size and adjusted seeding rate.

Variety	Exp. No.	Kernel Weight (g)	Seeds per Pound	Adjusted Seeding Rate ¹ (lb/A)	Released Year	Developer(s)/Distributor of variety
Soft White Winter Wheat						
Appleby CL+	ORI2161250CL+	43	10,549	95	2019	Oregon State AES
Brundage	ID86-14502B	42	10,930	91	1996	Idaho AES
Bruneau	ID93-64901A	36	12,600	79	2009	Idaho AES
Devote	WA8271	48	9,549	105	2019	Washington State University and USDA-ARS
Eltan	WA7431	39	11,782	85	1990	Washington State University and USDA-ARS
Jasper	WA 8169	43	10,673	94	2015	Washington State University and USDA-ARS
LCS Artdeco	NSA06-2153A	42	10,930	91	2011	Limagrain Cereal Seeds, LLC
LCS Blackjack	LWW15-71945	47	9,651	104	2019	Limagrain Cereal Seeds, LLC
LCS Drive	LWW12-7105	40	11,484	87	2015	Limagrain Cereal Seeds, LLC
LCS Ghost	LWW14-74143	41	11,063	90	2018	Limagrain Cereal Seeds, LLC
LCS Hulk	LWW14-73163	41	11,200	89	2017	Limagrain Cereal Seeds, LLC
LCS Shark	LWW14-71195	49	9,257	108	2017	Limagrain Cereal Seeds, LLC
LCS Shine	LCS72916	36	12,600	79	2018	Limagrain Cereal Seeds, LLC
LCS Sonic	LWW14-73161	41	11,200	89	2017	Limagrain Cereal Seeds, LLC
Nixon	OR2121086	48	9,450	106	2019	Oregon State AES
Norwest Duet	LOR-092	44	10,428	96	2015	OSU /Limagrain Cereal Seeds, LLC
Norwest Tandem	LOR-334	41	11,063	90	2016	OSU /Limagrain Cereal Seeds, LLC
OR2X2CL+	ORI2150031Cl+	21	21,600	46	2019	Oregon State AES
Otto	WA008092	39	11,631	86	2011	Washington State University and USDA-ARS
Purl	WA8234	44	10,309	97	2018	Washington State University and USDA-ARS
Rosalyn	OR2071071	37	12,259	82	2013	Oregon AES, USDA
Stephens	OR65-116	42	10,930	91	1977	Oregon AES, USDA
Stingray CL+	WA8275CL+	48	9,450	106	2019	Washington State University and USDA-ARS
SY Assure	04PN096-2	38	11,937	84	2016	AgriPro /Syngenta Cereals
SY Dayton	09PN062#18	44	10,428	96	2017	AgriPro /Syngenta Cereals
SY Ovation	03PN108#21	45	10,080	99	2011	AgriPro /Syngenta Cereals
SY Raptor	04PN046#16	52	8,808	114	2017	AgriPro /Syngenta Cereals
UI Castle CLP	IDN 09-DH10	38	11,937	84	2015	Idaho AES / Limagrain Cereal Seeds
UI Magic CLP	IDN 09-DH11	39	11,631	86	2015	Idaho AES / Limagrain Cereal Seeds
UI Sparrow	IDO1108DH	35	12,960	77	2016	Idaho AES
VI Bulldog	UIL 07-28017B	40	11,484	87	2019	Idaho AES / Limagrain Cereal Seeds, LLC
WB 456	BU6W99-456	39	11,631	86	2009	Bayer Crop Science / WestBred
WB1376CLP	WB-1030CL	41	11,200	89	2014	Bayer Crop Science / WestBred
WB1529	BZ6W07-436	48	9,549	105	2013	Bayer Crop Science / WestBred
WB1783	BZ6W09-471	45	10,193	98	2016	Bayer Crop Science / WestBred
Hard Red and White (W) Winter Wheat						
AP NuGrain (W)	W96-530-053W	25	18,144	55	2006	AgriPro /Syngenta Cereals
AP Redeye	05PN044-20	44	10,428	96	2019	AgriPro /Syngenta Cereals
Bobcat	MTS1588	28	16,495	61	2019	Montana AES
Curlew	UT9325-55	36	12,600	79	2009	Utah AES, USDA
Deloris	UT2030-32	39	11,631	86	2002	Utah AES, USDA
FourOSix	MT1462	36	12,777	78	2018	Montana AES
Golden Spike (W)	UT1944-158	33	13,957	72	1999	Utah AES, USDA
Greenville	UT9743-42	36	12,600	79	2011	Utah AES, USDA
Irv (W)	OR2110679	37	12,259	82	2018	Oregon State AES
Juniper	IDO 575	42	10,930	91	2005	Idaho AES, USDA
Keldin	ACSS55017	45	10,080	99	2011	Bayer Crop Science / WestBred
LCS Jet	NSA 7208	46	9,861	101	2015	Limagrain Cereal Seeds, LLC
LCS Rocket	NSA10-2196	46	9,969	100	2018	Limagrain Cereal Seeds, LLC
LCS Yeti (W)	LCII3DH-2222	46	9,861	101	2018	Limagrain Cereal Seeds, LLC
LCS Zoom	LWH14-73915	38	12,096	83	2019	Limagrain Cereal Seeds, LLC
Millie (W)	OR2130118H	39	11,782	85	2019	Oregon State AES
Northern	MT0978	32	14,175	71	2015	Montana AES
Norwest 553	ORN00B553	36	12,600	79	2007	Oregon State AES, USDA-ARS, Limagrain U.K.
Promontory	UT1567-51	37	12,259	82	1990	Utah AES, USDA
Ray	MTF1432	38	11,937	84	2018	Montana AES
Scorpio	WA8268	38	12,096	83	2019	Washington State University and USDA-ARS
Sequoia	WA8180	40	11,340	88	2015	Washington State University and USDA-ARS
SY Clearstone 2CL	MTCL1077	38	12,096	83	2012	AgriPro /Syngenta Cereals
SY Touchstone	04PN028B-3	41	11,200	89	2016	AgriPro /Syngenta Cereals
UI Bronze Jade (W)	IDO1706	37	12,427	80	2019	Idaho AES
UI Silver (W)	IDO658B	33	13,745	73	2011	Idaho AES, USDA
UI SRG	IDO656	40	11,340	88	2012	Idaho AES, USDA
UICF-Grace (W)	IDO651	37	12,427	80	2009	Idaho AES, USDA
Utah 100	UT1650-150	39	11,782	85	1997	Utah AES, USDA
WB4311	XA4104	47	9,651	104	2017	Bayer Crop Science / WestBred
WB4623CLP	BZ9WM09-1663	36	12,777	78	2014	Bayer Crop Science / WestBred
WB4792		35	13,148	76	2018	Bayer Crop Science / WestBred
Whetstone	W98-344	38	11,937	84	2009	AgriPro /Syngenta Cereals
Yellowstone	MT00159	40	11,484	87	2005	Montana AES

¹ Adjusted to plant 1 million seeds per acre under irrigation according to the number of seeds per pound for each variety.

Table 1 (cont'd). Released varieties tested in 2018-2019 with seed size and adjusted seeding rate.

Variety	Exp. No.	1000	Seeds	Adjusted	Released	Developer(s)/Distributor of variety
		Kernel	per Pound	Seeding Rate ¹ (lb/A)		
Soft White Spring Wheat						
Alturas	IDO526	29	15,641	64	2002	Idaho AES, USDA
AP Coachman	08PN2001-07	47	9,651	104	2020	AgriPro / Syngenta Cereals
Louise	WA7921	36	12,777	78	2004	Washington AES, USDA
Melba (club wheat)	WA8193	31	14,632	68	2016	Washington AES, USDA
Ryan	WA8214	35	13,148	76	2016	Washington AES, USDA
Seahawk	WA8162	46	9,861	101	2015	Washington AES, USDA
SY Saltese	SY3024-2	41	11,063	90	2016	AgriPro / Syngenta Cereals
Tekoa	WA8189	43	10,673	94	2016	Washington AES, USDA
UI Cookie	IDO1405S	42	10,800	93	2019	Idaho AES, USDA
UI Pettit	IDO632	28	16,200	62	2006	Idaho AES, USDA
UI Stone	IDO599	37	12,259	82	2012	Idaho AES / Limagrain Cereal Seeds
WB1035CL+		44	10,428	96	2011	Bayer Crop Science / WestBred
WB6121	BZ608-121	40	11,484	87	2013	Bayer Crop Science / WestBred
WB6430	BZ608-125	37	12,259	82	2013	Bayer Crop Science / WestBred
Hard Red Spring Wheat						
Alum	WA8166	44	10,428	96	2015	Washington AES, USDA
AP Octane	USW112000024-1-4	43	10,673	94	2019	AgriPro / Syngenta Cereals
AP Renegade	06PN3017-9	43	10,549	95	2018	AgriPro / Syngenta Cereals
AP Venom	USW112000083-1-3	42	10,800	93	2019	AgriPro / Syngenta Cereals
Cabernet	95WV10616	36	12,600	79	2007	AgriPro / Syngenta Cereals
Choteau	MT9920	43	10,673	94	2003	Montana AES
Dagmar	MT16121	40	11,340	88	2019	Montana AES
Duclair	MT0832	37	12,259	82	2011	Montana AES
Glee	WA8074	46	9,969	100	2012	Washington AES, USDA
Jefferson	IDO462	38	12,096	83	1998	Idaho AES, USDA
Net CL+	WA8280 CL+	43	10,549	95	2019	Washington AES, USDA
SY Coho	04W40292R	43	10,673	94	2015	AgriPro / Syngenta Cereals
SY Gunsight	06PN3015-08	34	13,540	74	2017	AgriPro / Syngenta Cereals
SY Selway	04PN3001-2	36	12,600	79	2015	AgriPro / Syngenta Cereals
WB9411	BZ908-418	34	13,540	74	2014	Bayer Crop Science / WestBred
WB9590	F9N12-0151	45	10,080	99	2016	Bayer Crop Science / WestBred
WB9668	BZ908-552	36	12,600	79	2013	Bayer Crop Science / WestBred
WB9879CLP	IMICHT79	38	12,096	83	2011	Montana AES / Bayer Crop Science / WestBred
Hard White Spring Wheat						
Dayn	WA8123	43	10,549	95	2012	Washington AES / AgriPro / Syngenta Cereals
Klasic	NK77S1817	36	12,777	78	1982	Northrup-King Co., Minneapolis, MN
SY Teton	SY10136	58	7,821	128	2015	AgriPro / Syngenta Cereals
UI Platinum	IDO694C	42	10,800	93	2014	Idaho AES, Anderson Group
WB7202CLP	XA7320	42	10,930	91	2017	Bayer Crop Science / WestBred
WB7328	BZ9S09-0133W	47	9,755	103	2014	Bayer Crop Science / WestBred
WB7589	BZ9S09-0735W	48	9,549	105	2014	Bayer Crop Science / WestBred
WB7696		42	10,930	91	2018	Bayer Crop Science / WestBred
Spring Durum Wheat						
Alzada	YU894-75	41	11,063	90	2003	Bayer Crop Science / WestBred
Imperial	PH833-15	45	10,080	99	1987	Bayer Crop Science / WestBred
Winter Barley - malt						
Charles	94Ab1274	40	11,484	87	2005	USDA-ARS, Aberdeen
Endeavor	95Ab2299	40	11,484	87	2008	Idaho AES, USDA
KWS Donau		60	7,560	132		KWS Cereals
KWS Scala	GW2895	53	8,558	93	2012	KWS Cereals
KWS Sommerset	GW3479	55	8,247	97	2017	KWS Cereals
LCS Calypso		52	8,723	92		Limagrain Cereal Seeds, LLC
Thunder	10.0777	41	11,200	71	2016	Oregon AES, USDA
Wintmalt		44	10,428	77	2014	KWS Lochow
Winter Barley - feed and food						
Buck ²	09-OR-86	27	16,800	60	2014	Oregon AES, USDA
Eight-Twelve	79Ab812	33	13,957	72	1988	Idaho AES, USDA
Sunstar Pride	SDM204-B	34	13,540	74	1995	Sunderman Breeding, Twin Falls, ID
Upspring ²	05ARS748-270	42	10,930	91	2018	Idaho AES, USDA

¹ Adjusted to plant 1 million (800,000) seeds per acre for wheat (barley) under irrigation according to the number of seeds per pound for each² Hulless

Table 1 (cont'd). Released varieties tested in 2019 with seed size and adjusted seeding rate.

Usage Variety	Exp. No.	1000	Seeds	Adjusted	Year	Release Developer(s)/Distributor of variety
		Kernel Weight (g)	per Pound	Seeding Rate ¹ (lb/A)		
Two-Row Spring Barley						
feed Altorado	BZ509-601	45	10,080	79	2016	Highland Specialty Grains
feed Champion	YU501-385	52	8,723	92	2007	Highland Specialty Grains
feed Claymore	BZ509-216	50	9,164	87	2015	Highland Specialty Grains
feed Idagold II	C32	42	10,930	73	2002	Coors Brewing Co. Inc., Burley, ID
feed Lenetah	01Ab11107	46	9,861	81	2008	Idaho AES, USDA
feed Millennium (6R)	UT004603	32	14,175	56	2000	Utah AES, USDA
feed Oreana	BZ509-448	41	11,063	72	2015	Highland Specialty Grains
feed Xena	BZ594-19	42	10,930	73	2000	Highland Specialty Grains
food Goldenhart	2Ab09-X06F058HL-31	40	11,340	71	2018	Idaho AES, USDA
food Julie ²	03AH6561-94	45	10,080	79	2010	Idaho AES, USDA
food Kardia	2Ab09-X06F084-51	40	11,484	70	2016	Idaho AES, USDA
food Transit ²	03AH3054-51	46	9,861	81	2010	Idaho AES, USDA
malt AAC Connect	TR04282	46	9,861	81	2016	Agriculture Canada / Canterra Seeds
malt AAC Synergy	TR09208	39	11,782	68	2015	Agriculture Canada / Syngenta
malt ABI Eagle	2B11-4949	32	14,175	56	2018	Busch Agricultural Resources, LLC, Ft. Collins, CO
malt ABI Growler	2B09-3425	44	10,309	78	2015	Busch Agricultural Resources, LLC, Ft. Collins, CO
malt ABI Voyager	B3719	49	9,353	86	2011	Busch Agricultural Resources, LLC, Ft. Collins, CO
malt AC Metcalfe	TR232	40	11,340	71	1994	Agriculture Canada
malt Bente		51	8,894	90		Nordsaat Saatzucht GmbH
malt CDC Bow	TR11127	48	9,450	85	2017	CDC University of Saskatchewan/ SeCan
malt CDC Copeland	TR150	44	10,309	78	1999	CDC University of Saskatchewan/ SeCan
malt CDC Fraser	TR12135	45	10,193	78	2018	CDC University of Saskatchewan/ SeCan
malt Conrad	B5057	40	11,340	71	2004	Busch Agricultural Resources, LLC, Ft. Collins, CO
malt Esma		42	10,800	74		Ackermann Saatzucht GmbH & Co. KG
malt Explorer		45	10,080	79		Secobra Recherches
malt Fandaga		48	9,549	84		Nordsaat Saatzucht GmbH
malt Fangio	SC 9447 S2	45	10,080	79	2019	Secobra Recherches
malt Full Pint	BCD-47	48	9,549	84	2014	Oregon State University
malt GemCraft	2Ab08-X05M010-65	43	10,549	76	2018	USDA ARS, Idaho AES
malt LCS Genie	NSL07-8424-A	44	10,309	78	2011	Limagrain Cereal Seeds, LLC
malt LCS Odyssey	NSL08-4556-A	41	11,063	72	2015	Limagrain Cereal Seeds, LLC
malt Manta		42	10,800	74		Ackermann Saatzucht GmbH & Co. KG
malt Merit 57	2B99-2657	36	12,600	63	2009	Busch Agricultural Resources, LLC, Ft. Collins, CO
malt Moravian 69	C69	47	9,755	82	2005	Coors Brewing Co. Inc., Burley, ID
malt Moravian 179	C179	47	9,755	82	2018	Coors Brewing Co. Inc., Burley, ID
malt Sangria		44	10,309	78		Ackermann Saatzucht GmbH & Co. KG

¹ Adjusted to plant 800,000 seeds per acre under irrigation according to the number of seeds per pound for each variety.² Hulless

RESULTS AND DISCUSSION

Planting Conditions

The fall of 2018 provided good conditions for planting winter grain at irrigated locations but soil moisture at the dryland locations varied and at Soda Springs the trial was planted in dry ground. At Aberdeen, there was no September precipitation (see Chart 1), followed by a very wet October with a high degree of variability in the precipitation amounts throughout the year. The dryland conditions benefited from some October rains that improved the soil moisture prior to the onset of winter in eastern Idaho.

Spring planting conditions were good for stand establishment, and moisture in April was above average, resulting in excellent soil moisture for establishment and early growth. However, planting was delayed a little due to spring rain. Most locations were seeded a little later than the previous year.

Weather Conditions

Natural precipitation was below the 10-year and 105-year averages in September, December, June and August and above average in February and April (Chart 1). An early fall frost contributed to lower aphid populations and the subsequent transmission of barley yellow dwarf virus was reduced. High moisture conditions late winter resulted in heavy snow-pack and late spring plantings. Cool spring conditions resulted in seasonal deficits in growing degree days, which delayed crop maturity, with heading dates delayed 4-14 days. Seedlings of spring planted crops showed cold banding indicating multiple freezing events early in the season. Multiple frost events damaged winter and spring grains during heading and flowering, significantly reducing yields at some locations (see Aberdeen Research and Extension Center, Spring Grain on Table 35).

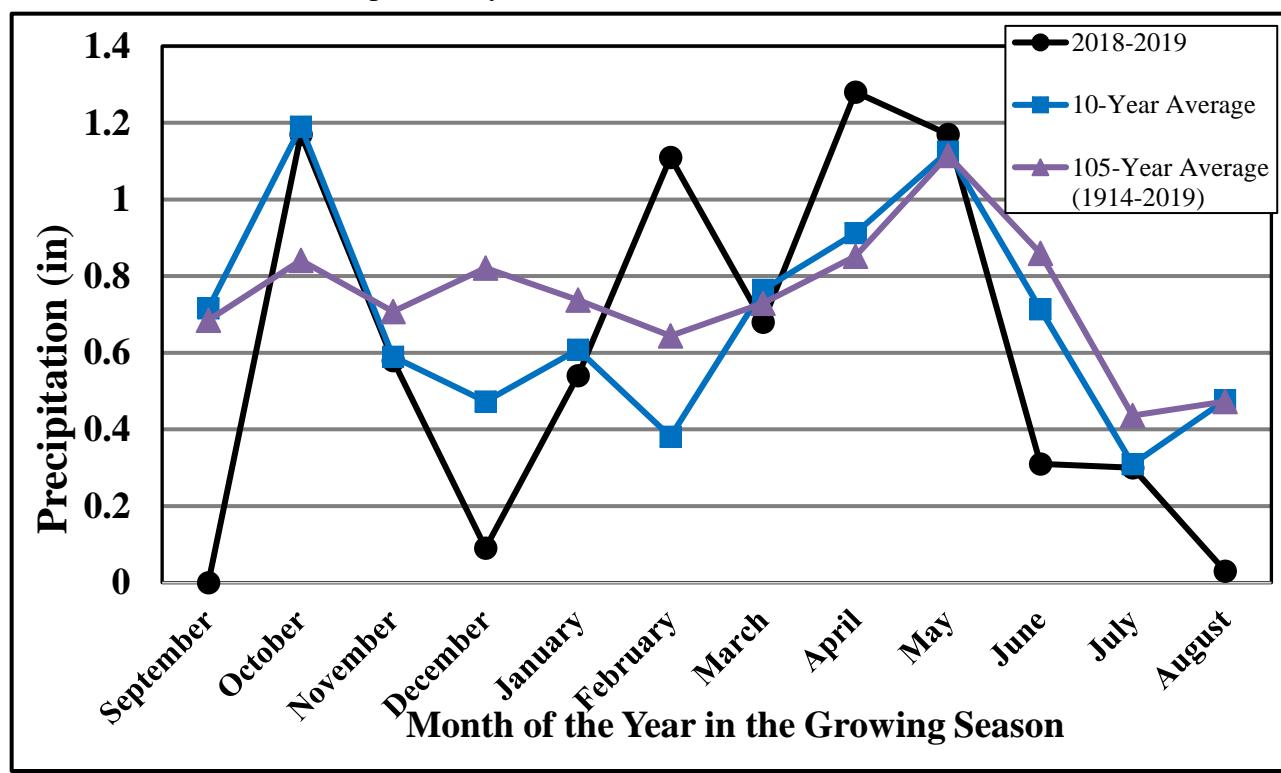


Chart 1. 2018-2019 growing year precipitation recorded at Aberdeen, ID, versus 10-year and 105-year averages. Source: NWS & Agrimet data.

Severe spring storms with multiple hail events severely damaged grain production in some areas throughout southern and eastern Idaho. The precipitation in June through August were average or below average, but there was enough subsoil moisture to finish off the dryland winter crop, and in some cases, the dryland spring crop.

A moderate weather pattern established in May and continued into June with summer temperatures being similar to the historical average. Over all locations, heading dates for winter wheat nurseries were five days later than the average of the previous ten years (Table 3). Spring wheat heading dates were two days later than previous ten-year average, and spring barley was four days later. Plant heights were higher than average for winter and spring crops. Lodging was low for fall crops, and higher than the previous ten years in spring crops. Trial yields for winter and spring wheat were above average, and below average for spring barley. Test weights were above average for winter wheat, and at 10-year averages for spring wheat and barley.

Crop quality was considered excellent with very little damage from Fusarium head blight (FHB) and very low vomitoxin levels detected overall.

Disease and Insect Problems

Overall, major insect and disease issues were limited to wireworms, stem sawfly, snow mold, late-season stripe rust and *Xanthomonas* black chaff / bacterial leaf streak. Physiological leaf spot (PLS) occurred in many winter wheat fields and varieties.

Late snows led to high snow-pack and in many areas of eastern Idaho, winter wheat was damaged by snow mold. Damage in several fields near Ashton led to almost 100% stand loss. Due to unusually severe

spring storms in April through May, hail directly damaged winter and spring grain, resulting in bent and broken stems and heads. Due to extensive tissue damage from hail and sleet, bacterial infection easily developed in those open wounds. As *Xanthomonas* bacteria are fairly ubiquitous throughout our grain production areas, bacterial leaf streak and black chaff quickly develop first on the leaves, then on the heads of cereal crops. Infection often occurs earlier in the season facilitated by hail events, then develops rapidly as the temperature increases and is spread via irrigation. There is very little that can be done to prevent or reduce the disease as fungicides are completely ineffective on bacteria. Reducing frequency of irrigation and increasing amount of irrigation may reduce how fast the disease spreads. Clean seed is also supposed to reduce likelihood of transmission to additional fields; however, the bacteria are everywhere, and hail events are unpredictable and uncontrollable. Effective measures to reduce the disease are often not practical or possible.

Wireworms (of various species) were damaging in many areas across the entire region, reducing stand and yield of spring wheat and barley in dryland production. Winter grain could be used to avoid wireworm damage as wireworms are less active in warmer, drier soils when winter wheat would be planted. However, emergence in dry soils is problematic, and winter kill increases under dry conditions. Insecticides applied as seed treatments reduce but do not control wireworms and the resultant feeding damage.

Wheat stem sawfly (*Cephus cinctus* Norton) was not as damaging in dryland spring grain when compared to previous years. The discovery of Hessian fly (*Mayetiola destructor* Say) in southern Idaho in 2015 raised a great deal of concern, as many of our currently grown varieties are not Hessian Fly resistant. The Hessian fly larvae

were discovered in late-planted spring wheat in the Parma area, and also can damage spring barley. There were no additional reports of Hessian fly in the subsequent growing seasons.

Volunteer grain continues to contribute to some green bridge conditions. Usually, early planted winter wheat and barley suffer from barley yellow dwarf (BYD) and wheat streak mosaic virus (WSMV) infections, but many producers have the equipment necessary to avoid having to plant too early to get all their acreage planted. Stripe rust did not appear to infect susceptible varieties of fall-planted wheat, preventing carryover.

Stripe rust (*Puccinia striiformis* f.sp. *tritici*) did not overwinter near the Oregon – Idaho border, but was found in Brundage soft white winter wheat and in susceptible spring wheat and barley varieties much later in the season. Susceptible spring wheat became severely infected late in the season, resulting in 20-25% yield loss compared to fungicide treated plots. Actively scouting fields of susceptible varieties is highly recommended in order to identify infection as early as possible. Fungicides can then be applied to prevent yield loss especially should stripe rust infect wheat plants prior to flowering. Susceptible varieties, such as Brundage, may need two fungicide applications to control stripe rust. Two-rowed barleys tend to have greater levels of resistance to stripe rust than do the six-rowed varieties, and surprisingly high levels of barley stripe rust was found in some two-rowed malt varieties in 2019.

Barley scald (*Rhynchosporium secalis*) did not reach the damaging levels of the previous years and was seen at low to intermediate levels. In most years, low levels of early season scald infection do little to affect the barley crop and yield, and can be ignored. Previous years (2009-2011) were not by any means typical, and scald ran rampant in fields in 2009 where application

of fungicides would have prevented significant crop loss. This will be a disease to watch in future years, especially as production of winter barley increases the chances of high levels of disease developing which then may affect early development in spring barley. Barley scald will also increase in minimum and no-till situations where the fungus may reside in residue.

Snow mold (*Typhula spp.*) occurs during long periods of snow cover when snow falls on unfrozen soil. Stand of winter wheat in upper elevation areas was reduced 75-100% in production fields around Ashton. Those fields were replanted with spring grain.

Strawbreaker foot rot (formerly *Pseudocercospora herpotrichoides* now *Ocumacula yallundae* and *O. acuformis*) is usually a stem-based disease in winter wheat and barley, but in some years can be found in spring grains. Strawbreaker occurred throughout the production region in 2019, and was as prevalent as incidences of take-all. Infection occurs from residue-borne fungi when there is excess moisture, humidity and cool temperatures through the winter and spring. Characteristic elliptical lesions form at the lower nodes of the stem, weakening the tiller and increasing lodging. This disease is exacerbated by rainy spring conditions and successive years of grain production. High rates of nitrogen also promote the disease, especially when applied alone without other ‘balancing’ nutrients. The most effective means of reducing this disease is through crop rotation. However, if detected early in the spring, this disease is reduced with the application of benomyl fungicides like Benlate, Topsin M, or Mertect.

Fusarium spp. causing foot rot, some **Rhizoctonia spp.** and **Take-all** (*Gaeumannomyces graminis* var. *tritici*) was prevalent in areas where grain follows grain. Fusarium occurs where deficit moisture conditions early in the season predispose

crops to infection and occurs where irrigation was not increased to compensate for moisture deficits. Dry land foot rot was not a problem in 2019. However, there were several spring wheat fields with severe Pythium and Rhizoctonia infections that occurred when volunteer plants were killed with herbicide immediately prior to planting. It is highly recommended to eliminate volunteer grain in the fall prior to winter setting in, or at least two to *three* weeks prior to spring sowing. Later planting reduces spring yield and quality, but substantial and greater yield reductions occur with soil-borne diseases in grain following grain. Diseases that spread from dying grain can cause a great deal of damage to the developing roots and seedlings of the newly planted crop, reducing tillering, water and nutrient uptake.

Rhizoctonia infections occurred in many production fields where winter wheat followed winter wheat. Symptoms were more severe with heavier wheat straw residue leading to reduced stands in affected areas, with the cool wet spring exacerbating the severity. Symptoms include stunting and yellowing of plants, fewer tillers and leaves with yellow stripes that resembled nutrient deficiencies. Best management practices include crop rotation and even distribution of straw at harvest with combine choppers/spreaders.

Pythium damaged winter wheat and early planted spring wheat and barley fields. Pythium can be very damaging to early planted spring grain when rains and cool temperatures followed planting, which was definitely an issue in 2019. Seed treatments with metalaxyl, mefenoxam and / or ethaboxam are important for preventing infection of vulnerable seedlings. There are strains of Pythium with resistance to metalaxyl / mefenoxam, that do not show resistance to ethaboxam fungicide.

Luckily, growing conditions in 2019 were not conducive to widespread grain infections of **Fusarium head blight (FHB)** (also called Head Scab, causal organisms *Fusarium graminearum* and other *Fusarium* spp.). Cool conditions at flowering were not favorable for infection. There were some localized problems in spring wheat and spring barley, especially in fields planted in and near corn residue, but overall the environment was not conducive to widespread FHB infection. A significant problem in 2015, FHB reduced yields and contaminated grain with toxins over multiple years - in 2011, 2012, 2014 and 2015. In 2015, *Fusarium graminearum* was widespread but **was not** restricted to where wheat follows corn production. Spores formed on corn residue can travel many miles in the wind. This disease was also severe where spring barley followed corn, as the fungus reproduces extensively on corn residue. Rejectable levels of deoxynivalenol toxin, (abbreviated as DON and also called VOM, short for vomitoxin), which is a by-product of the fungal infection process, contaminated 2015 malt barley and many acres of spring barley in the Rupert production region. It is highly recommended that irrigated spring grain be treated with an appropriate fungicide at flowering to reduce infection, especially when a hard white or hard red spring wheat or barley follows corn production. Even in 2019 where conditions did not favor FHB, low levels of DON (less than 2 PPM) were found in barley following corn. It is essential that a **triazole** fungicide be utilized, as strobilurin fungicides are ineffective in reducing the accumulation of toxins. (See Addendum 3a-3c for 2018 data of spring wheat reaction to FHB infection, and Addendum 4a-4c for spring barley.)

The “**Spot Form of Net Blotch**” (SFNB) of barley *Pyrenophora teres* f.sp. *maculata* was first diagnosed in a few fields near Blackfoot in 2013. In 2014, SFNB became severe in many areas throughout Idaho and Montana. This disease occurs widely in

North Dakota and the upper Mid-West, and can reduce yields by up to 50% and grain weight by 20%. SFNB was still problematic in 2019, especially in no-till situations, but was not as severe as in 2015. Areas that have reduced tillage and low crop diversity are at increased risk as this disease survives in barley stubble. Some varieties are more susceptible than others. Crop rotation and fungicide applications significantly reduce the impact of this disease. Fields that had been sprayed with fungicides at herbicide timing have been observed to have significantly less disease. Additional testing to develop control recommendations in our environment is required.

Cereal cyst nematode (*Heterodera avenae*) (CCN) damage was extensive in spring wheat and spring barley fields in the northern Snake River Plain, with visible damage in crops from Rexburg, Plano, and St. Anthony through the Ashton area. CCN affects all grassy crop species, and can even infect grassy weeds. Research conducted in St. Anthony with Dr. Richard Smiley (Professor Emeritus, Oregon State University) identified resistant and tolerant varieties of spring wheat and barley, and was published in 2015. Results of those screening trials are presented in the 2018 Small Grains report Addenda 8 for wheat and 9 for barley (available at the website). Crop rotation to broadleaf crops will substantially reduce CCN populations in the soil.

Green Bridge

A “green bridge” is generally defined as the overlap of different cropping cycles (or crop generations) within a year. This means there is a constant availability of living, green host material of a given crop. This occurs in many locations in southern and southeast Idaho for several reasons: 1) late maturing tillers (as in 2010) winter wheat stay green and growing even after harvest; 2) windy conditions causes shattering of spring grains (as in 2010) prior to complete maturity of

the crop; 3) hail storms induce shattering of grains prior to crop maturity. Shattered grain germinates and results in the continuous presence of living host material, which means there is a constant supply of host plant material for disease-causing organisms and insects; 4) In most years, volunteer grain blown out of the combine at harvest germinates and provides a green bridge, increasing the likelihood and risk of higher disease and insect problems for the next growing season. Many growers use the volunteer growth as feed or forage for livestock, but that can result in extensive carryover of pathogenic organisms from year-to-year. In years like 2019 where conditions are very dry in July, August and September, green bridge situations are less of a problem as there is little moisture for germination, unless irrigation is applied to stimulate germination of residual seed.

Other green bridge examples include heavy, unusual rains in August of 2014 prior to harvest, which resulted in extensive losses due to sprout but also set up green bridge conditions when grain shattered and germinated before harvesting of the 2014 crop could occur. Because of the green bridge, aphids and certain disease-causing organisms can jump to the emerging winter crop, causing direct damage and / or transmitting viruses. In 2015, many growers irrigated the volunteer for forage. With an early harvest and a long warm fall of 2015, the volunteer from the spring crop was in grain fill prior to a killing frost in November. The green bridge situation resulted in extensive BYD and stripe rust infection in the fall volunteer.

In the fall of 2014, 2015 and 2016, high populations of aphids moved into the earliest emerging winter wheat and barley, contributing to a widespread occurrence of BYD in southern Idaho. Corn is a ‘silent’ host of barley yellow dwarf virus, hosting high concentrations of the virus without symptoms or damage to corn. Late in the fall

season, aphids (especially English grain aphids and Bird-cherry oat aphids) move from corn to winter cereals, landing on the newly emerged grain and transmitting the virus to the new crop. Aphid populations may build up before a killing frost occurs. Severe stunting and yellowing of grain in the spring becomes apparent, resulting in yield reductions of over 50% in the most severely affected fields. However, in the spring of 2017, 2018 and 2019, lower levels of fall transmission occurred due to dry summers, delayed fall planting, use of insecticidal seed treatments and excellent growing conditions, preventing widespread losses from BYD.

2019 Report: Discussion of Location Conditions and Results

NASS in the USDA reports Idaho 2019 wheat yields at 88 bu/A over all categories (irrigated and dryland, winter and spring). Out of 1.195 million acres planted, 1.125 acres were harvested. For spring wheat, 440,000 acres were harvested of the 460,000 acres planted. For winter wheat, 684,000 acres were harvested of the 735,000 acres planted. Overall, quality was reported as good to excellent.

For barley, 520,000 of 540,000 acres planted in 2019 were harvested (NASS) for a total harvest of 54 million bushels. The average yield in the state was reported as 104 bu/A.

It is best to consider three year or multiple year, multiple site averages when choosing varieties for your specific location. Conditions vary tremendously from year to year, and one-year results can often be misleading. Yield stability and disease reactions often require many years and/or locations of evaluations. Balance selections based on yield, good test weight, protein levels appropriate to market class (low protein for soft wheats, high proteins for hard wheats) as well as disease resistance specific to your production zone. While the

multiple location/three-year average data presented in the Tables provide more accurate information, new varieties will have limited performance information, which may not be a good reflection of long-term performance.

Protein Targets

Hard Red Winter Wheat = 12.5% minimum
Hard Red Spring = 14.5% minimum
Soft White Winter = 10.5% (9-12%)
Soft White Spring = 10.5% (9-12%)
Club wheat <10%
Malt Barley = 9.5-12.5%

In several tables a duplicate of one variety per trial may have (QC) added for “Quality Control”, an internal measure of trial variability. All QC entries are a duplicate and technically should be exactly like the other same entry without the QC label attached. Ideally, the duplicate entries will be very close in yield and within the LSD for the trial. For example, under irrigation in Rupert (Table 34), Imperial QC yield was 113 bu/A, and Imperial was 109 bu/A, a difference of 4 bu/A. While that may seem significant, the LSD for the trial is 10.5 bu/A, indicating that differences of less than 10.5 are not statistically significantly different (with 95% confidence), and fall within the margin of error.

Keldin + 11-52-0 – In-furrow fertilizer was added to one variety in the hard winter group to test the effect of starter fertilizer on yield. (Monoammonium phosphate or 11-52-0 at 20 lbs phosphate per acre was included in-furrow.) In Table 6, Keldin +11-52-0 was 7 bu/A greater than Keldin without the starter fertilizer which is not considered statistically significant (LSD = 16 bu/A at $\alpha = .05$). Other agronomic traits were very similar indicating no effect of starter fertilizer. Under dryland conditions (Table 5), Keldin + 11-52-0 was 2 bu/A greater than Keldin, but with the site LSD of 5.2 bu/A, there also is no statistically significant difference between the two for yield.

Winter Wheat 3-Year Averaged Data

Three-year averages of hard winter wheat over all irrigated locations (Table 4, 10 site-years) put LCS Jet, Millie, Yellowstone and Keldin at the top with 159, 155, 155 and 153bu/A, respectively. The 50/50 blend of Norwest 553 and Yellowstone yielded the same as Yellowstone alone, but significantly higher than Norwest 553. Test weights were very good, averaging 61.6 lbs/bu. While yield average was below the highest yielding group, Whetstone did have a good combination of high test weight, protein and lower lodging. Protein targets for hard red winter wheat is 12.5%. **Averaged over all 2019 irrigated locations**, the highest yielding **hard winter wheat** varieties (Table 6) were LCS Jet (178 bu/A), AP Redeye (176 bu/A), Scorpio (174 bu/A) and Millie (171 bu/A). The hard white winter wheat Millie yield of 171 bu/A was not significantly greater than UI Bronze Jade hard white but poor quality will limit marketability of UI Bronze Jade.

Average 3-year dryland yields for hard red and white winter (Table 5) were 46 bu/A, where the top yielding varieties included SY Clearstone 2CL (52 bu/A), Deloris (51 bu/A), UI SRG (51 bu/A), Yellowstone (51 bu/A) and LCS Jet (51 bu/A). Deloris had a better combination of test weight and protein, but the average for these trials were still below 12.5%. **2019 combined dryland yields for hard red and white winter wheat** (Table 7) averaged 37 bu/A, with the highest yielding varieties at 45 bu/A (Deloris), 44 bu/A (UI Silver), 43 bu/A (SY Clearstone) and 41 bu/A (Sequoia, UI SRG, Yellowstone and WB4311).

The top yielding **soft white winter varieties over the last three years** over all **irrigated** locations (Table 15) are Bruneau (156 bu/A), SY Ovation (152 bu/A), UI Magic (149 bu/A), WB1783 (148 bu/A) and UI Castle (148 bu/A). Tall varieties like

Bruneau, UI Castle and UI Sparrow will have higher lodging. LCS Ghost, LCS Blackjack and WB1783 were the top named varieties in the **combined irrigated trials in 2019** at 188, 183, 181 and 175 bu/A, respectively (Table 17).

Average 3-year dryland yields for soft white winter (Ririe, Rockland and Soda Springs) (Table 16) were 47 bu/A, where the top yielding varieties included Eltan (52 bu/A), Otto (51 bu/A), WB1529 (51 bu/A), WB1783 (51 bu/A), UI Sparrow (51 bu/A) and Jasper (49 bu/A). WB1783 also had excellent test weight. 2019 combined dryland yields (Table 18) averaged 34 bu/A, with the highest yielding varieties at, 44 bu/A (Nixon), 41 bu/A (SY Dayton) and 40 bu/A (Stingray CL+). Test weights overall were low amongst the top yielders except for Devote, with average test weight of 60.9 bu/A and yield of 38 bu/A.

Winter Barley 3-Year Averaged Data

Three-year, multiple location averages for winter barley is presented in Table 26. Top yielding released varieties include Thunder (165 bu/A), Sunstar Pride (159 bu/A) and LCS Calypso (155 bu/A). There are both malt, feed and food lines in this table, with Buck and Upspring being hulless food lines with very high test weight – comparable to winter wheat. Thunder and LCS Calypso also had good spring stand, excellent plumps and excellent test weights. LCS Calypso also had very low lodging. For the **irrigated averages in 2019** (Table 27), the top yielding varieties are KWS Donau (186 bu/A), LCS Calypso (174 bu/A), KWS Somerset (170 bu/A) and KWS Scala (168 bu/A). Test weights averaged above 50 lbs/bu and grain proteins at 11.5%, except for the hulless food barleys Upspring and Buck with test weights close to 60 lb/bu.

Spring Wheat 3-Year Averaged Data

Over **three years over all locations**, the highest yielding hard spring varieties under irrigation (Table 31) were Dayn (hard white spring wheat at 126 bu/A), SY Teton (hard white at 119 bu/A), SY Coho (116 bu/A), SY Gunsight (114 bu/A). The hard reds with the best combinations of test weight and high protein include Alum, WB9411 and WB9668. The average 3-year test weight was 61.5 lbs/bu, and the average grain protein was 14.7%. High protein lines were WB9668 (16.1%), Alum (15.3%), WB9411 (15.0%) and the hard white WB7328 (15.2%). The **2019 combined irrigated average** (four locations) for hard spring wheat (Table 33) was 104 bu/A. AP Octane averaged 120 bu/A, AP Venom 120 bu/A, and Dayn 115 bu/A, all with protein less than 14%. High protein red lines were WB9668 (16.2%), WB9590 (15.5%) Alum (15.5%), WB9879CLP (15.4%), WB9411 (15.3%) and the white WB7328 (15.1%). (The durum variety Imperial also has high protein.)

There is only one **dryland location** for spring wheat (Soda Springs), three-year average data for which is in Table 32. Highest yielding hard spring varieties include Dayn (W) at 56 bu/A, WB9411 at 51 bu/A, UI Platinum at 47 bu/A and SY Selway at 46 bu/A.

Three-year averages for soft white spring wheat over all locations (Table 40) put WB6430 at the highest yield (124 bu/A), followed by Melba club wheat (122 bu/A), Tekoa, Alturas and Seahawk (all at 121 bu/A). The **2019 combined irrigated average** for soft white spring wheat (Table 42) was 108 bu/A., WB6121 yielded 117 bu/A, Melba club wheat yielded 115 bu/A UI Cookie 112 bu/A, and SY Saltese 110 bu/A. Test weight was 60.8 lbs/bu for the average, and grain protein 11.1%.

There is only one **dryland location** for soft white spring wheat (Soda Springs), three-year average data for which is in Table 41. Louise was the highest yielding variety at 58 bu/A, followed by UI Petit and UI Stone each 56 bu/A. Test weight average was 60.3 lbs/bu, and protein was 10.4%.

Spring Barley 3-Year Averaged Data

Spring malt varieties and feed/food lines are reported in separate tables.

Three-year averages for the malt varieties (Table 49) puts LCS Odyssey, LCS Genie, Explorer and Moravian 69 at the top (136, 133, 131 and 131 bu/A, respectively), all with excellent test weight and protein. Taking a look at **combined irrigated averages** for 2019 (Table 50), Fandaga, Bente, Moravian 179, Full Pint and Esma yielded 143, 143, 141, 135 and 131 bu/A respectively, all with excellent test weight, protein and plumps.

For the feed and food varieties, over three years, Millennium (six-rowed), Altorado, Oreana and Claymore were the highest yielding feed varieties (Table 57) at 143, 140, 140 and 135 bu/A, respectively. Julie was the highest yielding food barley, followed by Kardia (hulled), Julie, Transit and Goldenhart are hulless, as reflected in the very high test weight. In the **combined 2019 irrigated trials** (Table 58), the top yielding named varieties were Oreana (129 bu/A), Altorado (127 bu/A), Champion (117 bu/A) and the six-rowed Millennium (117 bu/A). Julie was the highest yielding food barley (109 bu/A).

Kimberly Research and Extension Center, Winter Grain

Winter wheat nurseries were planted into summer fallow September 25, 2018, in a field which was planted into potatoes in 2017 – and were planted into drier than optimal conditions. Irrigation helped provide conditions for uniform germination. The

crop suffered no winter damage and was planted late enough to avoid BYDV infection. Stripe rust was present at very low levels and not damaging. Plots were harvested August 6th and 7th. Soft white winter wheat yields were about 55 bu/A greater than 2018, and 70 bu/A greater than 2016, reflecting excellent irrigation practices. Hard winter wheat yields were about 60 bu/A greater than 2018 and 42 bu/A greater than 2017. Plots were harvested August 7, a week later than previous harvest dates.

The hard winter wheat group (Table 8) yield ranged from 155 to 197 bu/A. WB4792, UI Bronze Jade, LCS Rocket, Utah 100, Keldin and LCS Jet were the highest yielding varieties, yielding 193, 190, 188, 188, 187 and 185 bu/A, respectively. The mixed planting of Norwest 553 and Yellowstone yielded 183 bu/A, very similar to Yellowstone alone and 10 bu/A more than Norwest 553. The mix was planted with the objective of having Yellowstone in place to protect against the winter tender Norwest 553. In many years, Norwest 553 suffers extensive winter-kill. Planted in a dual mix, a grower could hedge bets between the winter hardiness of Yellowstone, the stripe rust resistance of Norwest 553, while combining the high yield potential of both. In 2019, there was a 10 bushel yield advantage over Norwest 553 to the mixed planting. Site average for yield of the hard winter group was 178 bu/A, 60 bushels more less than 2018 and 42 greater 2017. Test weight average was 62.1 lbs/bu, excellent for winter wheat, and grain protein average for the location was 11.3%. Total N available was 389 lbs N/acre. Optimal grain protein for hard red winter wheat should be 12.5% or greater. The ratio of applied N (178 average) to bu/A yield was 2.2, below the 3.0 to 3.5 ratio needed for optimal protein in hard winter wheat.

The entry of Keldin with 11-52-0 in-furrow yielded the same as the plots without starter

fertilizer. For an internal “Quality Control” (QC) Greenville was included as Greenville QC – from this as well as from the CV you can estimate the degree of variability of the test. The CV for this trial is very good (5.3%). The two separate entries of Greenville yielding at 179 and 177 bu/A, a difference of 2 bu/A. The LSD at 13.3 bu/A indicates that yield differences have to be greater than 13.3 bu/A to be considered statistically significantly different, which the duplicate Greenville entries were not.

In the soft white winter group (Table 19), 2019 irrigated yield varied from 146 to 207 bu/A with lower CV's for the location than in 2017 and 2018. LCS Ghost (205 bu/A), UI Castle CL+ (200 bu/A) and Purl (192 bu/A) were statistically the highest yielding varieties. Test weight averaged 60.7 lbs/bu, and grain protein average for the location was at 11.0%, indicating that available N met both yield and protein requirements for the crop. With a total of 279 lbs available N in the nursery (see site description on page 6) and average yield for soft white winter wheat nursery at 179 bu/A, the lbs of N to yield calculates to 1.6 lbs of nitrogen per bushel of yield.

Rupert, Luke Adams, Winter Grain

Plots were planted Sept 28th in silt loam soil following winter barley into good soil moisture and seedbed conditions. Spring stands of the winter wheat nurseries were very good, without the damage that occurred in 2017 from excessive snow, ponding water and freeze-thaw cycles. There were no visual symptoms of BYD occurring at this site. Plots were harvested August 1st.

Average yield for the hard winter wheat trial (Table 9) was 146 bu/A, 6 bu/A less than 2018 and 15 bushels greater than 2017. Yield ranged from 100 (LCS Yeti) to 168 bu/A for WA8289. Test weight averaged 59.7 lbs/bu, and protein averaged 12.2%. The ratio of average yield to total N was 360 / 146 = 2.5, below the 3.0-3.5 recommended

to obtain high protein (12.5% or greater) hard red winter wheat. As a result, the proteins of some varieties were lower than optimal with the trial average at 12.2%. LCS Jet, AP Redeye, Scorpio, Greenville, Millie and LCS Zoom were the highest yielding named lines at 167, 165, 164, 162, 158 and 158 bu/A, respectively. Stripe rust did not impact yield, and there was significant lodging.

The entry of Keldin with 11-52-0 in-furrow yielded 9 bu/A more than the plots without starter fertilizer but was still less than the 20 bu/A required to be considered statistically significant. For an internal “Quality Control” (QC) Greenville was included as Greenville QC – from this as well as from the CV you can estimate the degree of variability of the test. The CV for this trial is good (9.7%). The two separate entries of Greenville yielding at 162 and 151 bu/A, a difference of 11 bu/A. The LSD at 17.2 bu/A indicates that yield differences have to be greater than 17.2 bu/A to be considered statistically significantly different, which the duplicate Greenville entries were not.

The soft white winter group (Table 20) ranged in yield from 127 to 169 bu/A. The highest yielding varieties were WB1783 (169 bu/A), LCS Blackjack (165 bu/A), LCS Ghost (164 bu/A) and Bruneau (161 bu/A). Test weights averaged 59.8 lbs/bu. The ratio of available and applied N (265 lbs N/A) to average bushel yield (150) was 1.8 lbs N/bu. As a result, the proteins were lower than optimal with the trial average at 8.9%. There was lodging in the soft winter wheat nursery, especially of some varieties that would be better suited for dryland conditions.

Winter barley plots were harvested July 31st. Winter barley plots were plowed under in 2017 due to poor spring stands as a result of flooding and freeze-thaw cycles. 2018 plots averaged 147 bu/A, while this year the average yield was 124 bu/A (Table 28), with

yields ranging from 88 (Charles) to 173 bu/A KWS Donau). KWS Donau yield was substantially greater than LCS Calypso (151 bu/A) and Sunstar Pride (149 bu/A). Other high yielding winter barley varieties included KWS Somerset (146 bu/A) and KWS Scala (137 bu/A), all of which, except Sunstar Pride, are European malt lines. The ratio of available and applied N (265 lbs N/A) to average bushel yield (150) was 1.8 lbs N/bu. Proteins were good, averaging 11.3%, but there was extensive lodging in the winter barley nursery.

Aberdeen Research and Extension Center, Winter Grain

The winter trials in Aberdeen were planted September 24th in a Declo loam soil into good seedbed conditions and soil moisture, and harvested August 9, 12, and 13th. BYD and was not observed in the winter grain, however stripe rust did infect susceptible varieties and the data is reported in Addendum 1 & 2. The preceding crop was green manure oats.

The winter barley at Aberdeen had extensive winter damage in 2017, but survived well in 2018 and this year, with 2019 average spring stands at 95-100%. Winter barley yields were as high as 214 bu/A with an overall average of 178 bu/A (Table 29), 7 bu/A less than in 2018 and 59 bu/A greater than in 2017. High yielding named varieties included KWS Scala (200 bu/A), KWS Donau (199 bu/A), LCS Calypso (196 bu/A) and Thunder (194 bu/A). Charles and Endeavor, two older winter malt varieties, yielded 165 and 158 bu/A, respectively, with spring stands at 100%. If winter kill is a problem, these two varieties often are the most susceptible and are the first to show damage. Test weight averaged 53.1 lbs/bu, with moderate amounts of lodging, and grain protein averaging 12.1%. The ratio of applied N to average bushel yield was 1.7 lbs N/bu (305 lbs N/178 bu/A).

The hard winter wheat survival (Table 10) averaged 99-100%, showing good environmental conditions over the winter. Overall yields were less than 2018 by 6 bushels and higher than 2017 by 10 bu/A. Lodging averaged 5%. Stripe rust was present but did not significantly impact yield. The highest yielding line was LCS Jet (182 bu/A), Scorpio (176 bu/A), Millie (174 bu/A), LCS Rocket (171 bu/A) and LCS Zoom (171 bu/A). For an internal “Quality Control” (QC) Greenville was included Greenville QC – from this as well as from the CV you can estimate the degree of variability of the test. The CV for this trial is low (7.7%), also indicated by the two separate entries of Greenville yielding at 154 and 143 bu/A. The LSD at 17.2 bu/A indicates that yield differences have to be greater than 17.2 bu/A to be considered statistically significantly different, which the duplicate Greenville entries were not. Heading date for this group at Aberdeen was four days later than last year. Test weights were good at 60.7 lbs/bu for the overall average. There was relatively low lodging for such a high yielding trial. Grain protein averaged 13.0%. The ratio of applied N to average bushel yield was 2.6 lbs N/bu (415 lbs N/157 bu/A). Additional N is recommended for the upper yielding varieties to meet requirements for yield and target protein of 12.5%. The entry of Keldin with 11-52-0 in-furrow yielded 11 bu/A more than the plots without starter fertilizer but was still less than the 17 bu/A required to be considered statistically significant.

The overall yield average in the Aberdeen soft white winter trial (Table 21) was 165 bu/A, 8 bu/A less than 2018, 21 bu/A greater than 2017, ranging from the low of 141 bu/A (WB1376CLP) to a high of 196 bu/A. The highest yielding named varieties were LCS Ghost (196 bu/A), LCS Blackjack (187 bu/A), SY Raptor (178 bu/A), LCS Artdeco (178 bu/A) and Norwest Duet (177 bu/A). Heading date for this group at Aberdeen was four days later than last year.

The test weights averaged at 60.6 lbs/bu and the overall grain protein was low at 8.9%. The ratio of applied N (305 lbs N) to average bushel yield (165 bu/A) was 1.8 lbs N/bu, which is reflected in the low protein. There was very low lodging for such a high yielding trial.

Ririe, LDS Church Farm, Trevor Davey, Winter Wheat

This is a high elevation location (5600 ft.) and is our main location to test grain for winter hardiness under dryland conditions. Soil moisture was very good down to two feet when grain was planted relatively late October 3rd following chem fallow. Grain was planted into heavy stubble resulting in persistent trouble with coulters cutting through trash, resulting in a very poor seedbed. With the irregularity in seeding and plugged seed tubes, the trial did poorly due to dry conditions. For 2019, the spring stand for winter wheat (Tables 11 and 22) was relatively good, and yields were less than the previous two years. The average of 21 bu/A for hard wheat was about 29 bu/A less than 2018, and the soft winter wheat at 23 bu/A was 10 bu/A less. The trials were harvested September 3rd.

The hard winter wheat group (Table 11) had average yields of 21 bu/A, in comparison to 2018 at 50 bu/A, 2017 at 31 bu/A, 2016 at 42 bu/A, 2015 at 45 bu/A, 2014 at 21 bu/A, 2013 at 15.5 bu/A, and 2012 at 18 bu/A. The 2019 yield range went from a low of 15 bu/A (WA8289) to a high of 28 bu/A (MT1491). Overall site conditions were poor, as indicated by the low yields and the high yield CV (16.5%). Deloris, UI Silver, Greenville, Yellowstone, Sequoia, FourSix, and Bobcat were the top yielding hard winter wheat varieties, at 25, 25, 24, 24, 23, 23 and 23 bu/A, respectively. Average grain protein was low at 9.7%, reflecting inadequate nitrogen levels to meet yield and protein. Test weights were good and averaged 60.1 lbs/bu. There was no

lodging. The comparison of Keldin at 22 bu/A with Keldin with in-furrow fertilizer of 11-52-0 at 18 bu/A was not significantly different.

The soft white winter wheat (Table 22) yields varied from 16 bu/A to 28 bu/A, with the site averaging 23 bu/A, 19 bu/A more than 2017. Overall site conditions were poor, as indicated by the low yields and the high yield CV (16.1%). Average proteins were good to low for this soft group at 9.7%, test weights were low and averaged 58.5 lbs/bu. The top-yielding varieties were Norwest Duet, Nixon, SY Dayton, Appleby CL+ and SY Ovation (27, 26, 26, 26 and 26 bu/A, respectively). Average heading date was 6/25, eight days later than in 2018 (6/14), and average plant height was 24 inches.

Rockland, Gilbert and Carl Hofmeister, Hard and Soft White Winter Wheat

The hard red and white winter wheat trial at the Hofmeisters' was planted August 20th and harvested August 1st and 2nd, six days later than in 2018. Snow mold diseases were not a significant problem, and spring stands were good for hard winter wheat (95% in Table 12) and soft winter wheat (95% in Table 23). Dwarf bunt (*Tilletia controversa* Kuhn) was not a problem this year, but all winter varieties were included in dwarf bunt testing in Logan, UT, by Dr. David Hole, Utah State University professor and wheat breeder. When using varieties that are susceptible to dwarf bunt, it is highly recommended that an appropriate seed treatment is used to prevent dwarf bunt infection.

The hard winter wheat yield average was 33 bu/A, a lower than the 2018 average of 38 bu/A and 2017 average of 42 bu/A. (The 2016 yield average was 43 bu/A, the 2015 average was 47 bu/A, and 2014 was 37 bu/A). The 2019 yield ranged from 22 to 44 bu/A with a reasonable yield CV at 10.3%. The top yielding varieties this year were

LCS Jet (44 bu/A), LCS Rocket (41 bu/A), Scorpio, Keldin, WB4311 and Norwest 553 all at 39 bu/A, and FourSix and Millie both at 38 bu/A). The Keldin 11-52-0 included an in-furrow application of monoammonium phosphate at 20 lbs phosphate per acre, but yields 38 bu/A) were not statistically different than Keldin without the in-furrow fertilizer (39 bu/A). With a LSD of 4.8 bu/A, the yield of Keldin with 11-52-0 would have to be 44 bu/A to be considered significantly greater. Heading date was six days later than in 2018. Grain proteins were low (10.6%), indicating a deficit in available nitrogen to make protein for hard winter wheat.

The soft white winter nursery included at this location reflects the number of growers in the area that are producing soft white winter wheat, which is well-suited for hard winter wheat production. The soft white winter varieties Norwest Tandem, Norwest Duet, LCS Shine and LCS Sonic averaged 39, 33, 32 and 32 bu/A, respectively (Table 23). The test weights were a little low, averaging 59 lbs/bu. Grain protein averaged 10.3%, optimum for soft white winter. Heading date was seven days later than in 2018. There was no lodging.

Soda Springs, Mark and Craig Ozburn, Dryland Winter Wheat

The two small dryland winter wheat trials of both hard and soft winter wheat were increased to full nurseries at Soda Springs in 2018 at the request of area growers. The 2019 trial was planted October 1st and harvested September 16th, three weeks later than in 2018. Due to the dry planting conditions, the stands were not uniform, but winter survival was better than expected. The relatively cool spring resulted in later than expected heading dates, with the hard winter group heading 11 days later than the previous year. The soft white group also headed late – 12 days later than 2018.

In the hard winter trial, forty varieties of hard red and hard white wheat were planted, including one check with in-furrow phosphorus fertilizer and a mix planting of 50/50 Norwest 553/Yellowstone. The Keldin 11-52-0 included an in-furrow application of monoammonium phosphate at 20 lbs phosphate per acre but yields (54 bu/A) were not statistically different than Keldin without the in-furrow fertilizer (59 and 74 bu/A). With a LSD of 17.1 bu/A, the yield of Keldin with 11-52-0 would have to be 17.1 bu/A greater be considered significant.

The highest yielding varieties of the hard variety trial included UI Silver (81 bu/A), Deloris (73 bu/A), Sequoia (71 bu/A), SY Clearstone 2CL (70 bu/A), LCS Zoom (70 bu/A and UI SRG (70 bu/A) (Table 13). The Norwest 553 yielded 52 bu/A, Yellowstone yielded 63 bu/A and the 50/50 mix yielded 53 bu/A. There was no stripe rust pressure at this location, and although the stands were not uniform due to dry planting conditions, there was very little winter kill with stands in the spring ranging from 94-100%. Norwest 553 has sensitivity to dry cold conditions and winter kills in some years. Heading dates were significantly behind this location in 2018, with the average heading date 11 days behind 2018 (6/21). Test weight was good, averaging 59.9 lbs/bu. There was no lodging. The ratio of available and applied N (187 lbs N/A) to average bushel yield (52) was 3.6 N/bu. As a result, the proteins were good to high with the trial average of 11.6%. Some lines were above protein optimum levels.

Thirty-six soft white winter wheat varieties were included in a separate nursery (Table 24). Fall germination was affected by dry conditions at planting, but the winter wasn't severe resulting in an average 82-100% spring stand. Heading dates were significantly behind this location in 2018, with the average heading date 11 days behind 2018 (6/21). A dry summer resulted in yields about 21 bu/A less than in 2018

and 24 bu less than 2017, but yield CV's were high at 21.7%. Average yields for the soft nursery were 52 bu/A. The yield ranged from 36 bu/A (SY Assure) to 67 bu/A (Oregon line Nixon). The highest yielding named varieties included Nixon (67 bu/A), LCS Sonic (64 bu/A), UI Sparrow (64 bu/A), Stingray CL+ (58 bu/A) and Bobtail (58 bu/A). There was no lodging.

The Eltan 11-52-0 included an in-furrow application of monoammonium phosphate at 20 lbs phosphate per acre but yields (54 bu/A) were not statistically different than Eltan without the in-furrow fertilizer (56 bu/A). With a LSD of 17.3 bu/A, the yield of Eltan with 11-52-0 would have to be 70 bu/A to be considered significantly greater.

The ratio of available and applied N (187 lbs N/A) to average bushel yield (52) was 3.6 N/bu. As a result, the proteins were good to high with the trial average of 11.6%. Some lines were above protein optimum levels.

If risking planting winter wheat in this area, it is highly recommended that varieties with snow mold tolerance and dwarf bunt resistance be grown. Varieties susceptible to dwarf bunt should only be grown following appropriate seed treatments for dwarf bunt control.

Spring Grain Locations

Rupert, Duane Grant 4-D Farms and Alan Mohlman, Spring Grain

The variety trials in Rupert were planted March 26th in silt loam soils with good soil moisture and harvested August 14th and 15th. The preceding crop was sugar beets. There were no major weather-related problems.

There was some lodging for the **hard spring wheat** nursery (Table 34). Average yield was 131 bu/A, compared to 120 in 2018, 110 bu/A in 2017, 125 bu/A in 2016, and 105 bu/A in 2015. Test weight average was 61.8 lbs/bu, and average protein was at 14.2%. The top yielding named varieties

were SY Teton (151 bu/A and 13.4% protein), Dayn (145 bu/A and 13.4% protein), UI Platinum (144 bu/A and 13.2% protein) and Klasic (143 bu/A and 14.0% protein). The top four varieties were all hard white varieties with test weights above 60 lbs/bu. The ratio of available and applied N (392 lbs N/A) to average bushel yield (131) was 3.0 lbs N/bu. The average grain protein for this trial very good at 14.2%. All hard red and white spring plots were topdressed at flowering with 40 units of N/A. Heading date for this location was four days later than for 2018.

Statistically significant differences in the yields of three seeding rates of Klasic were not obtained, however Klasic seeded at 1 million seeds per acre (133 bu/A) was close to being significantly less than Klasic seeding at 1.4 million seeds per acre (143 bu/A). For an internal “Quality Control” (QC) Imperial (spring durum) was included as Imperial QC – from this as well as from the CV you can estimate the degree of variability of the test. The CV for this trial is low (5.7%), also indicated by the two separate entries of Imperial yielding at 113 and 109 bu/A, a four bushel difference. The LSD at 10.5 bu/A indicates that yield differences have to be greater than 10.5 bu/A to be considered statistically significantly different, which the duplicate Imperial entries were not.

The **soft white spring wheat** yield (Table 43) average was 140 bu/A. In 2018, it was 123 bu/A, in 2017 it was 119 bu/A, 2016 it was 124 bu/A, in 2015 it was 105 bu/A, and in 2014 the average yield at the Rupert location was 130 bu/A. In 2019, WB6430 yielded 150 bu/A at 10.3% grain protein, Tekoa yielded 150 bu/A at 10.5% protein, UI Cookie yielded 147 bu/A at 11.3% protein. Grain protein average was at 11.0%. The ratio of available and applied N (282 lbs N/A) to average bushel yield (140) was 2.0 lbs N/bu. Comparing the two entries of Melba, 142 and 139 bu/A, the differences

were only three bushels per acre. The yield CV was also good at 8.8%, indicating the variability in this trial was low.

The **spring malt barley** trial at Rupert (Table 51) had average yields of 144 bu/A, about 4 bushels less than 2018, 6 bu/A more than 2017, with a yield range from 115 (Merit 57) to 179 bu/A (Bente). The ratio of available and applied N (282 lbs N/A) to average bushel yield (144) was 2.0 lbs N/bu. Lodging averaged 30% overall, and grain protein averaged 11.2%. Bente was the top yielding malt barley (179 bu/A), followed by Moravian 179 (169 bu/A), LCS Odyssey (164 bu/A), Explorer (159 bu/A), Fandaga (151 bu/A) and AAC Connect (150 bu/A). Test weights averaged 52.3 lbs/bu, and percent plumps were 97%. Heading date for this trial was 6/14, very similar to 2018 which was 6/15.

The average yield for two-rowed feed barley in Rupert for 2019 (Table 59) was 139 bu/A, 12 bu/A less than 2018, and 3 bu/A less than 2017. The high yielding two-rowed feed varieties were the six-rowed Millennium (163 bu/A), Oreana (155 bu/A), Altorado (146 bu/A), Xena (143 bu/A) and Champion (142 bu/A). Average test weight for this trial was 52.3 lbs/bu for the feed barleys, and 53.8 lbs/bu for hulless and hulled (Kardia) food barleys. The hulless, high beta-glucan food barleys Julie, Transit, and Goldenhart yielded 137, 128, and 108 bu/A but also had high test weights (54.4, 53.4 and 58.0 lbs/bu, respectively). For this trial, the ratio of available and applied N (282 lbs N/A) to average bushel yield (139) was 2.0 lbs N/bu with an average site grain protein of 11.2% for the hulled, and 11.0% for the hulless.

Aberdeen Research and Extension Center, Spring Grain

Spring variety trials were planted April 19th in Declo loam soils with good soil moisture and soft white spring wheat plots were harvested August 23th, ten days later than in

2018. The hard spring wheat and spring barley plots were harvested August 26th, eleven to thirteen days later than in 2018. The preceding crop was green manure oats. The yields were substantially lowered with a frost occurring 3 days after heading of the spring wheat (see Chart 2). Stripe rust of wheat was present late in the season and there were some yield impacts in the susceptible wheat varieties.

13.2% protein), WB7202 CLP (111 bu/A and 13% protein) and UI Platinum (106 bu/A and 13.4% protein). The highest yielding hard reds were AP Renegade (105 bu/A with 14% protein), Cabernet (105 bu/A with 13.5% protein), SY Gunsight (104 bu/A and 14.7% protein) and AP Octane (104 bu/A with 14.3% protein). Test weights for the hard spring wheats averaged 60.0 lbs/bu. There was some lodging of two varieties (Glee and IDO1805S) and the grain

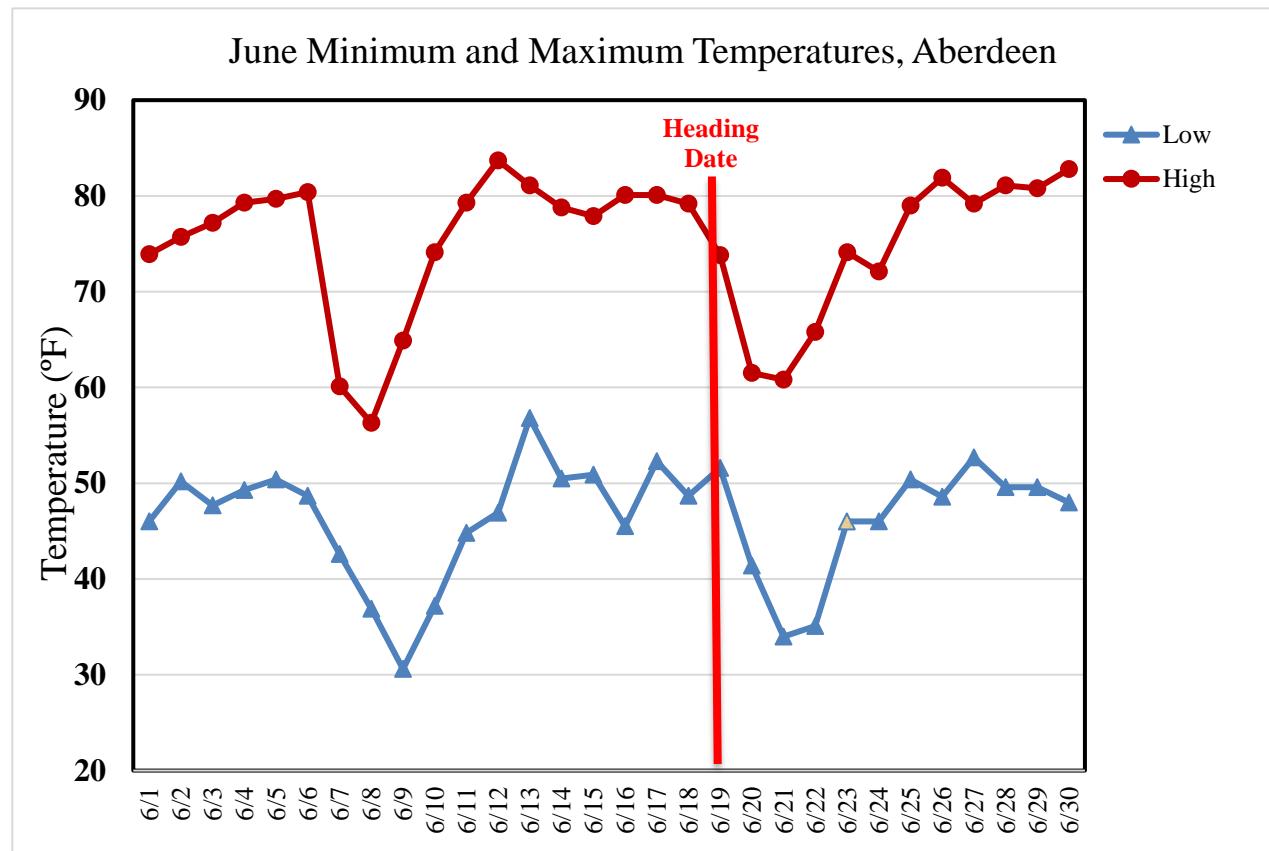


Chart 2. Maximum and minimum temperatures in June during the heading and flowering of wheat in Aberdeen. Average heading dates: Winter wheat 6/4. Winter barley 5/28. Hard spring wheat average heading date 6/19. Soft white spring wheat average heading date 6/22. Spring barley average heading date 6/27. Feed barley 6/22. Source: NWS & Agrimet data.

The CV's for the Aberdeen spring trials were low, with the CV for the hard spring wheat nursery at 7.5% for yield (Table 35). Hard spring wheat yield varied from 76 bu/A (WB9879CLP) to 119 bu/A (IDO1702S). The top four named varieties for yield in the hard red and white trial were the hard white springs Dayn (114 bu/A with 14.3% protein), SY Teton (112 bu/A and

protein average was 14.5%. (All hard spring wheat trials are top-dressed at flowering with 40 units of N to promote higher protein hard spring wheat.) The high protein wheats included WB9668 (16.8%), Alum (15.9 %), WB9411 (15.8%), Net CL+ (15.7%) and Imperial (durum 17.7 %). The ratio of available and applied N (357 lbs N/A) to average bushel yield (96) was 3.7 lbs N/bu.

Due to frost conditions limiting yield, the available N contributed to the high protein in the harvested grain.

Klasic hard white spring wheat was seeded at three rates: the standard 1 million seeds per acre, and at 1.2 and 1.4 million seeds per acre. Statistically significant differences in the yields of three seeding rates of Klasic were not obtained: yields were 79 bu/A, 83 bu/A, and 87 bu/A. The LSD for this location was 10.1 bu/A, indicating no statistically significant difference between the highest (1.4 million) and the lowest rates (1 million) and no advantage for increasing the seeding rate to improve yield. There may have been an advantage to a higher seeding rate if the some of the tillers in the higher seeding rate avoided the frost and contributed to the higher yields.

For an internal “Quality Control” (QC) Imperial (spring durum) was included as Imperial QC – from this as well as from the CV you can estimate the degree of variability of the test. The CV for this trial is good (7.5%), also indicated by the two separate entries of Imperial yielding at 87 and 79 bu/A, an eight bushel difference. The LSD at 10.1 bu/A indicates that yield differences have to be greater than 10.1 bu/A to be considered statistically significantly different, which the duplicate Imperial entries were not.

The soft white spring wheat yields at Aberdeen (Table 44) averaged 96 bu/A with a range from 71 (UI Pettit) to 116 bu/A. Late frost reduced the yields 42 bu/A from the 2018 average and 28 bu/A from 2017. Highest yields of named varieties were obtained from Seahawk (108 bu/A), WB6121 (107 bu/A), UI Cookie (106 bu/A), Melba (club wheat, 104 bu/A), and Tekoa (104 bu/A). The heading date of 6/22 was eight days later than in 2018. There was very little lodging and test weights averaged 59.7 lbs/bu. The ratio of available and applied N (247 lbs N/A) to average bushel

yield (96 bu) was 2.6 lbs N/bu with an average site grain protein of 11.7%. Similar to the hard spring wheat, frost reduced yield potential, and the available N contributed to higher than usual grain protein.

Two-rowed malt barley lines yield average was reduced 24 bu/A from 138 bu/A in 2018 to 114 bu/A due to late frost (Table 52). Yield ranged from 91 bu/A (Fangio) to 137 bu/A (10ARS191-3). The top yielding lines were Fandaga (136 bu/A), LCS Odyssey (132 bu/A), Esma (131 bu/A) and Bente (130 bu/A). The average heading date was ten days later than 2018 and lodging averaged 22%. The ratio of available and applied N (247 lbs N/A) to average bushel yield (114 bu/A) was 2.2 lbs N/bu with an average site grain protein of 11.2%.

The average yield for two-rowed feed barley in Aberdeen for 2019 (Table 60) was 118 bu/A, also significantly less than 2018 (147 bu/A). The highest yielding two-rowed feed varieties were Champion (129 bu/A), Altorado (129 bu/A) and Oreana (123 bu/A). Average test weight for this trial was 51.2 lbs/bu. The hulless, high beta-glucan food barleys Transit, Julie and Goldenhart yielded 108, 97 and 71 bu/A but also had high test weights (54.1, 54.0 and 57.3 lbs/bu, respectively). Kardia is hulled with lower test weight than the hulless lines. The heading date for this trials was five days later than in 2018. Lodging averaged about 25%. For this trial, the ratio of available and applied N (247 lbs N/A) to average bushel yield (91 bu/A) was 2.7 lbs N/bu with an average site grain protein of 11.1%. Due to frosts that reduced yield potential, it is surprising that grain protein isn't higher.

Idaho Falls, Marc Thiel, Spring Grain
The Idaho Falls location followed alfalfa, and was planted April 29th in silt loam soils with good soil moisture and harvested August 27th. The surrounding field was in barley.

Average grain yield for the hard spring wheat (Table 36) was 116 bu/A, which was 3 bushels less than 2018 and 10 bushels less than the average in 2017. Hard spring wheat ranged in yield from 94 (Imperial durum) to 139 bu/A (Dayn). Average grain protein was at 13.5%, and test weight was at 61.9 lbs/bu. The four highest yielding named varieties were Dayn hard white (139 bu/A and 13.0% protein), SY Coho hard red (126 bu/A and 13.5% protein), AP Venom (125 bu/A and 12.6% protein) and Alum (125 bu/A and 14.1% protein). Some varieties had high degree of lodging (Alum, Alzada durum, Jefferson, Net CL+ and WB9879CLP).

Klasic hard white spring wheat was seeded at three rates: the standard 1 million seeds per acre, and at 1.2 and 1.4 million seeds per acre. Yields were 107 bu/A, 116 bu/a, and 112 bu/A, although statistically not significantly different based on an LSD ($\alpha=.05$) of 9.4 bu/A. The high protein lines include Imperial (durum) at 16.3%, WB9590 at 15.3%, WB9668 at 14.9%, WB7328 at 14.6%, WB9879CLP at 14.4% and Alum at 14.1%, all of which had excellent test weight (except Imperial). The ratio of available and applied N (211 lbs N/A) to average bushel yield (116) was low, 1.8 lbs N/bu.

WB6430, Melba, Alturas and UI Cookie and topped the yield chart (Table 45) for the soft white spring wheat varieties at Idaho Falls at 143, 133, 131 and 127 bu/A, respectively, with an overall average of 120 bu/A, 12 and 18 bu/A less than 2018 and 2017, respectively. Yields ranged from 97 bu/A (Ryan) to 143 bu/A. Test weight averages were good at 61.2 lbs/bu, and grain proteins were at 10.4%. The ratio of available and applied N (116 lbs N/A) to average bushel yield (120) was 1.0 lbs N/bu.

For an internal “Quality Control” (QC) Alturas was duplicated – from this as well as from the CV you can estimate the degree of variability of the test. The CV for this trial is

good (10.3%), also indicated by the two separate entries of Alturas yielding at 131 and 125 bu/A, a six bushel difference. The LSD at 17.6 bu/A indicates that yield differences have to be greater than 17.6 bu/A to be considered statistically significantly different, which the duplicate Alturas entries were not.

Two-rowed malt barley yields (Table 53) averaged 108 bu/A, about 28 bu/A less than 2018 and 26 bu/A less than in 2017. The yield ranged from 82 (Fangio) to the highest yielding variety LCS Odyssey which hit 130 bu/A. Other top yielding named varieties included ABI Growler (128 bu/A), ABI Voyager (126 bu/A) and ABI Eagle (117 bu/A). Test weight average was 49.6 lbs/bu, protein average was 11.1% and lodging was high at 71%. The ratio of available and applied N (116 lbs N/A) to average bushel yield (108) was 1.1 lbs N/bu.

Two-rowed feed barley trial (Table 61) averaged 115 bu/A, with the top yielding lines averaging 146 bu/A (Altorado) with 52.2 lb test weight. Oreana yielded 137 bu/A, the six-rowed feed variety Millennium yielded 120 bu/A and Idagold II 116 bu/A. The test weight average for the feed lines was 50.6 lbs/bu and protein average was 10.8%. The presence of hulless food barleys in the trial will pull the test weight averages higher so they were averaged separately. Test weight of the hulless lines averaged lower than usual at 52.8 bu/A (with hulled Kardia, average was 49.7 lbs/bu) and the protein was at 10.7%.

Ashton, Alan Baum, Spring Grain
The Ashton location was planted April 30th in silt loam soil into good soil moisture following potatoes. Plots were harvested September 4th.

Two factors are important in plant health and reducing yield potential (above stripe rust impacting crop) in this area. Soil pH can

be low, sometimes below 6 which can contribute to high micro-nutrient accumulations (magnesium, manganese, iron and boron). This location was low at pH 5.9. Fields in the area may demonstrate symptoms of leaf necrosis (browning) as the pH varies from 4.5 to 6.0. In addition, high levels of nematode damage were found throughout the region, from Ashton through St. Anthony, to Rexburg and Plano. Both factors contribute to general unthriftiness, stunting, reduced tillering and yellowing of wheat and barley. Soil amendments such as lime should help reduce the toxic accumulation of micronutrients, but crop rotation to broadleaves is the only way to reduce the impact of cereal cyst nematodes (CCN). There are different levels of resistance and tolerance in our spring wheat and barley varieties. The results from screening trials conducted in St. Anthony are provided in 2016 Small Grains Report available online http://www.uidaho.edu/extension/cereals/scs_eidaho/sgr.

The average yield for the hard spring wheat (Table 37) was 74 bu/A, compared to 2018 at 100 bu/A, 2017 at 83 bu/A and 2016 at 88 bu/A, 2015 at 94 bu/A and 2014 at 100 bu/A. Yields were likely depressed due to cool temperatures – heading dates were delayed eight days from 2018. The range in yield varied from 58 bu/A (IDO1701S) to 85 bu/A (advanced hard white 12SB0224)). Test weights were average at 59.1 lbs/A, and protein averaged 15.5%. The high yielding named varieties were SY Teton (83 bu/A), UI Platinum (82 bu/A), SY Gunsight (82 bu/A) and WB9668 (81 bu/A). The highest proteins were seen in Imperial (durum at 16.9%), WB9590 (16.5%), Alum (16.5%), Net CL+ (16.5%) and WB9668 (16.4%). The ratio of available and applied N (337 lbs N/A) to average bushel yield (74) was 4.6 lbs N/bu. The average protein levels for hard spring wheat was 15.5%. Proteins are high due to the lower than expected yields – the field was fertilized for higher yields.

In the soft spring wheat trial (Table 46), the high yielding named varieties were UI Stone (94 bu/A), followed by WB6430 (84 bu/A), Alturas (83 bu/A) and SY Saltese (83 bu/A). The average yield for the soft white spring trial was 79 bu/A, lower than 2018 by 20 bu/A, and lower than 2017 by 24 bu/A, and ranged from a low of 71 bu/A to a high of 94 bu/A. Heading dates averaged nine days later than in 2018. The test weight average was a 60.4 lbs/A, with no lodging. Grain protein averaged 11.5%, at a higher than desirable level for soft white spring wheat. Despite the high ratio of 3.1 lbs N/bu it is surprising the grain protein isn't higher in the soft nursery.

Two-rowed malt barley yields (Table 54) ranged from 77 bu/A (AAC Synergy) to 115 bu/A. The average was 96 bu/A, 5 bu less than 2018, and 11 bu/A less than in 2017. The highest yielding named lines were Idagold II (115 bu/A), LCS Genie (110 bu/A), ABI Eagle (107 bu/A), GemCraft (107 bu/A) and LCS Odyssey (105 bu/A). Lodging averaged 16%. Overall test weight was 51.9 lbs/bu, protein averages were 10.9% and plumps were 93%. The N:bu ratio calculates as 3.2 lbs N/bu, very high for the average yield.

The feed lines averaged 90 bu/A with Claymore (98 bu/A), Altorado (95 bu/A) and Xena (94 bu/A) as the top yielding varieties (Table 62). The food barleys yielded an average of 90 bu/A. Kardia is a hulled, high beta-glucan food line. The hulled lines had a test weight of 49.9 lbs/bu and hulless lines had a test weight of 55.0 lbs/bu. Proteins of the feed lines averaged 10.8%, with a N:bu ratio of 2.7 lbs N/bu.

Soda Springs, Kyle Wangemann and Scott Brown, Spring Grain

The only spring dryland extension trials were in Soda Springs. The nursery was planted May 10th and harvested September 16th. The previous crop was spring barley.

Yield averages for the hard red and hard white spring nursery (Table 38) were 67 bu/A, 21 bu/A better than 2018, and 39 bu/a greater than 2017 due to good moisture. The range in yield went from 55 to 80 bu/A. The five highest yielding named varieties were the hard red Dagmar (80 bu/A), hard white SY Teton (78 bu/A), hard white Dayn (76 bu/A), hard red Jefferson (76 bu/A), hard white WB7202CLP (74 bu/A) and the hard red DuClair (72 bu/A). The heading dates at this location were 10 days later than in 2018. Test weights averaged 61.2 lbs/bu, and proteins were good, averaging 14.2%, with the highest proteins in WB9668 (15.4%), SY Selway (14.3%), Klassic (13.9%) and Glee (13.0%).

Klasic hard white spring wheat was seeded at three rates: the standard 1 million seeds per acre, and at 1.2 and 1.4 million seeds per acre. Yields were 58 bu/A, 56 bu/A and 55 bu/A, statistically not significantly different based on an LSD ($\alpha=.05$) of 10.1 bu/A.

For the soft white spring wheat (Table 47), the nursery averaged 83 bu/A, 25 bu/A greater than 2018, and 49 bu/A greater than 2017. The yield ranged from 74 (UI Pettit)

to 91 bu/A (WA 8303). AP Coachman, Tekoa, Seahawk, Melba and SY Saltese were the five top yielding varieties at 90, 89, 87, 86 and 86 bu/A, respectively. Test weight average was 61.0 lbs/bu, and proteins were at 11.3%.

Replicated dryland barley trials were added to Soda Springs trials. Two-rowed malt barley yields (Table 55) ranged from 93 bu/A (Full Pint) to 125 bu/A (10ARS191-3). The average was 108 bu/A, The highest yielding named lines were Sangria (119 bu/A), GemCraft (117 bu/A), Esma (117 bu/A) and ABI Growler (115 bu/A). There was no lodging, overall test weight was 51.5 lbs/bu and plumps were 99%. Protein averages were an acceptable 11.2%

The feed lines averaged 97 bu/A with Oreana (104 bu/A), Altorado (101 bu/A), Champion (97 bu/A) and Claymore (96 bu/A) as the top yielding varieties (Table 63). The food barleys yielded an average of 85 bu/A. Kardia is a hulled, high beta-glucan food line. The hulled lines had a test weight of 50.1 lbs/bu and hulless lines had a test weight of 54.6 lbs/bu. Proteins of the feed lines averaged 10.8%.

Table 2. Variety Descriptions

SPRING BARLEY - Malt

AAC Connect (TR04282) – released in 2016 by Agriculture Canada, AAC Connect has been in the trials for two years. AAC Connect has malt quality similar to AC Metcalfe. It is a mid-maturity two-rowed variety with moderate resistance to stem rust, spot blotch, spot form of net blotch (SFNB), and Fusarium head blight (FHB). Under Idaho growing conditions, AAC Connect was 3-4 inches taller than average with average lodging, had high test weight and percent plumps. In 2019, AAC Connect had high protein in the trials, and was at or a little lower than average for yield (Table 50). Lodging was high in the irrigated trials.

AAC Synergy – released in 2015 by Agriculture Canada, AAC Synergy is a two-rowed malt barley in the fifth year of testing in these trials. Overall yield was slightly below average (Table 49) and similar to ABI Growler, with average or better test weight and plumps. Height of Synergy is four inches less than Copeland, higher than Conrad, with similar tendencies for high lodging under irrigation. In Fusarium head blight (FHB) screening trials, AAC Synergy had one of the lowest indices for infection and was average to below average for levels of DON on the seed. AAC Synergy also expressed high levels of resistance to foliar pathogens. Synergy is being marketed by Syngenta in the US.

ABI Eagle (2B11-4949) – a newer release by Busch Agricultural Resources in 2018, Eagle has been tested in the variety trials for three years in which yield and test weight were comparable to ABI Voyager. ABI Eagle should replace Merit 57, having mid-level protein, with heading date two days later than Voyager, two – three inches

shorter, and plumps were a little lower. Lodging was a little less than Voyager, but protein was higher. FHB reaction initially has been similar to ABI Voyager.

ABI Growler (2B09-3425) – a 2015 release from Busch Agricultural Resources, ABI Growler is a two-rowed malt that exhibits high yield potential under irrigation, although the three-year yield and test weight averages were lower than the average other two-rowed malt barley in these trials (Table 49). Growler hits the average for height, test weight, proteins and plumps, and was one day later in heading date with less lodging than Voyager. ABI Growler may produce more thins under high temperatures, which can be reduced by increasing irrigation. For FHB data, DON accumulations were similar to Voyager.

ABI Voyager (B3719) – a 2011 release from Busch Agricultural Resources, Voyager consistently out yields many other two-rowed malt varieties in the production area. Three-year average yields were below LCS Odyssey and similar to Moravian 69, with higher test weight and similar lodging. Voyager is similar to Conrad in test weight, has a little earlier heading date, lower protein, but is taller (2-4 inches). ABI Voyager is susceptible to cereal cyst nematode (CCN), and for FHB shows DON accumulation at a little less than average.

AC Metcalfe (TR232) – two-rowed malting barley released in 1994 by Agriculture and Agri-Food Canada with excellent quality, lower yield potential than average, and taller with similar test weight and lodging to Conrad. It is widely adapted to western US and Canadian conditions, but as it is tall, it may lodge under higher production conditions. It is moderately susceptible to

FHB with average DON accumulation. Malting quality and extract are excellent.

Bente – Bente is a European two-rowed malt barley developed by Nordsaat Saatzucht GmbH. Entered into the trial in 2019, Bente showed very high yield potential in our environment, similar to Moravian 179 and higher than LCS Odyssey (Chart 8 and Table 50, one year of data). Bente had very good test weight, plump and headed six days earlier than the average of the trials. Plant height and protein were average and Bente had good straw strength, similar to Explorer.

CDC Bow (TR11127) – CDC Bow is a recent two-rowed malt variety from Crop Development Centre, University of Saskatchewan, marketed through SeCan and has been in the trials for two years. CDC Bow lodged more in 2019 (similar to Merit 57) than in 2018, was 5 inches taller than average and headed two days later with good test weight, plump kernels and average grain protein. In both years, CDC Bow performed similar to CDC Copeland and Merit 57 (lower than average) in the Idaho trials (Table 50 in 2019). CDC Bow performed better or similar to CDC Copeland for FHB, depending in the year.

CDC Copeland (TR150) – a two-rowed malt variety developed by the Crop Development Centre, University of Saskatchewan and released in 1999, Copeland has been in the trials since 2009 in southern Idaho. Copeland yields are similar to Conrad and AC Metcalfe (Table 49). Copeland was 3-5 inches taller than average with greater lodging, and was average for grain protein and plumps, with good test weight. In 2017 Fusarium head blight (FHB) screening trials, CDC Copeland had low indices for FHB infection and had average DON levels in the grain.

CDC Fraser (TR12135) – CDC Fraser is a more recent malt variety from Crop Development Centre, University of Saskatchewan, released in 2018. For the first year in the trials, CDC Fraser outperformed AC Metcalfe by 118% and performed similar to ABI Voyager, with yields, test weight, heading date and protein at average, and plumps above average. In 2019, yields were below trial average, similar to AAC Synergy and AC Metcalfe. CDC Fraser is adapted to western Canada, was taller than average with higher lodging potential under high input conditions. Malt profile is intermediate between CDC Copeland and AC Metcalfe.

Conrad (B5057) – two-rowed spring malt barley released by Busch Agricultural Resources in 2005. Conrad has below average yields and good test weight and end-use quality. Conrad is 3 inches shorter than ABI Voyager, and is average for lodging and protein. Conrad has yielded well in the dryland upper elevation areas. Conrad has low disease measures for FHB, but higher DON levels on the seed.

Esma – entered into the trials in 2018 by Ackermann Saatzucht GmbH & Co. KG, Esma was the highest yielding two-rowed malt variety in 2018, averaging 170 bu/A. In 2019, Esma yielded below Full Pint, but still 15 bu/A greater than trial average (Table 50, Chart 8). Like many of the European malt types, Esma is suited for the craft beer market. In eastern Idaho in 2019, Esma had below average (but still greater than the 48 lb/bu test weight minimum for Grade 1 barley), average heading date, and was 3 inches shorter but very low for lodging.

Explorer – a newer introduction from Secobra Recherches, Explorer is a two-rowed malting barley in the third year of these trials. In the 3-year summary, Explorer

was greater than average in grain yield (Table 49), similar to LCS Genie with slightly lower test weight. Heading date, protein, plump and test weight were at trial averages. Explorer is shorter than average and lower than average for lodging.

Explorer has good resistance to leaf diseases and is widely adapted. Explorer is a French maltsters preferred variety with excellent malting and brewing, and is good for distilling (whiskey). It also is currently favored by ABInBev in Europe for brewing.

Fandaga – a European malting barley bred through Nordsaat, Fandaga was approved as a malting barley by French CBMO Committee in 2018, and was first in these trials in 2019 (one year, Table 50, Chart 8). Fandaga has resistance to powdery mildew, excellent agronomic advantages and high yield consistency in Europe. In 2019, Fandage yields were similar to Bente, averaging 143 bu/A, similar to Moravian 179, with lower test weight. Heading was five days earlier than average, and even with high lodging, Fandaga had good plumps and test weight.

Fangio (SC 9447 S2) – Fangio is a two-rowed malt barley newly released in 2019 and developed through the North Dakota State University barley breeding program. In the first year of the trials, Fangio yields were below trial average, comparable to CDC Copeland (Table 50 and Chart 8). Test weight was below average but still above the 48 lb/bu test weight required for No. 1 barley. Heading date was four days later than average, and two days later than CDC Copeland. Fangio was shorter than average with less than average lodging.

Full Pint – released in 2014 by Oregon State University for the Craft market, Full Pint was tested in 2018 and 2019 in the eastern Idaho variety trials. Yields averaged

greater than LCS Genie and Moravian 69, with excellent test weight and protein (Table 50). Full Pint was early for heading, slightly shorter than average, with lower lodging and test weight. Plumps and protein were good.

GemCraft (2Ab08-X05M010-65) – released by the USDA-ARS and Idaho AES in 2018, GemCraft is a 2-row malt barley released for the craft industry and favored by the Brewers Association due to its good taste profile. Overall a great performing agronomic line, yields, test weight and plumps in 2019 were below Conrad. Taller than average with medium maturity, lodging tends to be greater under irrigated production systems. GemCraft was released under PVP.

LCS Genie – a European malt barley released in the U.S. through Limagrain Cereal Seeds, Genie is a short-statured two-rowed malt variety with yields slightly greater and test weight less than ABI Voyager. Protein and plumps of Genie were at trial averages (Table 49). LCS Genie is about 3-5 inches shorter than average with average lodging. Genie is susceptible to FHB and had high levels of DON in seed in the FHB disease nurseries. Genie has excellent malt quality and can also be used in distilling.

LCS Odyssey – LCS Odyssey is a European two-rowed malt barley released and distributed through Limagrain Cereal Seeds. In three years of testing, LCS Odyssey was the highest yielding variety, comparable to LCS Genie and ABI Voyager (Table 49). Test weights were lower and lodging was average, even as LCS Odyssey is 3-5 inches shorter than the trial average. Heading date is one to three days later than average and similar to LCS Genie. Proteins were average, and plumps were good. LCS Odyssey is more susceptible than current

U.S. malt varieties for FHB and has higher levels of DON accumulation. LCS Odyssey has excellent resistance to CCN populations in eastern and southern Idaho. Like Genie, Odyssey has excellent malt quality and can also be used in distilling.

Manta – a two-rowed spring malt barley developed through Ackermann Saatzucht GmbH & Co. KG. Manta represents typical European malt quality targeted for the craft beer industry. Manta yields in the 2018 irrigated trials averaged 154 bu/A, reaching 168 bu/A in Aberdeen. In 2019, yields were slightly above average and comparable to Explorer (Table 50). Plumps and plant height were average, and protein was greater than average, with no lodging.

Merit 57 (2B99-2657) – considered one of the industry standards for malt quality, Merit 57 was released in 2009 by Busch Agricultural Resources. Merit 57 is a later maturity two-rowed malt variety with small seed, lower yields, test weight and higher lodging than average. Merit 57 has good plumps and protein.

Moravian 69 (C69) - two-rowed spring malt barley released by Coors Brewing Co. in 2005. Moravian 69 has very high yield potential, especially in the Magic Valley area where it is widely grown, with 3-year yield average over all locations similar to ABI Voyager and higher than Copeland (Table 49). 2019 yields were comparable to LCS Genie and Odyssey (Table 50). M69 is short (2-4 inches below average) but may still be susceptible to lodging. Protein is at average in these trials, while test weight and plumps were below average. Moravian 69 is considered more susceptible to FHB with higher than average accumulation of DON in the seed.

Moravian 179 – Moravian 179 is a newly released two-rowed malt line from MillerCoors adapted to the higher production conditions of southern Idaho. Yields of Moravian 179 were greater than LCS Genie and M69 and significantly higher than average (Table 50) in 2018 and 2019, with very high plumps and test weight and lower than average lodging. Proteins were at trial average, with plant height similar to M69. MillerCoors lines are under Title V and PVP.

Sangria – a two-rowed spring malt barley developed through Ackermann Saatzucht GmbH & Co. KG, Sangria and Manta represent typical European malt quality targeted for the craft beer industry. In the first year of extension testing, Sangria yields were excellent, averaging 159 bu/A, with good lodging resistance, high plumps, and good protein and test weight. Yields in Aberdeen reached 170 bu/A. In 2019, Sangria and Manta had similar yields with both having no lodging. Protein and test weight were less than Manta and the trial averages.

SPRING BARLEY – Food

Goldenhart (2Ab09-X06F058HL-31) – A spring 2-rowed hulless food barley with beta-glucan content similar to Transit (9-10%) released for significantly increased yield potential, especially under dryland conditions. Three-year averages for irrigated production conditions put Goldenhart significantly lower in yield than Transit (Table 57, Chart 9). Goldenhart has very high test weight, plump and protein (Table 57) as expected for a hulless line. Goldenhart will be submitted for PVP.

Julie (03AH6561-94) – a two-rowed hulless barley released by the USDA-ARS and the University of Idaho AES in 2010 for high-

beta-glucan content and intended for human consumption. Julie has high test weight (due to the hulless characteristic) and protein, similar to other food barleys, with greater percentage of seed beta-glucan (averaging 7%) than previous industry standards such as CDC McGwire. Julie is the highest yielding hulless waxy barley currently in the trials. Lodging of Julie is less than average, and heading date 4-5 days later than Champion.

Kardia (2Ab09-X06F084-51) – Kardia is a two-rowed, hulled food barley line released in 2016 by the USDA-ARS in Aberdeen and the University of Idaho AES as a replacement for Salute, with yield improvement of 4-5% over Salute. Yield (3-years, Table 57) of Kardia was less than Julie and greater than Transit and Goldenhart. The beta-glucan level of Kardia is 7- 8.5% compared to 6.5% in Salute. Kardia has slightly higher levels of DON in the inoculated Fusarium head blight trials than the hulless food barley lines due to its hulled characteristic, and therefore also lower test weight.

Transit (03AH3054-51) – a two-rowed hulless variety released by the USDA-ARS and the University of Idaho AES in 2010 for high-beta glucan content (waxy) and intended for human consumption. Seed beta-glucan content (9-10%) is higher than other previous industry standards such as CDC Fibar and CDC McGwire. Transit yields are lower but the percent beta-glucan is higher than Julie. As a hulless line, test weights are high for barley. Transit had low disease ratings for FHB and lower DON levels.

SPRING BARLEY – Feed

Altorado (BZ509-601) – Altorado is a 2016 release from Highland Specialty Grains. Altorado is a two-rowed feed barley with

high yield potential. Average irrigated 3-yr average yield was greater than Champion with high test weight (Table 57). Altorado is similar to Champion in heading date, test weight, plant height, lodging, and lower in grain protein.

Champion (BZ509-216) – a 2007 release from WestBred, LLC, now handled by Highland Specialty Grain. Champion is a very high yielding two-rowed spring feed barley. Combined over locations and years, Champion yields were comparable to Xena and slightly more than Lenetah under irrigation with higher test weight and plumps. Champion has average height, less than average protein, and heads 1-2 days earlier than trial average.

Claymore (BZ509-216) – two-rowed feed originally developed through WestBred, Claymore is carried by Highland Specialty Grains. In three-year averages, Claymore out-yielded other feed lines, including Xena, Lenetah and Champion, and was comparable to Altorado and Oreana. Claymore is similar in height to Champion (Table 57), three days later in heading, with lower test weight and similar lodging.

Idagold II (C32) – a two-rowed spring feed and malt line developed by Coors Brewing Company in Burley and released in 2002. Idagold II is a short line with lower than average lodging and high test weight. Protein is average for a malt variety with average plumps. Idagold II is susceptible to FHB and showed higher levels of DON accumulated in the seed. Idagold II is used in these trials for fill plots and for its short stature.

Lenetah (01Ab11107) – a 2008 release from the USDA-ARS and Idaho AES, Lenetah is a high yielding two-rowed feed variety particularly well-adapted to the rain-fed conditions of northern Idaho, but also

producing well in irrigated southern Idaho conditions. In southern Idaho, Lenetah has average yield, test weight and plump, slightly earlier than average heading date and is two inches taller in height. Lenetah yields and lodging are similar to Champion.

Millennium (UT004603) – a six-row spring feed barley released in 2000 through Utah AES, Millennium does very well under irrigation, and has been in the top-yielding groups under dryland conditions when moisture was adequate. Millennium also has excellent straw strength, showing minimal lodging even under high-yield conditions. Millennium is of average height and protein for six-rowed varieties, and taller than two-rowed lines. Millennium has lower test weight and plump, and heads several days earlier than average. Millennium is susceptible to FHB and will accumulate high levels of DON.

Oreana (BZ509-448) – a two-rowed feed barley originally developed through WestBred, Oreana is carried by Highland Specialty Grains. In three-year data averages (Table 57), Oreana had good test weight, excellent yields similar to Millennium and Altorado, and was 4-5 inches shorter than average. Oreana showed intermediate reaction to FHB and showed higher levels of DON accumulated in the seed.

Xena (BZ594-19) – a two-rowed spring feed barley released by Western Plant Breeders that is now handled by Highland Specialty Grain. Xena has had very high yields over the locations tested from 2010-2019, similar to Champion. Xena is of average height and straw strength. Test weight tends to be slightly higher than average, but less than Champion. Xena has shown low FHB disease and lower DON levels.

WINTER BARLEY – Malt, Feed, Food

Buck – Buck (09-OR-86) – Oregon State University hulless, six-rowed winter food barley with intermediate levels of beta-glucan content in the seed, developed for human consumption and the heart-healthy food campaign. Buck is genetically related to #STRKR with better threshability. Buck yields are low if compared to hulled varieties, but yield is still high with a very high test weight (60.3 lbs/bu) due to the hulless seed trait (Table 26). In 2019, Buck yields (111 bu/A) and spring stand were low compared to Charles and other trial entries (Table 27). Buck is awned and can be used as food, feed or malt. Plumps are low.

Charles (94Ab1274) – Charles is the first AMBA approved two-rowed winter malt variety released by the USDA-ARS and the IAES in 2005. Charles yields and test weights are lower than the winter variety average (Table 26, 27, Chart 5). Charles is shorter than the average, earlier maturing and has a tendency to lodge. Charles has good plumps and yields very well in the Twin Falls area, even when harsh winter conditions reduce stand. Both Charles and Endeavor can suffer significant stand losses under cold, dry winter conditions.

Eight-Twelve – a six-rowed winter feed barley released by the USDA-ARS and the Idaho AES in 1991. Eight-Twelve yields averaged 137 bu/A under irrigation in 2016-2019 (Table 26). Eight-Twelve has good winter survival but will lodge under high production conditions.

Endeavor (95Ab2299) – Endeavor is the second two-rowed *winter* malt variety released by the USDA-ARS and the Idaho AES approved by AMBA for malt quality. Released in 2008, Endeavor has improved malt quality and yield over Charles,

especially in the Magic Valley area where winter kill is less of a problem than in eastern Idaho (Table 28, Chart 5) for 2019. Endeavor has good test weight and protein but had relatively low plumps for malt (Table 26).

KWS Donau – The variety KWS Donau is a two-rowed winter malt barley produced and released through KWS Lochow in Germany and marketed through KWS Cereals in the U.S. KWS Donau had very high yields, test weight and plumps in 2019, the first year entered in the trials (Table 27 and Chart 5). In Aberdeen, yields hit 199 bu/A (Table 29). Lodging was below average for the trials even though it was the yield leader. Maturity was earlier than average, and proteins were good at 9.6%, compared to the trial averages of 11.5%. For end-use quality, extract content for Donau was at the level of 81.4% with a low level of proteolytic and cytolytic modification, which is preferred in the craft brewing industry.

KWS Scala (GW2895) – 2-rowed winter malting variety from KWS Lochow, marketed in the U.S. through KWS Cereals. KWS Scala yielded above 2018 trial averages and in 2019 yields were similar to Thunder (Table 28) but with lower lodging. Test weight was low in comparison to other varieties, but still above the 48 lbs/bu needed for No. 1 barley, with good protein and plump. In Aberdeen, yields hit 200 bu/A (Table 29). Scala had good spring stand, was one day earlier in heading date and was 2 inches shorter than trial average. Testing in the Logan, UT area in 2012 and 2013 indicated good winter survival.

KWS Somerset (GW3479) – 2-rowed winter malting variety from KWS Lochow, marketed in the U.S. through KWS Cereals. In the first year of testing in southern Idaho, Somerset yields were comparable to KWS

Scala with good test weight, winter survival and plump. Heading dates, plant height and grain protein were about average. In 2019, KWS Somerset also has higher than average yields, similar to KWS Scala, with very good test weight, plump and low proteins. KWS Somerset was mid-maturity, taller than average with good lodging resistance.

LCS Calypso – a two-rowed winter malt barley brought in by Limagrain Cereal Seeds in 2016-17, Calypso is in the fourth year of testing in southeastern Idaho. LCS Calypso has shown excellent yield potential in southern Idaho, similar or greater to Sunstar Pride, with 155 bu/A and 52.9 lb/bu test weight over the three years of testing (Table 26, Chart 5). In Aberdeen in 2018, Calypso yielded 212 bu/A with little to no lodging. In 2019, yields in Aberdeen were 196 bu/A. Calypso was earlier in heading (3-4 days) and 2-4 inches taller than average with excellent percent plump and low lodging.

Sunstar Pride (SDM204-B) – winter six-rowed feed barley released by Sunderman Breeding in 1995. Sunstar Pride consistently has been one of the highest yielding varieties in the trials, similar to the high-yielding European malt lines. Test weight, protein, and plant height is below is average. Heading date is up to a week to ten days later than average, with low plumps.

Thunder (10.0777) – Thunder is a two-rowed winter malt release from Oregon State University (2016) with excellent yield potential and better winter survival than Charles and Endeavor. Thunder averaged 165 bu/A over the three-year summary (Table 26) with good test weight and spring stand. Heading date is three to five days earlier than the trial average and plant height was one to five inches less. Plump was above average and lodging was at trial averages, better than Endeavor and Charles.

In 2019, Thunder yields were comparable to KWS Scala, Sunstar Pride and better than Wintmalt, but with a tendency to lodge.

Upspring (05ARS748-270) – Upspring is a hulless, high beta-glucan (7% BG) winter barley variety and the latest food barley released from USDA-ARS breeding program in conjunction with the University of Idaho AES. Upspring was released as an alternative to Buck. While agronomically similar to Buck, Upspring had slightly higher yields, headed three to six days later, had greater percentages of plump seed and had 2% higher grain protein (Table 26). Seed germination may be low under dryland conditions. Upspring will be released under PVP.

Wintmalt – a shorter, two-rowed winter malt developed by KWS Lochow (Germany) and imported from Europe. Wintmalt has good foliar disease resistance, is being produced in the PNW and is an AMBA approved malt variety. In the third-year summary (Table 26), Wintmalt's lodging, protein and yields were at trial average. Wintmalt test weight was below average, heading was 1 day later than average, but plumps were excellent.

SPRING WHEAT – Soft White

Alturas (IDO526) – a low-protein soft white spring wheat released by Idaho AES and USDA-ARS in 2002. Alturas has a partial waxy endosperm which may make it vulnerable to low falling numbers. Alturas is adapted to both irrigated and dryland conditions, is average in yield (above average under irrigation Table 41), with average test weight, heading date and height. Alturas is susceptible to the current races of stripe rust and is moderately susceptible to Fusarium head blight (FHB).

AP Coachman (08PN2001-07) - dryland soft white spring from AgriPro / Syngenta Cereals with a release targeted for 2020. AP Coachman was tested in 2019 in one dryland location (Soda Springs, Table 47) and yielded very well (90 bu/A) competing with Tekoa and Seahawk. It was three inches taller than average, with average protein but it had low test weight. AP Coachman has resistance to current races of stripe rust, Hessian fly, and good (MR) resistance to Fusarium head blight.

Louise (WA7921) – soft white spring wheat released in 2004 from Washington State University's spring wheat breeding program and used as a long-term check for soft white spring wheat. Louise is a later maturity, tall wheat with below average yields and high lodging potential under irrigated conditions. Louise performed well under dryland conditions, being the highest yielding soft white spring variety in Soda Springs area (Table 41). Louise is susceptible to stripe rust and FHB.

Melba (WA8193) – Melba is a soft white spring club wheat developed by USDA-ARS in Pullman and released in conjunction with the Washington AES in 2016. Melba is one of the first club wheats with good yield performance in southeast Idaho, similar to Seahawk and UI Stone (Table 40 and Chart 7). Melba is average in height, five days later in heading than the soft white spring lines usually grown in the area, with low protein. Melba is resistant to stripe rust and had a similar “moderately resistant” reaction to FHB as Seahawk.

Ryan (WA8214) – Ryan is a partial waxy soft white spring wheat released from Washington State University, AES and USDA in 2016. In the first year of testing (2018), Ryan averaged higher in yield than

other soft white spring wheat varieties over four irrigated locations, but in 2019 (Table 42) irrigated yields were below average and similar to Louise. Under dryland conditions, yield was similar to SY Saltese and WB6430 (Table 47). Ryan has Hessian fly resistance, tolerance to low acid / high aluminum soils, and HTAP (high temperature adult plant) resistance to stripe rust. Ryan was early to heading, similar to UI Pettit, was shorter than average, had good test weight and resistance to lodging.

Seahawk (WA8162) – a soft white spring wheat released from Washington State University’s spring wheat breeding program in 2014 adapted to dryland and irrigated production areas. Seahawk has resistance to Hessian fly, is very resistant to stripe rust, and one of the least susceptible soft white spring wheats to FHB. Seahawk has tolerance to high aluminum, low pH soils. Yield and test weight has been one the highest of all currently available soft white springs, with similar to UI Stone and WB6430 (Table 40). Plant height is a little above average and heading date 2-4 days later than average. Seahawk may have a tendency to lodge under high production practices.

SY Saltese (SY3024-2) – a soft white spring wheat released in 2016 by Syngenta Cereals. SY Saltese has yield potential similar to Seahawk and UI Stone. Averaged over three years and four irrigated locations, SY Saltese yielded 120 bu/A (see Table 40). In 2019, SY Saltese yields were 7 bu below WB6121, and 3 bu/A greater than UI Stone (Table 42). SY Saltese also has good test weight and resistance to stripe rust (SR), but may be susceptible to currently developing SR races. SY Saltese may lodge under higher production situations and is susceptible to FHB. SY Saltese is also susceptible to Hessian fly.

Tekoa (WA8189) – a Washington State University 2016 release, Tekoa is a soft white spring wheat released for higher rainfall areas and will do well under irrigated conditions (Table 40). Tekoa did not yield as well in areas where irrigation was restricted at the end of the growing season. In 2018 and 2019, Tekoa yields were at trial average. Tekoa is adapted to low pH soils where aluminum toxicity can occur. Tekoa has good test weight, is a little later in maturity (heading date) than average and average for plant height. Tekoa is resistant to stripe rust, Hessian fly, and moderately resistant to FHB, similar to Seahawk.

UI Cookie (IDO1405S) – a soft white spring wheat released in 2019 by the University of Idaho Ag Experiment Station. Three-year irrigated averages (Table 47) show UI Cookie above trial average for yield, lower for test weight and higher for grain protein. UI Cookie has good end-use quality, similar or better resistance to FHB than UI Stone, better resistance to stripe rust and improved threshability.

UI Pettit (IDO632) – is a soft white spring wheat released in 2006 through the Idaho AES. Yields and test weight are lower than average. UI Pettit is short and heads 3-5 days earlier than Alturas. UI Pettit is very susceptible to current races of stripe rust and to FHB.

UI Stone (IDO599) - a soft white spring wheat released by Idaho AES in 2012, UI Stone has high yield potential, consistently greater than UI Pettit and similar to Alturas (Table 40). UI Stone was selected for good end-use quality and reduced FHB susceptibility (carries the Fhb1 resistance gene). In 2019, UI Stone yielded similar to Seahawk and about 10 bu/A below WB6121 (Table 42). The FHB reaction in UI Stone is

similar to Seahawk. UI Stone also has tolerance (not resistance) to Cereal Cyst Nematode, and is susceptible to the current races of stripe rust. Test weight, height and lodging are average, heading is two days earlier than average and two days later than UI Pettit.

WB-1035CL+ - 2-gene Clearfield soft white spring wheat released in 2011 by WestBred (a unit of Bayer Crop Science). Clearfield wheats have resistance to imazamox herbicides such as to Beyond® herbicide for hard-to-control grassy weeds. Clearfield spring wheats are mostly used behind winter wheat production where imazamox has been applied to reduce potential carryover damage from soil residual. Overall yields of WB-1035 CL+ are low and it is susceptible to stripe rust. WB-1035CL+ has good test weight (Table 42), is shorter and has earlier heading date than average, with relatively high protein.

WB6121 (BZ608-121) – soft white spring wheat released by WestBred (a unit of Bayer Crop Science) in 2015 intended for irrigated production areas. WB6121 has a Nick background but has good resistance to stripe rust. In the results of the third-year summary (Table 40), WB6121 yields were below average and similar to UI Pettit. In 2019, yields were the highest in the trial (Table 42), with good test weight, was 3 inches shorter than average and about two days earlier in heading than average. FHB disease reaction in 2017 **and** 2018 showed greater levels of resistance than Seahawk and UI Stone, but additional testing is required.

WB6430 (BZ608-125) – a soft white spring wheat released by WestBred (a unit of Bayer Crop Science) in 2014. WB6430 is a UI Pettit-type of soft white spring wheat with very high yield potential, good test weight, and resistance to stripe rust. Maturity is

slightly earlier than average, but 2-3 days later than UI Pettit. WB6430 is also 3 inches shorter than average and has good straw strength (Table 40). WB6430 is moderately resistant to stripe rust and susceptible to FHB. FHB reaction is more susceptible than Seahawk, which is moderately resistant, and has high levels of DON accumulation in the grain.

SPRING WHEAT – Hard White, Red and Durum

Alum (WA8166) – hard red spring wheat released in 2015 by Washington State University's Ag Experiment Station for tolerance to aluminum in low pH soils. Over the three years in the trials, Alum has had above average yields, similar to WB9411 for yield and test weight, but a little higher in protein (Table 31). Alum heads about four days later than WB9411, is four to five inches taller, and may lodge under high input production conditions. Alum has moderate resistance to moderate susceptibility to stripe rust and moderate resistance to Hessian fly. Alum would be suited for the Ashton area where acidic soils are problematic, and it did well in dryland conditions (Table 32).

Alzada (YU894-75) – durum wheat released in 2004 by WestBred (a unit of Bayer Crop Science) for excellent durum quality. Alzada yields are less than the average of other locally adapted hard red and white spring wheats, but greater than Imperial (durum) with average test weight and grain protein. Alzada is very susceptible to FHB, and is susceptible to the current races of stripe rust. Alzada has solid stems and performs well in dryland areas where the stem sawfly is a problem.

AP Octane (USW112000024-1-4) – Agripro / Syngenta released AP Octane hard red spring wheat in the Fall 2019 out of the

California program. Intended for irrigated production, AP Octane has performed well when fall planted. AP Octane in 2019 trials (Table 33) had high yield and below average protein. (Trials are managed for average expected yield, which often means higher yielding varieties do not have enough N available for both high yield and high protein.) AP Octane was 2 inches shorter than trial average and early maturity. AP Octane has resistance to stripe rust, BYDV and is Hessian fly susceptible.

AP Renegade (06PN3017-9) – a hard red spring released in 2018 from Agripro / Syngenta, AP Renegade is widely adapted across moisture zones with medium height and maturity in the Washington / Northern Idaho region showing quick germination and emergence. AP Renegade has shown later maturity (4 days) and higher plant height (4 inches) than average in testing in the Snake River Plain with good lodging resistance, average test weight and good protein. AP Renegade has resistance to Hessian fly, with good HTAP stripe rust and FHB tolerance. It should be available spring of 2020.

AP Venom (USW112000083-1-3) – Agripro / Syngenta released AP Venom – a tall hard red spring wheat released in Fall 2019 out of the California program. AP Venom is targeted for irrigated production, and in 2019 yielded equally as well as AP Octane in the average of the irrigated trials (Table 33). Venom has looked very strong in fall planted systems with good straw strength even though it was 4 inches taller than the trial averages and six inches taller than AP Octane. AP Venom was below average protein – these trials are managed for average expected yield, which often means higher yielding varieties do not have enough N available for both high yield and high protein. Like Octane, Venom is early maturity, heading three days earlier than

average. AP Venom has resistance to stripe rust and BYDV, but is Hessian fly susceptible.

Cabernet (95WV10616) – a 2007 hard red spring wheat from Resource Seeds, now Syngenta Cereals, Cabernet yields are similar to SY Gunsight and UI Platinum (Table 31). Cabernet is a little shorter than average, (1-2 inches shorter than WB9411, 4-5 inches shorter than Jefferson), has average to good test weight and may have lower protein unless appropriately managed with nitrogen applied at or shortly after heading. Cabernet was moderately resistant to the local race of stripe rust (2016), and moderately susceptible to susceptible to FHB.

Choteau – is a semidwarf hard red spring wheat released by Montana State University in 2003. Choteau has the solid-stem characteristic, which contributes to resistance to the stem sawfly. Choteau yields were below average and similar to Klasic under dryland conditions in Soda Springs (Table 38). Choteau is 4-5 inches taller and 2-4 days later in maturity than Klasic. Choteau had good test weight and protein, and has acceptable end-use quality.

Dagmar (MTS1588) – the dryland hard red spring wheat Dagmar is a 2019 release from Montana State University and in the first year of testing in UI trials was the top yielding variety in Soda Springs (Table 38). Dagmar had very good test weight, was medium maturity and was three inches taller than the trial average. Dagmar is PVP Title V (pending) and seed should be available 2021.

Dayn (WA8123) – Dayn is a hard white spring wheat released in 2012 by Washington AES and the USDA-ARS, and being handled in southern Idaho through

Syngenta Cereals. Dayn was the highest yielding hard white spring wheat over the past six years of the irrigated trials. Test weight is above average and heading date was at average. Protein was a little below average. Dayn was 2-3 inches taller than average but has good lodging resistance. End use quality is acceptable. Dayn is resistant to stripe rust and among the “least susceptible” hard white spring wheat for FHB.

Duclair – a hard red spring developed and released by Montana AES, with solid stem characteristic that reduces impact from wheat stem sawfly. It is currently under testing for adaptability to southeast Idaho conditions for areas where wheat stem sawfly is a problem. Duclair is an awned semi-dwarf variety, similar to Choteau, but heading three day earlier and about 1-3 inches taller, depending on the year. Yield of Duclair in Soda Springs was very good in 2019, comparable to SY Selway (Table 38), with below average test weight and protein with an early heading date. Duclair is PVP protected.

Glee (WA8074) – hard red spring wheat released in 2012 through Washington State University with desirable end use quality and resistance to stripe rust. Glee is included in the trial as a quality check. Yield of Glee is average in the dryland trials, lower than average under irrigation and similar to WB9411 (Table 33). Glee has good test weight, is taller than average (3-4 inches taller than WB9411) and is average for percent seed protein.

Imperial – a durum grain variety with awns that turn black with maturity, Imperial yields were less than Alzada in the trials. Imperial had low test weight and high grain protein (Table 31, 33).

Jefferson (IDO462) – hard red spring wheat released by Idaho AES and USDA-ARS in 1998. Jefferson is primarily intended as a dryland variety due to it being taller than average (about four inches taller under irrigation) and susceptible to lodging. Irrigated and dryland yields have been at or above nursery averages (Table 31, 32). Jefferson has good quality when there is adequate soil nitrogen and sulfur, when it has a minimum of 13% grain protein. Jefferson is susceptible to the current races of stripe rust and very susceptible to FHB, but resistant to Hessian Fly.

Klasic (NK77S1817) – a well-established hard white spring wheat with exceptional quality characteristics. Klasic was released in 1982 by Northrup-King, and while yields in the extension trials are low, yields can be excellent with appropriate irrigation practices, especially early season. Klasic has good test weight, is 5-6 inches shorter than average, and is earlier in heading and maturity. Klasic is very susceptible to stripe rust, FHB and Cereal Cyst nematode. While in certain years, FHB symptom development may be low due to earlier heading, the DON toxins from FHB infection can be high, as in 2016 trials. Triazole fungicides applied at flowering are highly recommended as a standard practice in growing Klasic. Two additional entries of Klasic at higher seeding rates were added to determine effect of seeding rate on yield. Klasic was seeded at 1, 1.2 and 1.4 million seeds per acre in all irrigated spring trials. Averaged across all locations (Table 33), the seeding rates resulted in 97, 105, and 99 bu/A for 1, 1.2 and 1.4 million seeds per acre. Given an LSD (alpha = 0.05) of 18.3 bu/A, there is no significant increase in yield resulting from higher seeding rates.

Net CL+ (WA8280 CL+) – a 2019 release from Washington State University, Net CL+

is a hard red spring, two-gene Clearfield variety (having Als1 and Als2). Net CL+ has good end-use quality and is intended for dryland production. Under irrigation in 2019, yields were slightly below average, it was 4 days later in maturity, was 5 inches taller and had a tendency to lodge (Table 33). Proteins were good under irrigation and dryland conditions (Table 38). At the dryland Soda Springs trial site, Net CL+ did very well for yield, similar to Jefferson and DuClair, but was six days later in maturity (heading date).

SY Coho (SY40292R) – released in 2015 by Syngenta Cereals, SY Coho has been tested in these trials for five years (see Table 31), with high yields similar to SY Teton and SY Gunsight. SY Coho had lower than average test weight and average protein. SY Coho suffers yield loss if irrigation is lower than needed late in the growing season. SY Coho is moderately resistant to moderately susceptible to stripe rust and moderately susceptible to FHB.

SY Gunsight (06PN3015-08) – Syngenta released this hard red spring in 2016. Average three-year yields were similar to SY Teton and Alum (Table 31). Test weight and grain protein of SY Gunsight are average, with earlier heading dates than SY Coho and one day later than trial average. It is moderately resistant to FHB (better than WB9411) and stripe rust, and susceptible to Hessian fly.

SY Selway (04PN3001-2) – A hard red spring wheat released for dryland production conditions in 2015 by AgriPro / Syngenta Cereals, SY Selway yields were similar to Jefferson and Alum. SY Selway had lower test weight than average and higher protein than Alum (Table 32), with similar heading date and plant height as Jefferson.

SY Teton (SY10136) – Syngenta Cereals released this hard white spring wheat in 2015. In the past three years, SY Teton was one of the highest averaging for yield of the hard white and hard red spring wheat group (Table 31). SY Teton was 7-10 bu/A less than Dayn for yield but with lower test weight and was three inches shorter. Heading date is early, and grain protein is less than average. Reaction to head blight was similar to Dayn, which was less susceptible than the majority of hard white spring wheat varieties. SY Teton is moderately susceptible to stripe rust, and may lodge at higher seeding rates

UI Platinum (IDO694C) – a University of Idaho and IAES hard white spring wheat, UI Platinum is an average yielding hard white spring wheat with good end-use quality, high test weight and good lodging resistance. Over the last three years, yield has been comparable to Alum and WB7589, and less than Dayn (W) and SY Teton (W) (Table 31). In some environments, UI Platinum will show dark chaff discoloration similar to black chaff infection, which is not a disease but a genetic trait called melanism. UI Platinum is susceptible to stripe rust and very susceptible to FHB.

WB7202CLP (XA7320) – a new hard white spring wheat released by Westbred (a unit of Bayer Crop Science). In the third year of testing, the irrigated yield average of WB7202CLP was similar to WB7589 and Jefferson and was at trial average. Test weight was higher than both varieties and higher than the average, heading date was 2 days earlier than trial average, and it was two inches taller than Klasic. WB7202CLP is a two-gene Clearfield wheat with tolerance to imazamox herbicide Beyond®. Additional use of spring Clearfield tolerant wheat includes planting following beans where imazamox may have a residual

presence in the soil, or to reduce wheat red volunteer in white spring wheat production. The FHB reaction of WB7202CLP was moderately susceptible, similar to Snow Crest and UI Stone.

WB7328 (BZS09-0133W) – most similar to Snow Crest, WB7328 is a hard white spring wheat with similar agronomic characteristics as Snow Crest, but is a little shorter. Released in 2015 by WestBred (a unit of Bayer Crop Science) as a Snow Crest replacement, WB7328 has better resistance to stripe rust and higher yield potential. In 2016, a year with high stripe rust pressure, WB7328 showed some susceptibility to stripe rust. Like almost all hard white spring wheat, WB7328 is susceptible to FHB. Agronomically similar to Klasic, it is 1-2 inches taller and has higher grain protein (Table 31).

WB7589 (BZ9S09-0735W) – a short-statured, hard white spring wheat most similar to Klasic in agronomic and end-use quality. WB7589 was released in 2015 by WestBred (a unit of Bayer Crop Science) as a replacement for Klasic, having better resistance to stripe rust and higher yield potential. WB7589 yields a little less than UI Platinum (Table 31). Under heavy pressure, WB7589 was moderately resistant to stripe rust in 2016. Like all hard white spring wheat, WB7589 is susceptible to FHB.

WB7589 (BZ) – WB7589 is a hard white spring wheat released in 2014 by WestBred (Bayer Crop Science) with yields in these trials comparable to Jefferson and Klasic (Table 31) under irrigation. WB7589 was at trial average for test weight and protein, was five inches shorter with heading date one day earlier than average. WB7589 did well in 2019 in the dryland trials, and comparable

to UI Platinum in the three-year dryland trial summary (Table 32).

WB7696 – a hard white spring wheat released in 2018 by WestBred (Bayer Crop Science), WB7679 was first tested in these trials in 2019, with yields and test weights similar to WB7589 but four inches taller with lower protein. WB7679 yielded four bu/A less than WB7589 under dryland conditions, but had similar test weight and 1% lower protein.

WB9411 (BZ908-418) – hard red spring wheat released by WestBred (a unit of Bayer Crop Science) in 2014 intended for irrigated and high rainfall production areas. WB9411 was similar in yield to Alum and Jefferson with significantly higher grain protein and test weight (Table 31). Test weight, heading date and plant height were at trial averages. End-use (baking) quality is excellent. WB9411 is resistant to current races of stripe rust, and moderately resistant to FHB.

WB9590 – a hard red spring released by Westbred / Bayer Crop Science in 2018 developed out of the North Dakota program. Yields in 2019 were similar to Alum in irrigated trials (Table 33), with average weight and high protein. WB9590 was 5-6 inches shorter than Jefferson with greater grain protein content, averaging 14.8% over the irrigated locations. Heading date was at average and three days later than Jefferson. WB9590 is resistant to stripe rust and moderately resistant to FHB.

WB9668 (BZ908-552) – a hard red spring wheat intended as a replacement for WestBred 936, WB9668 has been tested in the trials since 2014. Three-year data shows WB9668 to be lower than average for yield with excellent test weight and grain protein (Table 31), but yields very well under typical production conditions. WB9668 is 2

inches shorter than average with high test weight, lower lodging and an average heading date. WB9668 is very resistant to the current races of stripe rust and moderately susceptible to susceptible to FHB. WB9668 is also among the most resistant hard red spring wheats for cereal cyst nematodes (CCN).

WB9879CLP – developed by Montana State University and carried by WestBred /Bayer Crop Science, WB9879CLP is a hard red spring wheat with the solid stem characteristic that reduces impact from wheat stem sawfly. WB9879CLP is a two-gene Clearfield wheat with tolerance to imazamox herbicide Beyond®. Additional use of spring Clearfield tolerant wheat includes planting following beans where imazamox may have a residual presence in the soil, or to reduce wheat red volunteer in white spring wheat production. Under dryland conditions, yields were comparable to WB9668 with lower test weight and protein, with similar plant height. WB9870CLP headed three days later than WB9668. Under irrigation, yields were similar to Klasic (Table 33), but was 10 inches taller and six days later in heading.

WINTER WHEAT – Soft White

Appleby CL+ (ORI2161250CL+) – ORI2161250 CL+ is a Clearfield soft white winter wheat released in the fall of 2019 as 'Appleby CL+' after Dr. Arnold Appleby, a long-time professor of Weed Science at OSU. Clearfield wheats have resistance to imazamox herbicides such as to Beyond® herbicide for hard-to-control grassy weeds. Appleby CL+ has an earlier heading date than UI-Magic (1-4 days), good stripe rust resistance, good yield potential in the low to intermediate rainfall conditions and

acceptable quality. Under irrigation, Appleby CL+ yields were similar to Stephens and Brundage (Table 17). Appleby C+ was five inches taller than UI Magic CL+ and had good straw strength and low lodging.

Brundage (ID86-14502B) – a soft white winter wheat released in 1996 by the Idaho AES. Irrigated yield potential of Brundage is excellent, as is the end use quality. Yields in the last three years have been 90% of average as Brundage is very susceptible to several diseases, including stripe rust, dwarf bunt and Cephalosporium stripe. In 2016, stripe rust reduced Brundage yield significantly – by as much as 50% or greater of expected. In 2019 (Table 17) Brundage yielded 96% of trial average and 94% of SY Ovation, as stripe rust present late in the season but wasn't severe.

Bruneau (93-64901A) – soft white winter wheat released in 2009 by the University of Idaho AES. Bruneau has been a very high yielding variety, comparable to SY Ovation (Table 17). Bruneau is tall, later in maturity and has a tendency to lodge under high input environments. Bruneau will do well under irrigated and dryland production. In 2019, Bruneau yields were comparable to UI Castle CL+ and SY Ovation (Table 17 and Chart 4). Bruneau is moderately resistant to stripe rust, and has good end use quality, and low protein. It is susceptible to dwarf bunt. Like Brundage, Bruneau sprouts easily but had higher Falling number (FN) values.

Devote (WA8271) – a soft white winter wheat released in 2019 by the Washington State Ag Experiment Station and USDA-ARS, intended for rainfed production in areas of <12 inches of precipitation. Devote has excellent emergence when deep planted and yields exceed Otto (Table 24). Heading date was six days earlier than Otto and close

to SY Ovation. Tets weight was very good and plant height was about an inch less than trial average.

Eltan (WA7163) – soft white winter wheat released in 1990 by the Washington AES. Eltan has wide adaptability in the dryland production areas with good snow mold tolerance. Yields are still consistently good in dryland trials (Table 16). Eltan will lodge under irrigation and is one of the latest varieties for heading date, but is still a good choice for dry land production areas. Under heavy stripe rust pressure, Eltan was susceptible to stripe rust, and is moderately resistant to moderately susceptible to dwarf bunt.

Jasper (WA 8169) – Jasper is a soft white winter wheat that was officially released by the Washington State AES and the USDA-ARS in 2015. It is a mid-maturity line (four days earlier than Eltan and Otto) with good cold tolerance, stripe rust resistance, eyespot foot rot resistance, and very good end-use quality. It is broadly adapted with high yield potential, with yields in Southeastern Idaho comparable to LCS Artdeco and WB1529 under irrigation but with lower test weight (Table 15). Jasper seems to adapt very well to high rainfall and irrigation and does very well when water becomes limited later in the season. Under dryland conditions, Jasper yields were comparable to Eltan and UI Sparrow (Table 16). Jasper was better than Eltan for snow mold resistance, has good cold tolerance, is resistant to moderately resistant to stripe rust, but is very susceptible to dwarf bunt.

LCS Artdeco (NSA06-2153A) – Limagrain Cereal Seeds introduced several European lines into the US in 2011, including LCS Artdeco, a soft white winter wheat. In the three-year averages (Table 15), LCS Artdeco yields were similar to WB1529 and

UI Sparrow. The test weights were below average, and height was 2-3 inches shorter than average. LCS Artdeco is moderately resistant to stripe rust, and very susceptible to dwarf bunt.

LCS Blackjack (LWW15-71945) – Blackjack is a 2019 release from the Limagrain Cereal Seeds program; it is a soft white winter derived from a Bobtail/Roslyn cross with excellent yields in the 2019 trials (Table 17), similar to WB1783. Blackjack was two inches shorter than WB1783 with the same heading date but with lower test weight. Straw strength was good, and LCS Blackjack is resistant to stripe rust (Addendum 1).

LCS Drive (LWW12-7105) – a 2015 release from Limagrain Cereal Seeds, LCS Drive is a low protein, soft white winter wheat with yields similar to Brundage and SY Assure (Table 15), slightly below the trial average. In 2019, yields were below average, comparable to UI Sparrow and Stephens. LCS Drive has low test weight and runs 3-5 inches shorter than average, with strong straw strength and has a good fit under irrigation with wheel lines. It is an earlier maturing variety and therefore was preferred by voles in years where vole populations were high. LCS Drive is susceptible to dwarf bunt but should be grown under irrigated conditions where dwarf bunt pressure is low and with appropriate seed treatment. LCS Drive was very resistant to 2016 and 2019 races of stripe rust.

LCS Ghost (LWW14-74143) – an early maturity soft white winter wheat with improved stripe rust resistance over LCS Artdeco. Limagrain Cereal Seeds released LCS Ghost in 2019, targeted for low-intermediate rainfall zones. Under irrigation in 2019, LCS Ghost was at the top of the

yield chart (Table 17) at 188 bu/A in the irrigated averages, and 196 bu/A at Aberdeen (Table 21). Test weight was low, heading date was one day earlier than WB1783 and LCS Ghost was one inch taller. LCS Ghost wasn't tested under dryland conditions. LCS Ghost had good resistance to stripe rust in 2019.

LCS Hulk (LWW14-73163) – a soft white winter with released in 2018 by Limagrain Cereal Seeds for its wide adaptation in the PNW. In 2019, average yield of LCS Hulk was comparable to Norwest Duet with very good test weight (Table 17) and Eltan under dryland conditions (Table 18). Three year summaries show LCS Hulk with high yield potential (Table 15) comparable to SY Ovation with similar agronomic traits. Height is average under irrigated and dryland conditions, and heading date is also at trial average. LCS Hulk has good test weight and low to average protein. LCS Hulk is susceptible to dwarf bunt and resistant to stripe rust.

LCS Shark (LWW14-71195) – Also a 2018 release from Limagrain Cereal Seeds, LCS Shark is a soft white winter with high yield potential in the PNW and at trial average in the Snake River Plain with lower than average test weight. LCS Shark is derived from LCS Artdeco and has resistance to stripe rust and soil-borne mosaic virus (SBMV), endemic in some areas of the Palouse but not currently a problem in southern Idaho. 2019 performance of LCS Shark was average for yield, heading date, plant height, lodging and grain protein, but lower than trial average for test weight. LCS Shark is susceptible to dwarf bunt and is resistant to stripe rust (Addendum 1).

LCS Shine (LCS72916) – a broadly adapted soft white winter wheat with good

test weight and high yield potential in low to intermediate rainfall zone in the PNW. LCS Shine has a good quality profile derived from a cross of Bobtail and LCS Biancor. LCS Shine has excellent stripe rust and Cephalosporium stripe resistance. Shine was tested in the dryland trials in 2019 where yields were comparable to UI Sparrow (Table 18), while Shine was seven days earlier in heading and 6 inches shorter than UI Sparrow.

LCS Sonic (LCS 73161) – LCS Sonic is a soft white winter wheat with high yield potential, carries Pch1 foot rot resistance gene contributing to resistance to Cephalosporium stripe and crown rot. LCS Sonic is targeted for 12-16" rainfall zone in the Palouse area, is an excellent dryland fit for the eastern Washington growing area, and while tall is suitable for irrigated production in southern Idaho having good straw strength. In 2019, yield of LCS Sonic under dryland conditions was above average, similar to Norwest Tandem and greater than SY Ovation. LCS Sonic was 2 days earlier in heading, 2 inches taller than average, with test weight below average.

Nixon (OR2121086) – Soft white winter released from OSU in 2019, OR2121086 is being released as 'Nixon' after a couple who both served as chairs of the Oregon Wheat Commission, Bob and Jean Nixon. Nixon has an intermediate heading date, is stripe rust resistant and carries Pch1 for foot rot resistance. Nixon had good straw strength, good yield potential in intermediate to high rainfall conditions, good test weight and excellent end-use quality. Irrigated average yield over the past three years (Table 15) was 144 bu/A, comparable to WB1529 and Bobtail with good test weight. While Nixon yielded well under 2019 dryland conditions (Table 24), 3-year dryland average of 44

bu/A was below the 47 bu/A average (Table 16). Foundation seed available fall 2019.

Norwest Duet (LOR-092) – Norwest Duet was released in 2015 by Oregon State University jointly with Limagrain Cereal Seeds. Norwest Duet is a very tall soft white winter wheat that in the dryland locations performed less than average for yield and test weight. In 2019 irrigated trials, yield was comparable to WB1783, but with lower test weight. Heading date was 2 days later than average for the trial, and grain protein was at average. Norwest Duet is moderately susceptible to dwarf bunt and is resistant to stripe rust (Addendum 1).

Norwest Tandem (LOR-334) – a soft white winter wheat that was released in 2016 by Oregon State University jointly with Limagrain Cereal Seeds, LLC. Norwest Tandem yields were below average in 2017-2019 combined data, similar to UI Sparrow and UI Castle (Table 5). Tandem had average test weight, and 2 days earlier in heading date with strong straw strength. Dry land yields were above trial averages (Table 18) and similar to Bruneau. Norwest Tandem is susceptible to dwarf bunt, with good resistance to stripe rust.

OR2X2 CL+ (ORI2150031CL+) – ORI2150031 CL+ was released as 'OR2X2 CL+' in 2019. Its name is based on the line having two genes for herbicide resistance and two genes (Pch1 and Pch2) for foot rot resistance. Clearfield wheats have resistance to imazamox herbicides such as to Beyond® herbicide for hard-to-control grassy weeds. In southeastern Idaho, OR2X2 CL+ has an intermediate to late heading date, (a day or two after UI Magic CL+ under irrigation but 8 days later under dryland conditions, see Table 16), good stripe rust resistance, good straw strength, and acceptable quality.

Otto (WA008092) – a dryland (<12" rainfall production zone) soft white winter released September 2011 by Washington AES, Otto is similar agronomically to Eltan and both are 5 days later in heading than trial average (Table 16). Otto has similar yield potential to Eltan, similar to WB1783 and UI Sparrow with test weight similar to Eltan. Otto has good emergence in the dryland areas with good resistance to eyespot foot rot and cold tolerance, will have similar snow mold tolerance as Eltan, better stripe rust resistance and also is moderately resistant to dwarf bunt.

Purl (WA8234) – Purl is a soft white winter wheat released in 2018 by WSU and the Washington Ag Experiment Station. Purl has had high yield potential with very good test weight and cold tolerance, resistance to stripe rust, eyespot foot rot, cereal cyst nematodes, and low pH soils. Purl has shown good falling number data. Tested in 2019 in the dryland trials, Purl performed similar to Bruneau for yield, test weight (at trial average), winter survival, while heading 5 days earlier. Quality is not excellent but would be good to use for blending.

Rosalyn (OR2071071) – a soft white winter, 2013 release from Oregon State University and the USDA-ARS, Rosalyn irrigated and dryland yields in 2019 were above average and similar to Bruneau (Table 17 and 18, respectively), and test weight and grain protein were less than average. Rosalyn is moderately resistant to dwarf bunt and stripe rust.

Stephens (OR65-116) – a 1977 soft white winter release from Oregon AES, Stephens is still widely grown in southwestern Idaho. Yield and test weight under irrigation are below average (Table 15, and Table 16). Stephens heading date and protein are at

average. End-use quality is poor. Stephens is moderately susceptible to dwarf bunt, and does not have good resistance to BYDV, snow mold or stripe rust.

Stingray CL+ (WA8275CL+) – Officially released in 2019 through WSU as Stingray CL+, WA8275 CL+ was the top yielding 2-gene Clearfield line in Washington, Northern Idaho and Oregon. Stingray CL+ is broadly adapted and has very good stripe rust resistance, eyespot foot rot resistance, and very good falling numbers and test weight. In 2019 irrigated locations, Stingray CL+ yields were similar to LCS Hulk and Norwest Duet (Table 17), while under dryland conditions, Stingray yields were similar to SY Dayton and Bobtail (Table 24). Stingray CL+ was not included at all dryland locations.

SY Assure (SY 96-2) – a soft white winter wheat released in 2016 by Syngenta Cereals, yield in 2017-2019 irrigated trials was comparable to LCS Drive and greater than WB 456 (Table 15) with very good test weight. Heading was earlier than the trial average by three to four days. SY Assure is 1-3 inches shorter than average. SY Assure is moderately resistant to moderately susceptible to dwarf bunt, and resistant to stripe rust.

SY Dayton (SY62#18) – a soft white winter wheat adapted to the Dayton, WA area and released by Syngenta in 2017. Yield for SY Dayton in 2019 was similar to Bobtail and Eltan in Soda Springs (Table 24) with the test weight better than Bobtail but less than Eltan. Heading date is a little later than trials average but four days earlier than Eltan, and 2-3 inches shorter. SY Dayton was included in the irrigated trails in 2018 and yields were 10 bu/A above average with average test weight, heading date and plant height with no lodging and low grain protein (see Table

18 of the 2018 SGR available online). SY Dayton has two genes for resistance to soil-borne mosaic virus, has good tolerance to C-stripe and stripe rust, and is very susceptible to dwarf bunt.

SY Ovation (03PN108#21) – a soft white winter wheat released by Syngenta Cereals in 2011. SY Ovation has had excellent yields over the past six years, similar to Bruneau with better test weight. Heading date, height, test weight and grain protein were average (see Table 15). SY Ovation is resistant to soil-borne mosaic virus, moderately susceptible to current races of stripe rust and susceptible to dwarf bunt. SY Ovation has good end-use quality and threshability.

SY Raptor (04PN046#16) – Released in 2017 through Agripro/Syngenta Cereals, SY Raptor is a low protein soft white winter wheat tested for the first time in 2019. SY Raptor has good HTAP resistance to current races of stripe rust, moderate tolerance to Cephalosporium stripe, and short to medium height with good straw strength under irrigation. Yield performance in southern Idaho was similar to Jasper and LCS Shark, at trial average (Table 17). Test weight was slightly below trial average, with heading date one day earlier, similar to Brundage but three inches shorter.

UI Castle CL+ (IDN 09-DH10) – UI Castle CL+ is a soft white winter wheat and is a two-gene Clearfield line. Clearfield wheats have resistance to imazamox herbicides such as to Beyond® herbicide for hard-to-control grassy weeds. UI Castle CL+ was released in 2015 as a joint release from the Idaho AES and LCS seeds, and for the three-year averages (Table 15), the irrigated yields were above trial average, similar to WB1783. It was 3-4 later in heading than average, 3 days later than SY Ovation, and

more prone to lodging. Test weight of UI Castle CL+ was average, and dryland yields were a little lower than trial average (Table 16). UI Castle CL+ is intermediate in resistance to stripe rust, and susceptible to dwarf bunt.

UI Magic CL+ (IDN 09-DH11) – UI Magic CL+ is a soft white winter wheat and is a two-gene Clearfield line. Clearfield wheats have resistance to imazamox herbicides such as to Beyond® herbicide for hard-to-control grassy weeds. UI Magic CL+ was released in 2015 as a joint release from the Idaho AES and LCS seeds. Yields in 2017-2019 were above trial average (Table 15) and similar to SY Ovation. Test weight is slightly above average and similar to UI Castle CL+, heading date is at trial averages, but two inches shorter than average and SY Ovation. UI Magic CL+ is susceptible to stripe rust and to dwarf bunt.

UI Sparrow (IDO1108) – a 2016 release from the University of Idaho, UI Sparrow is a soft white winter wheat with high yield potential in irrigated and dryland production. While adapted to both, UI Sparrow has a higher tendency to lodge under irrigated production. Three-year irrigated yield was above average and similar to UI Castle CL+. UI Sparrow has lower test weight and a later heading date than average under irrigation (Table 15). Under dryland conditions, UI Sparrow was a top yielding variety over the past three years (Table 16). UI Sparrow is very resistant to dwarf bunt, which is a huge benefit under organic production systems. It is also susceptible to current 2019 races of stripe rust (see Addendum 1), a low disease pressure year.

VI Bulldog (UIL07-28017B) – VI (Varsity Idaho) Bulldog, developed from advanced experimental lines, has good test weight — a measure of the density of wheat kernels —

and extremely thick and strong straw. In trial plots throughout the Northern Idaho/Washington region, it's been the highest yielding variety at under 16 inches of annual moisture and has potential under irrigation or on dry land in Southern and Eastern Idaho. In the three-year summary (Table 15), VI Bulldog is medium maturity, has average yield and good test weight under irrigation. VI Bulldog is resistant to stripe rust (Addendum 1).

WB 456 (BU6W99-456) – a soft white winter wheat from WestBred (a unit of Bayer Crop Science). WB 456 was released as an improvement over WB 470 and as a replacement for WB 528. WB 456 yielded less than Stephens in the past three years (Table 15) and had excellent test weight. 2019 yields were below average (Table 17). WB 456 is shorter than Stephens with improved lodging resistance. WB 456 has an early heading date, 3-5 days earlier than average, and is moderately susceptible to stripe rust. WB 456 is susceptible to dwarf bunt.

WB1376CLP (WB-1038CL) – soft white winter wheat released by WestBred (a unit of Bayer Crop Science) in 2015. WB1376CLP is an imi-tolerant, soft white winter wheat, containing two genes for tolerance to BASF's grass herbicide Beyond®. Irrigated yields were below average (similar to WB 456) but with excellent test weights (Table 15, 16). Dryland yields were at the trial averages, similar to Bruneau (Table 16). Height is average and 1-2 inches taller than WB 456. WB1376CLP is susceptible to dwarf bunt, and moderately resistant to moderately susceptible to stripe rust.

WB1529 (BZ6W07-436) – soft white winter wheat released in 2014 by WestBred (a unit of Bayer Crop Science). Yields of

WB1529 under irrigation are similar to UI Sparrow and Jasper over three years 2017-2019 (Table 15), with much higher test weight and good straw strength. Grain protein was at nursery averages. Dryland yields of WB1529 were similar to UI Sparrow and Otto (Table 16). In comparison to WB1783, WB1529 is one day earlier in heading date and 1-3 inches shorter. WB1529 has good milling and baking quality. WB1529 is resistant to current races of stripe rust and resistant to dwarf bunt.

WB1783 (BZ6W09-471) – a high yielding soft white winter wheat released in 2016 by WestBred (a unit of Bayer Crop Science). Irrigated yield averaged as high as SY Ovation, Bruneau and UI Magic CL+ (Table 15), with good test weight and good straw strength. Multiple year and location dryland yields were also good, comparable to UI Sparrow (Table 16). Irrigated yield in 2019 was very good (Table 17 and Chart 4), higher than SY Ovation and UI Sparrow. Dryland yields (Table 16) were also excellent, similar to Otto, Eltan and WB1529. WB1783 is very resistant to stripe rust and very susceptible to dwarf bunt.

WINTER WHEAT – Hard Red and White

Hard White Winter Wheat

AP NuGrain (W96-530-053W) – a hard White Winter with very good end use quality and good protein from the central plains AgriPro Breeding project. AP NuGrain is very well adapted for Nebraska irrigated production and first tested in these trials in 2019. Yield in the irrigated trials were below average, similar to Utah 100, with good straw strength. AP NuGrain was two days earlier than average and had good grain protein. Foundation or Registered seed

is available. In 2019, a year of low stripe rust pressure, AP NuGrain was susceptible (Addendum 1).

Golden Spike (UT1944-158) – a 1999 release from Utah AES for dry land production, Golden Spike is a hard white winter wheat with a partial waxy endosperm. Golden Spike will lodge under irrigation. Under dryland conditions, Golden Spike's test weight is below average, with average yield and grain protein. Plant height was 1-3 inches less than Deloris and 2-3 inches greater than trial average (Table 5). Golden Spike is very resistant to dwarf bunt, but is susceptible to stripe rust.

Irv (OR2110679) – a hard white wheat released from Oregon State University in 2018, Irv had low yield average under dryland conditions (Table 5) in southeastern Idaho and slightly below average yields under irrigation. Irv had average spring stand, heading date and plant height, and was below average for protein and test weight. Irv was resistant to stripe rust in 2019.

LCS Yeti (LCI13DH-2222) – LCS Yeti is a hard white winter wheat released in 2018 by Limagrain Cereal Seeds. LCS Yeti yields under dryland production in the past three years (Table 7) were at trial average, similar to Golden Spike, with very good test weight. LCS Yeti had very good protein, 0.5 to 1% higher than UI Silver. LCS Yeti headed three days earlier than average and was one inch shorter. LCS Yeti is susceptible to dwarf bunt (DB) and needs seed treatment if grown in areas prone to DB disease. LCS Yeti is moderately susceptible to stripe rust and resistant to soil-borne mosaic virus.

Millie OR2130118H (W) – a hard white winter released the fall of 2019, named 'Millie' after Millie Rouch, wife of Irv

Rouch, a dryland wheat farm family in eastern Oregon who have been long time supporters of the OSU wheat breeding program and the HWW program at OSU. Millie has good straw strength even under irrigation, good stripe rust resistance, excellent yield potential across rainfall zones from dryland to irrigated. Yields of Millie in 2019 were excellent under irrigation (Table 6). Three-year summary of irrigated trials put Millie at the same yields as Yellowstone with very high test weight and 2 inches shorter than average. Millie has acceptable to good HWW quality which depends on hitting protein targets.

UI Bronze Jade (W) (IDO1706) – this hard white winter wheat has been in the trials for two years, and has demonstrated good yield, but very low test weight and overall poor quality and should be grown only with a specific market in mind and contracted. This dryland variety will lodge under irrigation and is 2 inches taller than average. Under dryland conditions, UI Bronze Jade was average for yield, heading date and plant height, and low for test weight. UI Bronze Jade was susceptible to stripe rust in 2019 (Addendum 1).

UI Silver (IDO658B) – a hard white winter wheat released in 2011 by the University of Idaho AES. UI Silver yields very well under dry land conditions with excellent test weight (Table 5). UI Silver has good end use quality for both bread and Asian noodles. UI Silver has resistance to stripe rust (high temperature adult plant or HTAP), dwarf bunt, and carries the SrTmp gene for resistance to stem rust. It is susceptible to black chaff and lodging, which can be a problem under irrigation. Like Golden Spike, UI Silver is a partial waxy winter wheat. UI Silver is very resistant to dwarf bunt and moderately resistant to stripe rust.

Hard Red Winter Wheat

AP Redeye (SY 05PN044-20) – a hard red winter wheat tested first in these trials in 2019, AP Redeye is well adapted to intermediate rainfall production zones. AP Redeye was developed and released by AgriPro / Syngenta Cereals in 2019, for disease tolerance, high yield potential, good protein and very good stripe rust resistance. In 2019, AP Redeye yield performance was comparable to LCS Jet with excellent test weight and no lodging (Table 6 but tested only at 2 locations). Protein was a little low, but additional nitrogen would need to be applied to meet N requirements for yield and protein. (Trials are managed for average expected yield, which often means higher yielding varieties do not have enough N available for both high yield and high protein.) AP Redeye was resistant to local races of stripe rust and has acceptable end-use quality.

Bobcat (MTS1588) – semi-dwarf solid stemmed hard red winter wheat from Montana AES with improved yield potential relative to other solid stemmed varieties and tested for the first time in these trials in 2019. Bobcat was developed by the Montana Agricultural Experiment Station and was released to certified seed growers in fall 2019. Bobcat is an awned, white-glumed, semi-dwarf wheat with medium to late maturity, and was two days later than trial average (Table 6). Stem solidness is excellent, significantly higher than to Warhorse (tested in the 2014-18 trials). Bobcat has above average test weight and average protein, and in MT trials, average winter hardiness. Bobcat is resistant to prevalent races of stripe rust (Addendum 1) and stem rust, but susceptible to leaf rust. Bobcat is a medium high PPO variety with good mill and bake properties.

Curlew (UT9325-55) – a hard red winter wheat released by the Utah AES for the dryland production areas of southern Idaho and northern Utah in 2009. Curlew yields are comparable to UI SRG and Utah 100 under dryland conditions and is agronomically similar to Utah 100 with medium maturity, and an inch taller with better test weight (Table 5). Curlew is very resistant to dwarf bunt, and is moderately resistant to stripe rust.

Deloris (UT2030-32) – a very high end-use quality hard red winter variety for dryland production. Deloris was released in 2002 by the Utah AES and yields well under dryland conditions when stripe rust is absent. Three-year yields place Deloris above average with good test weight and protein. Plant height is 2-3 inches taller than average (Table 7). Deloris is very susceptible to stripe rust and very resistant to dwarf bunt.

FourOsix (MT1462) – a hard red winter released in 2018 by Montana State University as a replacement to Yellowstone, well-known for its high yield, with improved milling and baking qualities. FourOsix has shown high loaf volume, water absorption and mixing characteristics. In our trials, FourOsix had comparable yield and grain protein, also has a higher test weight, was 3 inches shorter and had less lodging than Yellowstone. FourOsix heads 2 days earlier than Yellowstone and has better resistance to stripe rust.

Greenville (UT9743-42) – Utah AES released Greenville hard red winter wheat in 2010 for irrigated production. Greenville is short, was below average for 3-year average yield under irrigation (Table 4) and dryland conditions. Test weight was below average, heading date and grain protein were at trial average. Greenville currently is susceptible to stripe rust and dwarf bunt.

Juniper (IDO 575) – hard red winter wheat released in 2005 by the Idaho AES for dry land production areas. Juniper has low to moderate yield potential under dryland production (Table 5, 7), is extremely tall and will lodge under irrigation. Juniper has good test weight and protein. Juniper performs similar to Whetstone and Greenville, is very resistant to dwarf bunt and moderately resistant to stripe rust.

Keldin (ACS55017) – a hard red winter wheat distributed by WestBred (a unit of Bayer Crop Science) for irrigated production, Keldin has consistently been a high yielding hard red winter wheat tested in these trials. Comparable to Yellowstone and LCS Jet, yields are excellent under irrigated and dryland conditions (Table 5, 7), although in 2019, Keldin average irrigated yields were 156-163 bu/A, 15 bu/A less than the highest yielding variety LCS Jet (Table 6). Keldin is a little shorter than average for height, has very high test weight, and is below average for grain protein. Keldin is susceptible to dwarf bunt and in 2016 and 2018 was moderately susceptible to current races of stripe rust.

Keldin + 11-52-0 – In-furrow fertilizer was added to one variety in the hard winter and soft winter group to test the effect of starter fertilizer on yield. (Monoammonium phosphate or 11-52-0 at 20 lbs phosphate per acre was included in-furrow.) In Table 6 (irrigated averages for 2019), Keldin and Keldin +11-52-0 were within 7 bushels of each other (LSD = 17 bu/A), and very similar in other agronomic traits, indicating no effect of starter fertilizer on yield, stand or other agronomic traits. Under dryland conditions, Keldin + 11-52-0 was 2 bu/A greater than Keldin, but with the LSD of 9 bu/A, there is no statistically significant difference between the two for yield.

LCS Jet (NSA 7208) – a hard red winter wheat released in 2015 by Limagrain Cereal Seeds. LCS Jet has excellent yield potential (Table 4 irrigated, 15 dryland) and has been the top yielding hard red winter for the previous six years of irrigated testing. In 2019, LCS Jet yielded 111% of irrigated mean (Table 14 and Chart 3). Test weight, grain protein and lodging has been below average, and LCS Jet has been 3 inches shorter than average. LCS Jet is very susceptible to dwarf. In 2019, LCS Jet showed an increase stripe rust susceptibility with a susceptible infection type (Addendum 1). LCS Jet has good end use quality.

LCS Rocket (NSA10-2196) – is a hard red winter wheat released from Limagrain Cereal Seeds in 2018, demonstrating high yield potential in Northern Idaho and the Palouse area in high rainfall zones. Irrigated average yield in 2018 was below trial average, with low test weight and grain protein. Yields in 2019 under irrigation were 10 bu/A greater than trials average (Table 6), and 4 bu/A greater than Yellowstone. Test weight and protein were again below trial average. Three-year summary (Table 4) put LCS Rocket at trial average for yield but significantly below average for test weight. LCS Rocket has good resistance to stripe rust and is susceptible to dwarf bunt.

LCS Zoom (LWW14-73915) – a Limagrain Cereal Seeds hard red winter released in 2019 with good yield potential in the intermediate to low rainfall areas of OR and WA. LCS Zoom can emerge from deep furrows with a long coleoptile. LCS Zoom was comparable to Yellowstone for yield in 2019 irrigated trials (Table 6), was 6 days earlier in heading and 6 inches shorter. LCS Zoom had excellent stripe rust resistance in 2019 (Addendum 1).

Norwest 553 (ORN00B553) – a hard red winter wheat released by Oregon State in cooperation with the USDA-ARS and developed by Nickerson U.K. Norwest 553 showed a mixed reaction to stripe rust in 2019 and is tolerant to Fusarium crown rot and has yielded at or below trial averages (Table 4) under irrigation, comparable to Whetstone. Norwest 553 is 4-5 inches shorter than average with excellent lodging resistance. Grain protein, test weight, and heading date were at trial average. Winter hardiness is a problem in some years especially when entering the winter under dry conditions. Norwest 553 is susceptible to dwarf bunt.

Promontory (UT1567-51) – a hard red winter wheat released by Utah AES in 1990. Promontory is a dryland variety with good test weight. Yield under irrigation has been above average, but it will lodge and was not included in the irrigated trials in 2019. Promontory has short coleoptiles and may have trouble emerging when planted deep in dry soils. Over the past three years of testing (Table 7), Promontory yields were at trial average with excellent test weight. Promontory is resistant to dwarf bunt and moderately susceptible to stripe rust.

Ray (MTF1432) – Ray is Montana State University's new forage variety released in 2018. Bred as an awnless livestock forage, Ray was named after the late MSU Professor Ray Ditterline, who taught plant sciences courses in the College of Agriculture and bred alfalfa forage varieties for the Montana Agricultural Experiment Station. Ray can be used as a one-cut, annual hay crop which may suit the dairy production areas in Idaho, producing similar hay yields and forage quality as Willow Creek, but with a higher seed yield than Willow Creek. With dual-use potential, Ray's protein quality and market

characteristics are similar Yellowstone. Ray has a higher seed yield than Willow Creek, due to its higher tillering, earlier heading, shorter height and increased winter hardiness compared to Willow Creek. Yields under irrigation were below irrigated trial average and similar to Utah 100 (Table 6). Dryland yields in 2019 were comparable to LCS Jet (Table 7). Test weights were below average. Ray is moderately resistant to moderately susceptible to stripe rust.

Scorpio (WA8268) – a broadly adapted hard red winter wheat released in 2019 by Washington State University. Scorpio has high yield potential similar to LCS Jet and better than Keldin, had moderately susceptible reaction to stripe rust in 2019, and has good end-use quality. Scorpio did well under irrigation (Table 6), with yields close to LCS Jet and AP Redeye, with lower lodging than LCS Jet. Test weight was significantly less than AP Redeye, and heading date was two days later. Scorpio should be well-adapted to no-till situations with low pH and has Al tolerance.

Sequoia (WA8180) – a hard red winter wheat released in 2015 by Washington State University AES and the USDA-ARS, Sequoia was tested for the first time in the 2017-18 trial. Sequoia was released for its combination of emergence and high yield in rainfed production areas receiving less than 12 inches of precipitation in the deep-furrow planting systems of Oregon and Washington. Irrigated yield in 2019 was low (Table 6), while under dryland conditions, yield of Sequoia was good, averaging similar to SY Clearstone and Deloris (Table 7), with slightly good test weight. Sequoia is very tall, 2 inches shorter under irrigation than Juniper with 1% less grain protein. Sequoia did not perform well under irrigation as lodging was high and showed a very susceptible reaction to stripe rust

(Addendum 1). Sequoia was moderately susceptible to dwarf bunt, similar to Eltan.

SY Clearstone 2CL (MT CL1077) – a hard red winter wheat release by Syngenta in 2014, SY Clearstone 2CL is a two-gene Clearfield line agronomically similar to Yellowstone. Clearfield wheats have resistance to imazamox herbicides such as to Beyond® herbicide for hard-to-control grassy weeds. Under dryland conditions yields were excellent, similar to Yellowstone (Table 5, 7, Chart 3) with good test weight. Like Yellowstone, SY Clearstone 2CL is taller than average and may lodge under irrigation. SY Clearstone 2CL is moderately resistant to dwarf bunt, and moderately resistant to stripe rust.

SY Touchstone (04PN028B-3) – SY Touchstone is a short hard red winter wheat that performed similar to Greenville and Whetstone in 2017-19 dryland trials (Table 5), with good test weight and grain protein. Released by Syngenta Cereals in 2016, SY Touchstone is shorter in plant height than Keldin with good straw strength. SY Touchstone is winter hardy, has good snow mold tolerance, moderately resistant to stripe rust and susceptible to dwarf bunt.

UI SRG (IDO656B) – a hard red winter wheat released in 2012 by the Idaho AES for the dryland conditions of southern Idaho and northern Utah. SRG will lodge under irrigation without the use of growth regulators. Yields in the past three years have been well above dryland average, comparable to Yellowstone with similar test weight (Table 5). UI SRG is very resistant to dwarf bunt and resistant to stripe rust.

Utah 100 (UT1650-150) – a hard red winter wheat released in 1997 by the Utah AES. Utah 100 has consistently done well under both irrigated (Table 4) and dryland (Table

5) conditions for yield. As a dry land variety, Utah 100 may lodge under irrigated conditions. Utah 100 is very resistant to dwarf bunt and is susceptible to current races of stripe rust.

WB4311 – released in 2018 by Westbred / Bayer Crop Science, WB4311 is a hard red winter wheat released for its yield potential, standability, test weight and protein. WB4311 had good yield in irrigated and dryland areas in 2019 (Table 6, 7 and Chart 3), comparable to Yellowstone. WB4311 had excellent test weight, was 2-3 days earlier in heading, and had high grain protein. WB4311 has good stripe rust resistance and winter hardiness.

WB4623CLP – a hard red winter wheat released by WestBred (a unit of Bayer Crop Science), WB4623CLP is a two-gene Clearfield wheat. Clearfield wheats have resistance to imazamox herbicides such as Beyond® for hard-to-control grassy weeds. WB4623CLP had below average yields under irrigation but with excellent test weight and protein (Table 4). In the dryland trials yields were at trial average, similar to Juniper (Table 5). Heading date was a little early to average, and plant height was one inch taller than average under irrigation and 3 inches less in dryland. WB4623CLP is susceptible to dwarf bunt and resistant to stripe rust.

WB4792 – a hard red winter released in 2018 by WestBred/Bayer Crop Science, WB4792 is under the first year of testing in these trials. Initial results show very high yield potential with excellent test weights (Table 6). Yields were similar to LCS Rocket and greater than Yellowstone. WB4792 was 1 inch taller than trial average and had some lodging under irrigation, and proteins were low. Additional nitrogen would need to be applied to meet N

requirements for yield and protein. (Trials are managed for average expected yield, which often means higher yielding varieties do not have enough N available for both high yield and high protein.) Under dryland conditions, yields were similar to Juniper. WB4792 showed susceptibility to 2019 races of stripe rust (Addendum 1).

Whetstone (W98-355) – is a hard red winter wheat from AgriPro, now Syngenta Cereals, released in 2009. Whetstone is a medium height semi-dwarf with buckskin colored chaff at maturity. Whetstone is an early-maturing wheat heading 3-5 days earlier than irrigated trial averages (Table 4). Whetstone has a good level of winter-hardiness, but is susceptible to the current prevalent races of stripe rust (2019, Addendum 1). Yield in the past three years has been below average (Table 4, Chart 2), with good test weight and grain protein with very good loaf volume. Whetstone is very susceptible to dwarf bunt.

Yellowstone (MT00159) – a hard red winter wheat with excellent yield potential in both irrigated (Table 4, Chart 2) and dryland conditions (Table 7) of southeast Idaho. In 2018 at Aberdeen, Yellowstone yields reached 177 bu/A (Table 10), and in 2019 was 155 bu/A in Rupert (Table 9). Yellowstone was released by Montana State University and the AES in 2005 and has above average test weight and height, and average grain protein. End use quality is average, with above average loaf volume. Under very high production inputs, Yellowstone will lodge under irrigation. It is moderately resistant to dwarf bunt and susceptible to stripe rust. Yellowstone accounted for 18.8 percent of the Montana state's planted wheat acreage in 2016, according to the Montana Agricultural Statistics Service.

Table 3. Ten year averages of selected agronomic characteristics, 2009-2018 compared to 2019.

NOTE: "Average" values are for years 2009 to 2018

Winter Wheat (all market classes and locations)

YIELD			TEST WEIGHT			PLANT HEIGHT			HEADING DATE			LODGING			
Year	# of Loc.	bu/A	Year	# of Loc.	lb/bu	Year	# of Loc.	in.	Year	# of Loc.	date	Days fr. Jan.1	Year	# of Loc.	%
2018	7	104	2017	6	60.8	2015	6	35	2011	5	6/19	171	2014	5	25
2015	6	103	2018	6	60.3	2016	6	35	2010	5	6/19	171	2010	5	21
2009	5	102	2010	5	60.3	2009	5	35	2019	6	6/12	164	2009	5	17
2012	5	102	2011	5	60.2	2010	5	34	2009	5	6/10	162	2016	6	11
2014	4	101	2019	6	60.0	2019	6	33.2	Avg.	---	6/7	159	Avg.	---	10
2019	6	99	2009	5	60.0	2018	7	33	2017	6	6/7	159	2011	5	9
Avg.	---	96	2012	5	59.7	2011	5	32	2013	5	6/6	158	2013	5	8
2010	5	95	Avg.	---	59.5	Avg.	---	33	2014	5	6/5	157	2012	5	5
2016	6	94	2016	6	59.4	2014	5	32	2018	7	6/5	157	2015	6	4
2017	6	91	2013	5	59.4	2013	5	31	2012	5	6/4	156	2019	6	3
2011	5	86	2015	6	58.1	2012	5	30	2016	6	5/31	152	2018	7	1
2013	5	79	2014	4	56.1	2017	6	29	2015	6	5/31	152	2017	6	0

Spring Wheat (all market classes and locations)

YIELD			TEST WEIGHT			PLANT HEIGHT			HEADING DATE			LODGING			
Year	# of Loc.	bu/A	Year	# of Loc.	lb/bu	Year	# of Loc.	in.	Year	# of Loc.	date	Days fr. Jan.1	Year	# of Loc.	%
2014	5	107	2016	5	61.9	2014	4	34	2010	5	7/10	192	2014	4	16
2009	5	107	2009	5	61.8	2019	5	34	2011	5	7/10	192	2010	5	5
2018	5	106	2017	5	61.6	2009	5	34	2009	5	7/3	185	2019	5	4
2019	5	100	2013	5	61.4	2010	5	33	2019	4	6/28	180	Avg.	---	3
2017	5	98	2012	5	61.4	2011	5	32	Avg.	---	6/26	178	2011	5	3
2015	5	97	2015	5	61.0	2018	5	31	2012	5	6/25	177	2016	5	3
Avg.	---	97	2018	5	61.0	Avg.	---	31	2017	5	6/24	176	2015	5	2
2011	5	96	2019	5	60.8	2016	5	31	2013	5	6/23	175	2013	5	2
2010	5	91	Avg.	---	60.7	2015	5	30	2016	5	6/21	173	2017	5	1
2016	5	91	2010	5	60.6	2012	5	30	2018	5	6/20	172	2012	5	0.4
2012	5	90	2011	5	59.2	2017	5	28	2015	5	6/18	170	2018	5	0.3
2013	5	86	2014	5	56.5	2013	5	28	2014	5	6/18	170	2009	5	0

Spring Barley (all market classes and locations)

YIELD			TEST WEIGHT			PLANT HEIGHT			HEADING DATE			LODGING			
Year	# of Loc.	bu/A	Year	# of Loc.	lb/bu	Year	# of Loc.	in.	Year	# of Loc.	date	Days fr. Jan.1	Year	# of Loc.	%
2016	5	129	2016	5	53.6	2010	4	37	2011	5	7/9	191	2014	4	56
2012	4	129	2009	4	52.5	2014	4	36	2010	4	7/5	187	2013	4	33
2017	4	128	2010	4	51.7	2019	5	35	2009	4	7/1	183	2019	5	31
2014	4	127	2013	4	51.6	2009	4	34	2019	4	6/30	182	2011	5	26
2015	4	124	2011	5	51.6	2018	5	34	Avg.	---	6/26	178	2015	4	24
2013	4	122	2019	5	51.5	2011	5	33	2012	4	6/25	177	2010	4	24
Avg.	---	121	Avg.	---	51.5	Avg.	---	33	2017	4	6/24	176	Avg.	---	21
2009	4	118	2017	4	51.4	2013	4	33	2014	4	6/24	176	2017	4	17
2018	5	117	2012	4	51.4	2015	4	33	2018	5	6/24	176	2009	4	13
2011	5	112	2018	5	51.4	2017	4	31	2013	4	6/21	173	2016	5	11
2019	5	111	2015	4	50.6	2016	5	31	2016	5	6/20	172	2018	5	10
2010	4	106	2014	4	48.8	2012	4	30	2015	4	6/16	168	2012	4	0.4

Table 4. Hard Winter Wheat Irrigated Nurseries, 3-Year Averages (2017-2019; 10 site-years)

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
LCS Jet	159	60.5	95	5/31	34	1	11.4
WA8252 (W)	157	62.2	96	6/3	42	4	11.6
Millie (W)	155	63.0	95	6/1	35	2	12.0
Yellowstone	155	61.7	96	6/2	40	7	11.7
Norwest 553/Yellowstone (50/50)	155	61.7	96	6/2	40	1	12.0
Keldin	153	62.5	98	5/31	38	8	11.5
Utah 100	147	60.6	97	6/3	44	1	12.0
LCS Rocket	147	59.7	95	5/30	34	2	11.1
Whetstone	146	62.2	94	5/29	38	3	12.5
Greenville	144	60.9	96	5/31	33	0	11.9
Norwest 553	144	61.3	95	6/1	35	0	11.9
Irv (W)	144	60.0	95	6/1	37	1	11.9
IDO1506 (W)	136	60.1	96	6/1	29	2	12.1
WB4623CLP	136	63.2	97	6/1	38	7	13.2
Average	148	61.6	96	6/1	37	3	11.9
LSD ($\alpha = .05$)	10.1	0.8	4.5	1.6	1.7	4.6	0.7
CV%	15.4	2.4	10.7	2.4	10.5	372	6.8
Pr > F	<.0001	<.0001	0.9294	<.0001	<.0001	0.0011	<.0001

(W) = White

Table 5. Hard Winter Wheat Dryland Nurseries 3-Year Averages (2017-2019; 9 site-years)

	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Variety							
SY Clearstone 2CL	52	61.0	96	6/14	29	0	10.9
Deloris	51	61.6	96	6/16	33	0	11.9
UI SRG	51	61.0	96	6/14	33	0	11.2
Yellowstone	51	61.2	94	6/15	28	0	10.9
LCS Jet	51	58.4	95	6/13	24	0	10.6
UI Silver (W)	50	61.9	95	6/16	29	0	11.2
Curlew	49	61.3	94	6/14	31	0	11.9
Norwest 553/Yellowstone (50/50)	48	61.0	92	6/15	28	0	11.3
Keldin + 11-52-0	48	61.4	94	6/14	27	0	10.4
Promontory	47	62.5	95	6/13	29	0	11.2
UICF Grace (W)	47	60.2	96	6/13	36	0	11.4
Utah 100	46	60.2	94	6/16	31	0	11.7
Golden Spike (W)	46	60.4	96	6/16	30	0	11.3
Keldin	46	61.5	94	6/14	27	0	10.8
WB4623CLP	45	61.4	95	6/13	25	0	11.8
Millie (W)	44	62.2	93	6/14	25	0	11.4
Juniper	43	61.2	95	6/15	35	0	11.8
Whetstone	42	61.5	92	6/12	26	0	11.6
LCS Yeti (W)	42	61.7	96	6/12	26	0	11.5
SY Touchstone	41	61.0	94	6/17	23	0	11.6
Greenville	41	60.2	92	6/13	22	0	11.2
Norwest 553	39	60.5	84	6/15	24	0	11.2
Irv (W)	39	59.8	93	6/15	25	0	11.4
Average	46	61.0	94	6/14	28	0	11.3
LSD ($\alpha = .05$)	9.2	0.9	3.1	4.9	1.7	0	0.8
CV%	38.4	3.1	7.1	6.2	12.7	.	7.4
Pr > F	0.2396	<.0001	<.0001	0.7911	<.0001	.	0.005

(W) = White

Table 6. Irrigated Hard Winter Wheat Data Combined from Aberdeen, Kimberly and Rupert, 2019.

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
LCS Jet	178	60.1	100	5/31	37	2	11.1
WA8289	178	60.7	100	6/1	35	0	11.2
AP Redeye	176	62.6	100	5/31	38	0	11.0
Scorpio	174	60.3	100	6/2	38	0	11.1
Millie (W)	171	62.9	100	6/1	38	3	12.2
WA8252 (W)	170	62.0	100	6/3	45	6	12.0
WB4792	170	63.1	100	6/1	41	11	11.1
LCS Rocket	170	59.9	100	5/31	37	5	11.2
UI Bronze Jade (W)	169	58.3	100	6/1	42	17	11.5
LCS Zoom	168	60.1	100	5/29	38	7	11.3
WB4311	168	63.5	100	5/30	39	3	13.4
Norwest 553/Yellowstone (50/50)	166	62.3	100	6/2	45	2	12.3
Yellowstone	166	61.4	100	6/3	44	16	12.0
Norwest 553	163	61.7	100	6/1	37	1	12.0
Keldin + 11-52-0	163	61.3	100	6/1	40	30	11.8
FourOsix	162	62.2	100	6/1	40	3	11.7
Greenville	161	60.0	100	6/2	36	0	12.1
Keldin	156	61.1	100	6/1	40	22	12.0
Irv (W)	156	58.9	100	6/2	41	1	12.3
Whetstone	156	62.2	100	5/29	41	7	12.7
Bobcat	154	62.0	100	6/3	38	11	13.1
IDO1607	153	58.9	100	6/4	40	19	12.6
IDO1506 (W)	153	59.9	100	6/1	32	0	12.2
Utah 100	151	59.2	100	6/4	49	2	12.4
IDO1806 (W)	150	62.5	100	6/2	38	9	12.6
AP Nugrain (W)	149	64.1	99	5/30	38	2	12.4
Ray	148	60.1	100	6/5	47	59	12.7
WB4623CLP	141	62.8	100	6/1	41	13	13.1
LCS Yeti (W)	130	62.9	100	5/29	43	28	14.3
Sequoia	116	59.6	100	6/10	52	18	13.0
Average	160	61.1	100	6/1	40	9	12.1
LSD ($\alpha = .05$)	16.1	1.4	0.5	2.7	1.8	13.1	1.3
CV%	12.0	2.4	0.7	2.1	5.3	166.8	6.2
Pr >F	<.0001	<.0001	0.5890	<.0001	<.0001	<.0001	0.0003

(W) = White

Table 7. Dryland Hard Winter Wheat Data Combined from Ririe, Soda Springs, and Rockland, 2019.

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Deloris	45	61.3	98	6/23	33	0	11.8
UI Silver (W)	44	61.8	97	6/22	29	0	10.7
MT1491	43	61.0	96	6/21	29	0	10.7
SY Clearstone 2CL	43	60.3	97	6/21	29	0	10.8
Sequoia	41	61.2	97	6/25	33	0	11.6
UI SRG	41	60.8	97	6/20	33	0	11.3
Yellowstone	41	60.8	96	6/21	28	0	10.7
WB4311	41	61.5	95	6/18	24	0	11.0
Keldin	40	61.1	95	6/21	27	0	10.5
Utah 100	39	60.4	96	6/22	31	0	11.0
FourOsix	39	60.1	95	6/21	26	0	10.5
LCS Jet	39	58.1	95	6/20	23	0	9.7
LCS Zoom	39	57.2	92	6/19	26	0	9.8
Millie (W)	39	62.1	94	6/22	25	0	11.2
Ray	38	59.5	95	6/24	30	0	10.5
Keldin + 11-52-0	38	60.8	95	6/20	27	0	10.8
Curlew	38	60.9	97	6/21	30	0	11.3
WB4623CLP	38	61.0	96	6/21	24	0	11.6
Promontory	37	62.0	96	6/20	28	0	10.7
WA8289	37	58.7	91	6/22	24	0	10.0
UI Bronze Jade (W)	37	59.4	95	6/22	27	0	10.3
Norwest 553/Yellowstone (50/50)	37	60.5	93	6/22	27	0	11.3
LCS Rocket	36	57.2	94	6/19	25	0	10.2
Norwest 553	36	60.2	84	6/22	25	0	10.7
Greenville	36	59.8	93	6/20	23	0	11.5
IDO1608	36	58.3	97	6/23	26	0	12.2
IDO1806 (W)	36	61.4	96	6/21	24	0	11.4
Whetstone	36	61.0	96	6/18	27	0	11.5
WA8252 (W)	36	60.5	96	6/21	29	0	10.3
LCS Yeti (W)	36	61.3	96	6/18	26	0	11.3
Scorpio	36	59.3	93	6/22	25	0	10.7
Golden Spike (W)	35	60.2	96	6/23	28	0	11.0
WB4792	35	61.5	95	6/19	27	0	10.1
SY Touchstone	34	60.3	95	6/23	24	0	12.1
Juniper	34	60.6	98	6/21	33	0	12.7
Bobcat	33	60.8	89	6/23	25	0	10.2
IDO1607	32	58.0	96	6/23	24	0	10.3
UICF Grace	32	59.9	97	6/20	35	0	11.2
Irv (W)	32	59.3	93	6/21	25	0	11.5
IDO1506 (W)	31	58.7	95	6/20	20	0	10.2
Average	37	60.2	95	6/21	27	0	10.9
LSD ($\alpha = .05$)	14.5	1.1	2.0	2.0	2.0	0	1.2
CV%	48.0	2.1	6.8	6.3	11.1	.	6.5
Pr >F	0.9993	<.0001	0.0025	1.000	<.0001	.	0.0001

(W) = White

Table 8. Agronomic Data for Hard Winter Wheat at Kimberly, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
WA8252 (W)	133	137	197	63.0	100	5/31	45	0	10.7
WB4792	---	---	193	63.5	100	5/28	40	0	9.3
UI Bronze Jade (W)	---	142	190	59.9	100	5/28	41	14	10.8
WA8289	---	---	190	60.8	100	5/29	35	0	10.2
LCS Rocket	148	122	188	60.3	100	5/27	36	0	10.6
Utah 100	137	134	188	61.1	100	6/2	50	0	10.8
Keldin	152	123	187	62.5	100	5/28	39	19	11.1
AP Redeye	---	---	187	62.6	100	5/28	38	0	10.3
Keldin + 11-52-0	137	110	187	62.8	100	5/29	40	15	10.8
LCS Jet	159	129	185	61.0	100	5/28	37	0	10.9
Yellowstone	139	121	185	62.5	100	5/29	44	10	11.0
WB4311	---	110	184	63.6	100	5/26	38	3	12.3
Northwest 553/Yellowstone (50/50)	155	118	183	62.5	100	5/29	44	0	11.3
Scorpio	---	133	182	61.2	100	5/29	37	0	11.0
Millie (W)	138	129	182	63.1	100	5/29	38	0	11.1
Greenville	144	116	178	6.3	100	5/29	35	0	11.4
LCS Zoom	---	---	177	60.5	100	5/26	38	0	10.5
Whetstone	146	115	175	63.1	100	5/25	40	0	11.8
Norwest 553	136	121	173	62.2	100	5/29	36	0	11.0
FourOsix	---	---	172	62.8	100	5/29	38	0	11.2
Irv (W)	132	125	171	60.8	100	5/29	39	0	11.3
IDO1607	---	111	171	60.8	100	6/3	40	30	11.6
Bobcat	---	---	168	62.6	100	5/31	37	0	12.3
AP Nugrain (W)	---	---	168	64.8	100	5/26	38	0	12.3
Ray	---	119	168	60.8	100	6/2	47	46	12.0
IDO1506 (W)	138	92	165	60.5	100	5/29	30	0	11.6
IDO1806 (W)	---	---	163	64.1	100	5/29	37	0	11.7
LCS Yeti (W)	---	---	160	62.8	100	5/27	42	26	13.2
WB4623CLP	131	107	155	63.3	100	5/29	40	15	13.7
Average	136	119	178	62.1	100	5/29	39	6	11.3
LSD ($\alpha = .05$)	22.9	23.3	13.3	0.8	0	1.2	2	17	
CV	12.0	14.0	5.3	0.9	.	0.6	4	203	
P>F	0.3	0.0	<0.0001	<.0001	.	<.0001	<.0001	<.0001	

(W) = White

Table 9. Agronomic Data for Hard Winter Wheat at Rupert, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2017	2018	2019						
WA8289	---	---	168	60.0	100	6/3	35	0	10.3
LCS Jet	143	169	167	60.0	100	6/2	37	6	10.6
AP Redeye	---	---	165	62.0	100	6/3	38	0	11.6
Scorpio	---	155	164	59.5	100	6/3	35	0	11.3
Millie (W)	132	157	158	61.6	100	6/3	37	10	12.6
LCS Zoom	---	---	157	58.5	100	6/1	39	21	10.8
Greenville	139	157	156	59.0	100	6/4	35	0	12.5
Yellowstone	140	170	155	60.2	100	6/6	41	31	12.2
WB4311	---	143	155	62.4	100	6/1	39	5	12.3
WB4792	---	---	154	61.2	100	6/4	40	28	10.5
LCS Rocket	136	150	150	57.8	100	6/2	36	15	10.9
UI Bronze Jade (W)	---	176	148	56.7	100	6/4	41	38	11.6
Norwest 553/Yellowstone (50/50)	135	153	148	59.4	100	6/6	44	6	12.9
WA8252 (W)	150	157	146	60.3	100	6/5	43	16	11.7
FourSix	---	---	145	61.3	100	6/4	39	10	11.5
Norwest 553	129	139	145	59.4	100	6/4	36	4	12.3
Keldin + 11-52-0	130	175	143	59.4	100	6/3	40	50	11.9
IDO1607	---	144	142	58.5	100	6/5	40	19	12.7
IDO1506 (W)	118	145	141	59.5	100	6/3	32	0	11.3
AP Nugrain (W)	---	---	140	62.9	100	6/2	36	5	12.5
Utah 100	138	150	139	57.2	100	6/6	47	5	13.1
Irv (W)	---	151	136	56.8	100	6/5	41	3	12.5
Whetstone	129	157	134	59.3	100	5/31	40	16	13.2
Keldin	156	167	134	60.0	100	6/4	39	29	12.5
Bobcat	---	---	133	60.2	100	6/5	36	33	12.7
IDO1806 (W)	---	---	131	60.5	100	6/4	37	26	13.5
Ray	---	138	126	57.2	100	6/6	46	73	12.9
WB4623CLP	127	136	125	61.7	100	6/3	40	24	14.3
LCS Yeti (W)	---	---	100	60.3	100	5/31	43	55	14.6
Average	131	152	146	59.7	100	6/3	39	18	12.2
LSD ($\alpha=.05$)	24.9	13.4	19.8	2.0	0.0	2.0	3	28	
CV %	13.6	6.3	9.7	2.4	.	0.9	5	115	
Pr > F	0.215	<.0001	<0.0001	<0.0001	.	<.0001	<.0001	<.0001	

(W) = White

Table 10. Agronomic Data for Hard Winter Wheat at Aberdeen, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2017	2018	2019						
LCS Jet	151	175	182	60.6	100	6/3	39	0	11.8
Scorpio	---	176	176	59.4	99	6/7	41	0	11.0
WA8289	---	---	175	60.7	99	6/4	37	0	13.2
Millie (W)	161	181	174	62.7	100	6/3	40	0	13.0
LCS Rocket	136	161	171	59.5	100	6/2	40	0	12.0
LCS Zoom	---	---	171	59.8	100	6/1	38	0	12.5
Norwest 553	140	144	170	61.3	99	6/3	40	0	12.7
UI Bronze Jade (W)	---	173	169	58.4	99	6/5	45	1	12.1
FourSix	---	---	169	62.7	100	6/3	42	0	12.6
WA8252 (W)	168	172	168	61.1	100	6/6	46	1	13.5
Norwest 553/Yellowstone (50/50)	168	176	167	62.0	100	6/4	46	0	12.6
WB4311	---	168	164	63.3	100	6/2	41	0	15.6
WB4792	---	---	163	62.7	100	6/3	43	5	13.6
Irv (W)	143	168	161	59.2	100	6/4	43	0	12.9
Bobcat	---	---	160	61.3	99	6/6	40	0	14.4
Keldin + 11-52-0	151	163	158	61.6	100	6/4	41	25	12.9
Whetstone	143	169	157	61.3	100	6/1	44	5	13.2
Yellowstone	163	177	156	60.3	100	6/5	46	8	12.8
IDO1806 (W)	---	---	155	62.9	100	6/5	39	0	12.5
IDO1506 (W)	126	130	152	59.6	100	6/5	34	0	13.7
Ray	---	145	151	59.4	100	6/10	49	58	13.3
Greenville	139	160	149	59.3	100	6/5	38	0	12.8
Keldin	162	177	147	60.9	100	6/4	42	18	12.5
IDO1607	---	141	145	57.5	100	6/6	42	8	13.4
WB4623CLP	147	156	144	62.3	100	6/4	44	0	11.3
AP Nugrain (W)	---	---	138	63.4	98	6/2	39	0	12.4
Utah 100	155	177	126	57.4	100	6/6	50	0	13.2
LCS Yeti (W)	---	---	117	63.1	100	5/31	43	1	15.1
Sequoia	---	132	116	59.6	100	6/10	52	18	13.0
Average	147	163	157	60.7	100	6/4	42	5	13.0
LSD ($\alpha=.05$)	19.0	15.7	17.2	1.6	1.5	2.0	2	11	
CV %	7.9	6.8	7.7	1.9	1.1	0.9	3	167	
Pr > F	0.0013	<.0001	<.0001	<.0001	0.343	<.0001	<.0001	<.0001	

(W) = White

Table 11. Agronomic Data for Hard Winter Wheat at Ririe, Dryland, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
MT1491	---	---	28	60.4	96	6/25	27	0	9.4
IDO1806 (W)	---	---	26	61.9	95	6/24	22	0	10.6
Deloris	37	53	25	62.0	99	6/24	31	0	10.9
UI Silver	38	50	25	62.3	97	6/25	28	0	10.2
Greenville	25	45	24	59.8	85	6/24	21	0	10.1
Yellowstone	30	54	24	60.4	94	6/25	27	0	9.8
Sequoia	---	47	23	61.9	98	6/25	29	0	10.3
FourOsix	---	---	23	59.4	93	6/24	25	0	10.0
Bobcat	---	---	23	61.4	83	6/25	23	0	8.6
LCS Jet	26	61	23	56.7	91	6/23	21	0	8.7
SY Clearstone 2CL	34	52	23	59.6	97	6/25	27	0	10.0
Norwest 553/Yellowstone (50/50)	30	50	23	60.6	90	6/25	26	0	9.9
UICF Grace	34	50	22	60.1	99	6/24	35	0	9.9
Ray	---	55	22	60.0	91	6/25	28	0	10.1
SY Touchstone	32	49	22	61.0	95	6/24	22	0	10.3
Irv (W)	26	49	22	59.2	89	6/23	24	0	9.9
Keldin	28	53	22	60.6	94	6/24	26	0	8.9
WA8252 (W)	---	---	21	60.5	95	6/24	26	0	8.1
WB4623CLP	31	52	21	61.7	93	6/24	21	0	9.6
Utah 100	38	52	21	60.5	96	6/24	28	0	8.8
WB4792	---	---	21	61.8	90	6/23	24	0	7.7
UI SRG	36	56	21	60.8	97	6/23	31	0	9.2
IDO1607	---	52	21	57.2	95	6/25	23	0	9.1
Promontory	34	48	21	61.5	96	6/23	26	0	9.8
Scorpio	---	---	21	59.2	86	6/25	23	0	9.0
UI Bronze Jade (W)	---	51	20	59.0	91	6/26	26	0	8.9
Whetstone	29	52	20	60.8	93	6/22	24	0	9.5
WB4311	---	51	20	61.3	91	6/22	22	0	9.9
LCS Zoom	---	---	20	56.4	90	6/22	23	0	8.4
Curlew	35	53	20	61.3	95	6/24	27	0	9.4
Golden Spike (W)	35	48	19	59.9	96	6/26	27	0	9.7
Millie (W)	---	---	19	62.8	89	6/24	23	0	10.2
Juniper	38	51	19	60.8	99	6/24	32	0	11.9
Norwest 553	33	45	19	60.3	70	6/25	24	0	10.3
IDO1506 (W)	---	---	18	59.4	92	6/24	17	0	8.9
IDO1608	---	---	18	57.9	98	6/26	24	0	12.2
Keldin + 11-52-0	30	50	18	60.9	94	6/23	27	0	10.4
LCS Yeti (W)	---	---	18	60.4	96	6/21	23	0	9.2
LCS Rocket	---	---	17	56.5	88	6/23	23	0	9.5
WA8289	---	---	15	57.7	83	6/26	22	0	8.7
Average	31	50	21	60.1	92	6/24	25	0	9.7
LSD ($\alpha=.05$)	7.6	8.5	5.0	0.8	11.6	1.5	2	0	
CV %	17.6	12.1	16.5	1.0	9.0	0.6	7	.	
Pr > F	<.0001	0.0964	0.0012	<.0001	0.007	<.0001	<.0001	.	

(W) = White

Table 12. Agronomic Data for Hard Winter Wheat at Rockland, Dryland, 2019.

Variety	Yield (bu/A)	Test Wt.	Spring	Heading	Height	Lodging	Protein		
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
LCS Jet	60	45	44	59.1	95	6/5	26	0	9.9
LCS Rocket	45	37	41	58.6	95	6/4	28	0	9.8
IDO1608	---	---	39	58.5	95	6/10	28	0	11.1
Scorpio	---	---	39	59.5	95	6/8	27	0	10.3
Keldin	52	37	39	62.2	95	6/6	29	0	9.8
WB4311	---	41	39	62.1	95	6/4	28	0	10.5
Norwest 553	34	38	39	61.3	95	6/7	26	0	10.4
MT1491	---	---	39	61.0	94	6/7	28	0	11.3
FourOsix	---	---	38	61.5	94	6/7	27	0	10.5
Millie (W)	38	44	38	62.4	95	6/7	26	0	10.8
Keldin + 11-52-0	48	43	38	62.2	95	6/7	29	0	9.3
Yellowstone	47	39	37	60.9	95	6/6	28	0	10.2
IDO1506 (W)	---	---	36	60.5	95	6/8	23	0	9.6
Deloris	40	43	36	61.2	95	6/10	33	0	11.4
LCS Zoom	---	---	36	58.3	95	6/4	28	0	9.7
WA8252 (W)	---	---	35	61.7	94	6/8	29	0	10.0
SY Touchstone	---	34	35	61.3	95	6/9	25	0	11.3
Juniper	45	34	35	61.5	95	6/7	38	0	11.6
LCS Yeti (W)	37	24	35	62.6	95	6/2	29	0	11.1
Norwest 553/Yellowstone (50/50)	39	41	35	60.5	95	6/7	29	0	10.9
SY Clearstone 2CL	47	44	34	60.6	95	6/6	29	0	10.3
WB4623CLP	36	34	34	61.0	95	6/7	27	0	12.2
UI SRG	44	42	33	60.4	95	6/7	34	0	11.4
Ray	---	37	33	58.4	95	6/12	30	0	10.5
Utah 100	46	40	32	59.7	95	6/10	32	0	10.7
Whetstone	34	39	32	61.6	95	6/3	29	0	11.0
IDO1806 (W)	---	---	32	62.0	94	6/7	26	0	10.3
Sequoia	---	45	30	61.3	95	6/16	34	0	11.1
Curlew	44	39	30	61.3	95	6/6	32	0	10.8
WA8289	---	---	29	58.9	94	6/9	27	0	9.9
UI Bronze Jade (W)	---	40	28	59.4	95	6/9	30	0	10.0
Greenville	35	35	28	59.2	95	6/6	24	0	11.7
Irv (W)	44	37	28	58.6	95	6/8	27	0	11.9
WB4792	---	---	28	62.6	95	6/4	28	0	9.7
Bobcat	---	---	27	61.1	94	6/10	26	0	10.7
UI Silver	42	37	27	62.0	95	6/10	31	0	10.4
Promontory	41	34	25	62.3	94	6/6	30	0	10.9
UICF Grace	50	46	24	60.2	95	6/6	37	0	10.3
Golden Spike (W)	42	33	22	60.1	95	6/11	30	0	11.2
IDO1607	---	38	22	58.0	95	6/12	26	0	11.0
Average	42	38	33	60.6	95	6/7	29	0	10.6
LSD ($\alpha=.05$)	7.6	7.7	4.8	0.8	1.0	1.8	2	0	
CV %	13.1	14.5	10.3	0.9	0.76	0.8	4	.	
Pr >F	<.0001	<.0001	<.0001	<.0001	0.325	<.0001	<.0001	.	

(W) = White

Table 13. Agronomic Data for Hard Winter Wheat at Soda Springs, Dryland, 2019.

Variety	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2017	2018	2019						
UI Silver	80	66	81	61.0	98	7/4	32	0	11.6
Deloris	88	69	73	60.6	99	7/7	34	0	13.1
Sequoia	---	60	71	60.3	99	7/9	31	0	13.4
SY Clearstone 2CL	89	70	70	60.7	100	7/4	31	0	12.1
LCS Zoom	---	60	70	56.9	99	7/6	27	0	11.4
UI SRG	89	70	70	61.3	98	7/2	32	0	13.4
Promontory	82	70	67	62.1	98	6/30	30	0	11.5
Curlew	88	71	65	59.9	100	7/4	33	0	13.7
Utah 100	60	61	64	60.9	98	7/2	34	0	13.5
MT1491	---	---	64	60.7	97	7/3	31	0	11.4
Yellowstone	88	79	63	61.0	98	7/4	29	0	12.2
Golden Spike (W)	88	63	63	60.8	97	7/3	28	0	12.3
WB4311	---	74	61	61.2	100	6/30	23	0	12.7
Ray	---	73	60	60.3	98	7/7	30	0	11.1
Greenville	59	63	59	60.5	98	6/30	24	0	12.6
WB4623CLP	75	64	59	60.3	99	7/3	25	0	13.1
Keldin	68	73	59	60.7	97	7/2	27	0	12.8
WA8252 (W)	---	---	57	59.3	100	7/2	31	0	12.8
Whetstone	52	64	56	60.7	99	6/30	28	0	14.2
WB4792	---	---	55	60.1	99	6/30	28	0	12.9
Keldin + 11-52-0	90	79	54	59.3	98	7/2	27	0	12.8
UI Bronze Jade (W)	---	62	54	60.0	98	7/3	26	0	12.0
Norwest 553/Yellowstone (50/50)	89	73	53	60.4	96	7/3	27	0	13.1
Millie (W)	67	64	52	61.2	97	7/4	26	0	12.6
IDO1607	---	56	52	58.8	97	7/3	23	0	10.7
Norwest 553	50	49	52	59.1	94	7/5	25	0	11.4
LCS Rocket	79	60	52	56.5	98	7/1	24	0	11.3
IDO1608	---	---	51	58.6	99	7/3	26	0	13.2
LCS Jet	77	70	51	58.6	99	7/1	23	0	10.5
IDO1806 (W)	---	---	51	60.2	99	7/1	27	0	13.5
Bobcat	---	---	50	60.0	98	7/4	26	0	11.3
LCS Yeti (W)	60	68	50	60.8	98	6/29	26	0	13.6
WA8289	---	---	50	59.5	96	7/1	24	0	11.4
UICF Grace	81	62	50	59.4	96	7/2	35	0	13.2
Scorpio	---	---	48	59.1	98	7/2	24	0	12.8
Juniper	60	62	47	59.6	100	7/1	29	0	14.6
Irv (W)	64	62	46	60.2	96	7/3	24	0	12.6
SY Touchstone	52	55	45	58.6	95	7/5	25	0	14.6
FourOsix	---	---	44	59.4	99	7/1	25	0	10.9
IDO1506 (W)	---	---	39	56.1	99	6/30	22	0	12.0
Average	72	65	57	59.9	98	7/2	27	0	12.5
LSD ($\alpha=0.05$)	23.9	10.4	17.1	2.3	3.6	2.0	5	0	
CV %	23.7	11.4	21.1	2.7	2.6	0.8	13	.	
Pr > F	<.0001	<.0001	0.0005	<.0001	0.2212	<.0001	<.0001	.	

All varieties are Hard Red Winter unless annotated.

(W) = Hard White Winter

Table 14. Hard Winter Wheat Yield Percentage of Location Averages, 2019.

Variety	(100% = Average)						Variety Average
	Kimberly	Aberdeen	Rupert	Ririe	Rockland	Soda Springs	
MT1491	---	---	---	133	118	112	121
Deloris	---	---	---	119	109	128	119
UI Silver	---	---	---	119	81	142	114
SY Clearstone 2CL	---	---	---	109	103	123	112
LCS Jet	104	116	115	109	133	89	111
AP Redeye	105	---	113	---	---	---	109
Yellowstone	104	99	107	114	112	111	108
UI SRG	---	---	---	100	100	123	108
LCS Zoom	99	109	108	95	109	123	107
WB4311	103	104	106	95	118	107	106
Scorpio	102	112	113	100	118	84	105
WA8252 (W)	110	107	100	101	106	99	104
Northwest 553/Yellowstone (50/50)	103	106	102	109	106	93	103
Millie (W)	102	111	108	90	115	91	103
Keldin	105	94	92	104	118	104	103
LCS Rocket	105	109	103	79	124	90	102
FourOsix	97	108	100	109	115	77	101
Norwest 553	97	108	100	90	118	91	101
Greenville	101	98	104	114	84	104	101
Greenville QC	99	91	111	---	---	---	101
Curlew	---	---	---	95	91	114	100
Keldin + 11-52-0	105	101	98	85	115	95	100
WB4792	108	104	106	101	83	96	100
Sequoia	---	74	---	109	91	125	100
UI Bronze Jade (W)	107	108	102	96	84	95	99
Utah 100	105	80	95	101	97	112	99
IDO1806 (W)	92	99	90	123	97	89	98
IDO1608	---	---	---	85	118	89	98
Ray	94	96	86	104	100	105	98
Promontory	---	---	---	100	75	118	98
WA8289	106	111	116	72	87	87	97
Whetstone	98	100	92	95	97	98	97
SY Touchstone	---	---	---	104	106	79	96
WB4623CLP	87	92	86	100	103	104	95
Bobcat	94	102	91	109	81	88	94
Irv (W)	96	103	94	104	84	81	93
Juniper	---	---	---	90	106	82	93
AP NuGrain (W)	94	88	96	---	---	---	93
IDO1506 (W)	93	97	97	85	109	68	92
IDO1607	96	92	98	100	66	91	91
Golden Spike (W)	---	---	---	90	66	111	89
UICF Grace	---	---	---	104	72	88	88
LCS Yeti (W)	90	75	69	85	106	88	85
Location Average	100	100	100	100	100	100	100

All varieties are Hard Red Winter unless annotated
(W) = Hard White

2019 Hard Winter Wheat Yield Percentage Across All Locations

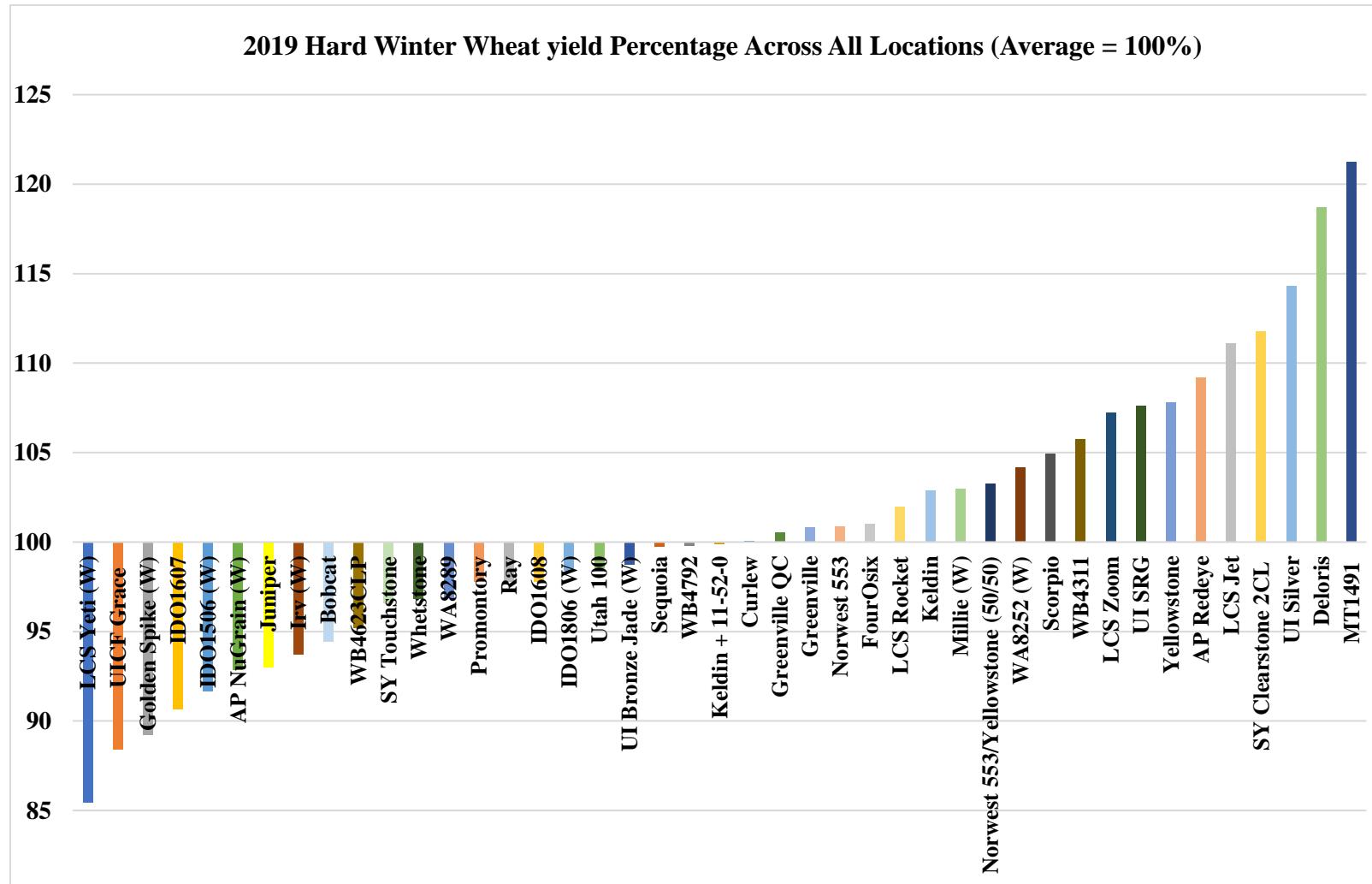


Chart 3. Hard Winter Wheat Yield Percentage Across All Locations.

(W) = White Winter Wheat

Table 15. Soft White Winter Wheat Irrigated Nurseries, 3 Year Averages (2017 - 2019; 9 site-years)

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Bruneau	156	60.0	96	6/3	39	7	9.1
SY Ovation	152	60.4	96	5/31	37	0	9.1
LCS Hulk	151	60.6	96	6/1	37	1	9.4
UI Magic CL+	149	60.8	97	5/30	35	0	9.6
WB1783	148	60.0	97	5/31	38	0	9.9
UI Castle CL+	148	60.5	96	6/3	39	5	10.4
UI Sparrow	147	57.9	96	6/4	41	2	9.6
WB1529	146	62.3	97	5/31	37	0	9.9
Jasper	145	58.9	97	6/2	38	1	10.0
LCS Shark	145	58.9	95	5/30	37	1	9.7
LCS Artdeco	144	59.3	96	5/29	34	0	8.8
Nixon	144	60.0	96	6/1	38	0	9.5
Bobtail	144	58.0	94	6/1	35	1	9.4
VI Bulldog	144	60.6	97	5/30	37	1	9.4
Stephens	143	59.4	96	5/31	37	1	9.5
Brundage	142	60.9	97	5/29	38	1	9.5
Norwest Tandem	141	60.0	96	5/29	33	1	9.6
LCS Drive	140	58.6	97	5/28	32	1	9.4
SY Assure	137	61.3	96	5/28	34	0	9.6
WB1376CLP	136	62.8	97	5/31	37	0	10.6
WB 456	135	62.4	96	5/29	36	0	9.8
OR2X2 CL+	129	60.1	96	6/1	38	0	10.0
Average	144	60.3	96	5/31	37	1	9.6
LSD ($\alpha = .05$)	12.2	0.5	3.5	2.1	1.7	2.3	0.7
CV%	18.8	1.8	8.2	3.1	10.5	591	7.4
Pr > F	0.0067	<.0001	0.9798	<.0001	<.0001	<.0001	<.0001

Table 16. Soft White Winter Wheat Dryland Nurseries, 3 Year Averages (2017 - 2019; 8 site-years)

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Eltan	52	59.7	94	6/24	28	0	10.8
Otto	51	59.4	94	6/24	28	0	11.3
WB1529	51	60.2	95	6/19	24	0	10.9
WB1783	51	61.3	92	6/20	27	0	11.3
UI Sparrow	51	58.2	93	6/20	29	0	10.1
Jasper	49	56.7	95	6/20	26	0	10.7
Bruneau	48	59.4	96	6/22	26	0	10.3
OR2X2 CL+	48	58.4	88	6/23	27	0	12.0
WB1376CLP	47	61.2	89	6/19	26	0	12.7
Norwest Tandem	45	59.1	93	6/14	24	0	10.2
UI Castle CL+	45	59.6	94	6/20	27	0	11.5
Stephens	45	57.7	90	6/20	26	0	11.0
Nixon	44	58.8	90	6/17	27	0	11.4
UI Magic CL+	44	59.5	92	6/15	25	0	11.0
Norwest Duet	44	58.7	91	6/17	29	0	10.5
Brundage	30	60	90	6/11	25	0	10.0
Average	47	59.2	92	6/19	27	0	11.0
LSD ($\alpha = .05$)	11.5	1.1	5.8	5	2	0	1.4
CV%	43.9	3.1	11.1	5	11	.	11.1
Pr > F	0.2152	<.0001	0.2387	<.0001	<.0001	.	0.0076

Table 17. Irrigated Soft White Winter Wheat Data Combined from Aberdeen, Kimberly and Rupert, 2019.

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
LCS Ghost	188	58.2	100	6/1	42	5	9.1
UIL15-72223	183	59.6	100	6/3	41	0	9.3
LCS Blackjack	181	59.4	100	6/2	39	0	9.3
UIL 11-456031A	177	60.0	99	6/2	40	0	8.8
WB1783	175	62.2	100	6/2	41	0	9.9
Norwest Duet	173	60.8	100	6/4	46	0	9.6
LCS Artdeco	173	59.5	100	5/31	38	0	8.8
Stingray CL+	171	60.2	100	6/5	40	0	11.5*
LCS Hulk	171	61.5	100	6/3	40	2	9.9
Nixon	170	60.4	100	6/3	42	1	9.8
SY Ovation	170	60.7	100	6/3	42	0	9.6
Bruneau	169	60.1	100	6/5	43	17	9.4
UI Castle CL+	169	60.0	100	6/4	42	5	10.6
Purl	168	61.5	100	6/2	41	4	9.7
Rosalyn	168	59.4	100	6/3	42	5	9.2
IDO1708	168	59.0	100	6/1	40	11	9.0
Bobtail	167	59.0	100	6/2	39	3	8.9
Jasper	167	59.8	100	6/4	42	2	9.8
SY Raptor	165	59.7	100	6/1	40	1	8.8
LCS Shark	165	59.4	100	6/2	40	2	9.6
SY Assure	164	61.4	99	5/29	38	0	9.4
UI Magic CL+	163	60.8	100	6/1	37	0	9.7
UIL 17-6268 (CL+)	163	60.1	100	6/2	35	0	9.1
Norwest Tandem	162	60.5	100	6/1	35	2	9.7
VI Bulldog	161	61.0	100	6/2	41	4	9.5
UI Sparrow	161	57.7	100	6/6	45	4	9.6
LCS Drive	161	59.1	100	5/31	34	0	9.3
Stephens	159	60.0	100	6/2	42	4	9.7
Appleby CL+	159	61.5	100	5/31	42	0	9.9
Brundage	159	61.1	100	6/1	43	2	9.3
UIL 17-6333 (CL+)	158	62.3	100	6/2	39	0	10.4
UIL 17-6834 (CL+)	154	61.2	100	5/31	38	2	10.0
WB 456	152	62.4	99	5/31	40	0	10.2
WB1529	152	62.4	100	6/1	40	0	10.2
OR2X2 CL+	146	60.5	100	6/3	41	0	10.2
UIL 17-6546 (CL+)	146	61.3	99	5/28	37	0	10.3
WB1376CLP	144	62.7	99	6/2	40	0	10.8
Average	165	60.4	100	6/2	40	2	9.6
LSD ($\alpha = .05$)	15.0	0.7	0.67	2.7	2	6	1.0
CV%	10.9	1.5	0.81	2.1	5	355	6.4
Pr >F	<.00001	<.00001	0.2237	<.00001	<.00001	<.00001	0.0032

* Data only from Kimberly

Table 18. Dryland Soft White Winter Wheat Data Combined from Ririe, Rockland and Soda Springs, 2019.

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Nixon	44	58.2	99	6/29	28	0	11.1
SY Dayton	41	58.8	97	6/30	24	0	11.3
Stingray CL+	40	58.4	99	6/28	25	0	11.4
LCS Sonic	39	58.3	97	6/22	27	0	10.1
Devote	38	60.9	97	7/1	24	0	10.9
OR2X2 CL+	38	58.5	87	7/2	26	0	12.4
Norwest Tandem	38	58.4	95	6/20	23	0	10.0
UIL 17-6451 (CL+)	37	59.8	96	6/20	26	0	10.3
Appleby CL+	37	58.3	90	6/27	24	0	12.1
Rosalyn	37	57.2	89	6/30	26	0	8.6
SY Ovation	36	59.2	96	6/23	27	0	11.2
IDO1810	36	59.0	99	6/30	26	0	10.5
UIL 17-6268 (CL+)	36	59.2	90	6/23	24	0	10.9
LCS Shine	36	56.9	96	6/19	22	0	8.7
UI Sparrow	36	58.0	95	6/26	28	0	10.2
Jasper	35	56.6	96	6/23	25	0	10.3
WB1529	34	59.2	94	6/27	23	0	10.4
UIL 11-456031A	34	57.7	95	6/21	25	0	10.4
Eltan	34	59.9	97	6/28	27	0	10.1
LCS Hulk	34	59.0	97	6/23	26	0	9.9
IDO1808	34	57.2	91	6/29	24	0	10.1
Norwest Duet	34	58.5	98	6/23	28	0	10.5
Purl	33	58.8	95	6/20	25	0	10.0
Bruneau	33	58.7	96	6/25	26	0	10.1
IDO1708	33	56.6	97	6/27	25	0	9.6
Otto	33	60.0	98	6/28	28	0	10.8
UIL 17-6834 (CL+)	32	59.2	95	6/19	24	0	11.3
UI Castle CL+	31	59.7	96	6/26	26	0	11.7
WB1783	31	60.9	95	6/29	26	0	11.4
WB1376CLP	31	60.3	92	6/28	25	0	12.2
Eltan 11-52-0	30	59.7	97	6/28	27	0	10.7
Stephens	30	57.2	90	6/28	26	0	10.8
SY Assure	29	58.1	98	6/26	22	0	10.3
UIL 17-6546 (CL+)	29	58.7	90	6/18	24	0	10.9
UI Magic CL+	28	58.9	93	6/21	25	0	11.1
UIL 17-6333 (CL+)	24	60.3	95	6/9	25	0	11.0
Brundage	21	58.6	95	6/13	26	0	9.7
UIL15-72223	17	57.6	95	6/8	28	0	10.4
Average	34	58.7	95	6/24	25	0	10.5
LSD ($\alpha = .05$)	15.2	0.8	6.2	8.6	2.0	0	1.9
CV%	46.3	1.5	6.9	5.2	8.2	.	9.2
Pr >F	0.5947	<.0001	0.0010	<.0001	<.0001	.	0.0072

Table 19. Agronomic Data for Soft White Winter Wheat at Kimberly, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
UIL15-72223	---	---	207	59.1	100	5/29	40	0	11.3
LCS Ghost	---	---	205	58.6	100	5/29	41	0	10.2
UI Castle CL+	103	122	200	60.9	100	6/1	41	3	13.3
IDO1708	---	122	192	59.1	100	5/29	39	10	10.6
Purl	---	---	192	61.6	100	5/29	41	4	11.1
UIL 11-456031A	---	---	191	59.8	100	5/29	39	0	10.2
LCS Blackjack	---	---	190	59.8	100	5/29	38	0	10.8
UI Sparrow	---	---	190	59.1	100	6/3	45	0	10.9
Nixon	113	120	189	61.1	100	5/31	42	0	11.3
WB1783	110	135	189	62.5	100	5/29	41	0	11.3
SY Ovation	119	123	188	60.8	100	5/30	42	0	11.3
Bobtail	109	118	186	59.7	100	5/30	40	0	9.0
LCS Shark	---	---	186	60.1	100	5/28	41	0	10.5
LCS Artdeco	117	116	184	60.1	100	5/28	37	0	9.8
Bruneau	140	142	182	60.9	100	6/2	42	26	9.6
Norwest Duet	---	---	181	61.7	100	6/1	46	0	11.3
Stephens	99	129	181	60.3	100	5/29	41	0	10.9
SY Assure	125	125	180	61.7	100	5/25	37	0	10.7
Brundage	105	117	180	61.5	100	5/29	42	0	9.6
LCS Drive	91	107	179	59.0	100	5/27	34	0	10.4
LCS Hulk	---	---	177	62.0	100	5/31	40	0	11.1
Jasper	115	118	177	60.7	100	5/31	40	0	12.2
VI Bulldog	---	---	176	61.1	100	5/29	40	0	10.6
Rosalyn	---	135	174	59.7	100	5/31	41	0	9.8
UI Magic CL+	87	115	172	60.5	100	5/28	36	0	11.1
Norwest Tandem	86	119	171	60.6	100	5/29	35	0	11.0
Appleby CL+	---	---	171	61.5	100	5/28	42	0	10.6
UIL 17-6268 (CL+)	---	---	171	60.1	100	5/29	35	0	10.4
WB 456	91	108	171	62.4	100	5/28	40	0	11.8
SY Raptor	---	---	171	59.3	100	5/27	39	0	10.1
WB1529	105	137	166	62.0	100	5/28	38	0	11.9
UIL 17-6333 (CL+)	---	---	163	62.6	100	5/28	37	0	12.3
WB1376CLP	86	92	162	62.8	100	5/29	40	0	13.0
UIL 17-6834 (CL+)	---	---	152	61.1	100	5/26	37	0	11.8
UIL 17-6546 (CL+)	---	---	147	60.7	100	5/23	36	0	12.6
OR2X2 CL+	116	107	146	60.7	100	5/30	40	0	12.3
Average	109	124	179	60.7	100	5/29	39	1	11.0
LSD ($\alpha=.05$)	28.0	23.4	16.3	0.9	0.0	1.3	2.4	7.5	
CV %	18.3	13.5	6.5	1.0	.	0.6	4.4	455	
Pr > F	0.0034	0.0003	<0.0001	<0.0001	.	<.0001	<.0001	<.0001	

Table 20. Agronomic Data for Soft White Winter Wheat at Rupert, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
WB1783	126	150	169	61.3	100	6/5	40	0	9.9
UIL15-72223	---	---	167	59.6	100	6/5	42	0	8.3
LCS Blackjack	---	---	165	58.8	100	6/4	38	0	8.4
LCS Ghost	---	---	164	57.2	100	6/4	41	15	8.8
Bruneau	152	157	161	59.5	100	6/6	43	18	8.1
Norwest Duet	---	---	160	59.9	100	6/5	44	0	8.6
LCS Hulk	140	152	160	61.2	100	6/4	39	5	8.4
UIL 11-456031A	---	---	160	59.5	100	6/4	40	0	8.4
UI Magic CL+	136	152	159	60.3	100	6/3	38	0	8.9
Rosalyn	---	135	157	58.7	100	6/4	41	15	9.3
LCS Artdeco	127	160	156	58.2	100	6/2	39	0	8.4
SY Assure	134	149	155	60.5	100	5/31	38	0	8.8
Brundage	135	144	154	60.8	100	6/3	43	5	9.2
Northwest Tandem	137	142	153	60.1	100	6/4	35	5	9.1
UIL 17-6268 (CL+)	---	---	152	59.0	100	6/4	36	0	8.7
UIL 17-6834 (CL+)	---	---	152	60.8	100	6/5	39	6	10.1
Jasper	119	149	151	58.9	100	6/6	42	5	8.9
UI Castle CL+	147	145	150	59.9	100	6/4	41	0	9.4
Bobtail	157	154	149	58.2	100	6/6	38	5	8.9
SY Ovation	131	159	147	60.0	100	6/5	40	0	8.1
SY Raptor	---	---	147	59.2	100	6/3	39	3	8.1
VI Bulldog	---	---	147	60.1	100	6/5	40	11	9.0
UIL 17-6546 (CL+)	---	---	146	60.6	100	5/31	38	0	9.4
LCS Shark	140	146	146	58.0	100	6/5	39	5	8.6
Nixon	132	145	146	59.4	100	6/5	42	3	8.5
Appleby CL+	---	---	146	60.9	100	6/2	42	0	9.4
Purl	---	---	145	60.8	100	6/5	40	7	9.0
UIL 17-6333 (CL+)	---	---	145	61.7	100	6/6	39	0	9.7
UI Sparrow	121	146	144	57.8	100	6/7	45	5	8.3
Stephens	125	148	142	59.2	100	6/4	41	13	9.0
LCS Drive	143	144	142	57.8	100	6/2	33	0	8.3
IDO1708	---	160	141	57.8	100	6/2	39	20	7.8
OR2X2 CL+	118	134	138	60.5	100	6/4	40	0	9.2
WB 456	118	136	135	62.0	100	6/2	38	0	8.8
WB1529	139	161	133	62.0	100	6/3	40	0	9.8
WB1376CLP	139	147	127	62.5	100	6/4	39	0	9.6
Average	134	148	150	59.8	100	6/4	40	4	8.9
LSD ($\alpha=0.05$)	19.3	15.2	18.3	0.8	0	1.7	2.2	13.6	
CV %	10.3	7.3	8.6	1.0	.	0.8	4.0	241	
Pr > F	<.0001	0.001	0.0011	<.0001	.	<.0001	<.0001	0.105	

Table 21. Agronomic Data for Soft White Winter Wheat at Aberdeen, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2017	2018	2019						
LCS Ghost	---	---	196	58.7	100	6/3	44	0	8.1
LCS Blackjack	---	---	187	59.7	100	6/4	41	0	8.6
UIL 11-456031A	---	---	179	60.7	98	6/4	40	0	7.9
SY Raptor	---	---	178	60.6	100	6/4	42	0	8.1
LCS Artdeco	145	176	178	60.3	100	6/2	38	0	8.1
Norwest Duet	---	---	177	60.8	100	6/7	47	0	8.9
LCS Hulk	147	181	175	61.3	77	6/7	40	0	10.1
SY Ovation	152	182	174	61.2	100	6/5	44	0	9.4
UIL15-72223	---	200	174	60.1	100	6/6	42	0	8.4
Jasper	127	178	174	59.9	100	6/7	44	0	8.4
Nixon	146	175	174	60.6	100	6/6	43	0	9.6
Rosalyn	---	167	173	59.6	99	6/5	43	0	8.4
Stingray CL+	---	---	171	60.2	100	6/5	40	0	---
IDO1708	---	174	169	60.1	100	6/4	42	3	8.5
Purl	---	---	168	62.0	100	6/4	43	0	9.1
UIL 17-6333 (CL+)	---	---	167	62.5	100	6/4	40	0	9.2
WB1783	155	197	165	62.9	100	6/4	42	0	8.6
Bruneau	157	177	165	59.9	99	6/8	43	6	9.3
LCS Shark	125	178	163	60.0	78	6/4	42	0	9.5
UIL 17-6268 (CL+)	---	---	162	61.0	100	6/4	36	0	8.4
Applyby CL+	---	---	162	62.0	100	6/2	43	0	9.8
LCS Drive	138	157	161	60.6	100	6/1	36	0	9.0
VI Bulldog	---	---	161	61.7	100	6/3	42	0	8.8
Norwest Tandem	149	159	160	60.8	99	6/2	35	0	9.0
UI Magic CL+	131	187	160	61.5	100	6/3	38	0	8.9
UIL 17-6834 (CL+)	---	---	158	61.8	100	6/3	40	0	8.0
SY Assure	136	167	157	62.0	97	6/1	39	0	8.8
UI Castle CL+	153	159	157	59.4	99	6/6	44	11	9.1
WB1529	153	181	157	63.1	100	6/4	42	0	8.9
Stephens	155	163	156	60.0	100	6/4	44	0	9.3
OR2X2 CL+	138	150	154	60.4	99	6/6	44	0	9.2
WB 456	143	167	152	62.8	98	6/2	42	0	9.9
UI Sparrow	138	184	148	56.4	100	6/7	47	8	9.7
UIL 17-6546 (CL+)	---	---	144	62.5	98	5/30	38	0	8.8
Brundage	127	177	143	61.1	100	6/2	45	0	9.1
WB1376CLP	139	163	141	62.8	98	6/4	42	0	9.7
Average	144	173	165	60.6	98	6/4	41	1	8.9
LSD ($\alpha=0.05$)	17.1	13.3	12.7	0.9	15.2	1.6	2.2	5.2	
CV %	8.4	5.5	5.5	1.0	11.0	0.8	3.7	489	
Pr > F	<.0001	<.0001	<.0001	<.0001	0.565	<.0001	<.0001	0.105	

Table 22. Agronomic Data for Winter Wheat at Ririe, Dryland, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
IDO1810	---	---	28	59.3	99	6/25	26	0	10.5
Norwest Duet	40	51	27	58.4	99	6/24	27	0	9.9
Nixon	30	43	26	57.6	100	6/25	26	0	10.4
SY Dayton	---	---	26	59.2	95	6/26	23	0	11.0
Appleby CL+	---	---	26	57.7	82	6/23	25	0	11.4
SY Ovation	---	---	26	59.6	98	6/26	25	0	11.6
Norwest Tandem	34	55	25	57.8	97	6/24	21	0	9.3
Eltan	35	59	25	60.0	98	6/28	25	0	8.0
UIL 17-6451 (CL+)	---	---	25	59.5	96	6/24	24	0	9.6
LCS Hulk	33	56	25	58.8	98	6/25	25	0	8.5
Purl	---	---	25	58.1	91	6/23	25	0	9.0
Devote	---	58	25	61.6	95	6/27	23	0	9.9
Jasper	38	52	24	56.0	93	6/25	24	0	8.9
LCS Shine	---	---	24	55.2	94	6/23	20	0	8.0
UI Sparrow	35	65	24	57.5	93	6/28	27	0	10.0
Otto	41	57	24	60.4	100	6/27	26	0	9.6
UIL 11-456031A	---	---	24	57.1	91	6/24	23	0	8.1
WB1376CLP	26	51	24	61.0	97	6/24	26	0	10.7
UI Castle CL+	32	50	23	60.1	95	6/27	25	0	11.2
Eltan 11-52-0	---	---	23	60.2	98	6/28	25	0	9.2
Rosalyn	---	48	23	56.3	87	6/25	25	0	8.4
LCS Sonic	---	---	23	57.8	96	6/24	25	0	8.9
Stingray CL+	---	---	23	58.6	99	6/25	25	0	9.0
SY Assure	---	---	22	58.0	98	6/23	23	0	9.2
WB1783	35	57	22	60.9	91	6/25	26	0	9.4
WB1529	29	52	22	58.9	89	6/24	23	0	9.6
Bruneau	36	57	22	59.0	83	6/27	25	0	9.3
OR2X2 CL+	31	52	22	57.9	92	6/26	26	0	12.1
UIL 17-6546 (CL+)	---	---	22	57.8	87	6/22	23	0	9.7
UIL 17-6268 (CL+)	---	---	21	59.2	86	6/25	22	0	10.3
Stephens	31	46	21	57.3	91	6/25	26	0	10.3
IDO1708	---	51	20	56.3	94	6/24	25	0	9.2
UIL 17-6834 (CL+)	---	---	20	59.8	91	6/25	23	0	9.8
UI Magic CL+	34	52	19	58.1	94	6/24	23	0	9.6
Brundage	29	50	19	58.4	75	6/23	24	0	8.8
IDO1808	---	---	16	57.1	86	6/25	23	0	9.0
Average	44	33	23	58.5	93	6/25	24	0	9.7
LSD ($\alpha=.05$)	8.3	5.0	5.4	1.1	14.5	1.4	2	0	
CV %	13.3	9.2	16.1	1.3	11.1	0.6	5	.	
Pr > F	0.0003	<.0001	0.0037	<.0001	0.209	<.0001	<.0001	.	

Table 23. Agronomic Data for Soft White Winter Wheat at Rockland, Dryland, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
Norwest Tandem	---	43	39	58.9	95	6/4	27	0	9.5
UIL 17-6834 (CL+)	---	---	37	60.2	95	6/3	28	0	11.2
Norwest Duet	---	41	33	58.1	95	6/12	30	0	10.2
LCS Shine	---	---	32	58.0	95	6/5	25	0	9.1
LCS Sonic	---	---	32	58.3	95	6/9	29	0	9.8
LCS Hulk	---	44	30	58.9	95	6/10	28	0	10.4
SY Ovation	---	---	29	59.6	95	6/9	28	0	10.1
Otto	---	---	29	59.7	95	6/17	29	0	10.6
UIL 17-6546 (CL+)	---	---	29	60.5	94	6/3	27	0	10.6
UIL 17-6451 (CL+)	---	---	27	60.5	94	6/6	28	0	10.5
Eltan	---	---	27	59.5	95	6/17	29	0	10.3
UIL 17-6268 (CL+)	---	---	26	59.2	95	6/9	25	0	10.1
Brundage	---	---	26	58.8	95	6/4	28	0	10.6
Purl	---	---	24	59.4	95	6/6	28	0	9.7
UIL 17-6333 (CL+)	---	---	24	60.3	95	6/9	25	0	11.0
Bruneau	---	---	23	58.5	95	6/12	28	0	10.6
Eltan 11-52-0	---	---	23	59.3	95	6/16	29	0	10.5
UI Castle CL+	---	40	23	59.2	95	6/14	27	0	11.6
Jasper	44	40	21	56.8	95	6/11	27	0	11.1
UI Magic CL+	---	41	20	59.9	95	6/5	27	0	11.1
UIL 11-456031A	---	---	19	58.8	95	6/6	29	0	9.1
UIL15-72223	---	39	17	57.6	95	6/8	28	0	10.4
UI Sparrow	---	44	15	57.8	95	6/14	29	0	9.5
Average	36	39	26	59.0	95	6/9	28	0	10.3
LSD ($\alpha=.05$)	8.1	7.4	3.8	0.9	0.6	1.7	1.3	0	
CV %	15.1	13.2	9.8	1.1	0.47	0.72	3.4	.	
Pr > F	0.0024	0.0194	<.0001	<.0001	0.5464	<.0001	<.0001	.	

Table 24. Agronomic Data for Soft White Winter Wheat at Soda Springs, Dryland, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
Nixon	---	78	67	58.7	99	7/2	29	0	11.7
LCS Sonic	---	---	64	58.9	100	7/2	28	0	11.4
UI Sparrow	87	81	64	58.6	98	7/7	29	0	11.3
UIL 17-6451 (CL+)	---	---	61	59.4	97	7/2	25	0	10.8
UIL 17-6268 (CL+)	---	---	60	59.1	90	7/5	24	0	12.3
UIL 11-456031A	---	---	60	57.3	99	7/4	24	0	10.9
Stingray CL+	---	---	58	58.3	100	7/1	25	0	13.9
Bobtail	---	---	58	56.0	99	7/4	24	0	9.6
IDO1708	---	70	58	56.9	100	6/30	26	0	10.1
SY Dayton	---	---	57	58.4	99	7/4	24	0	11.5
Devote (WA8271)	---	82	57	60.3	99	7/5	24	0	12.0
Eltan	94	80	56	60.3	98	7/9	27	0	12.0
LCS Shine	---	---	56	57.6	100	6/30	21	0	8.9
Jasper	75	69	55	57.1	100	7/3	24	0	11.0
LCS Hulk	74	73	55	59.4	99	7/3	26	0	11.0
Rosalyn	---	72	55	58.1	90	7/6	26	0	8.7
SY Ovation	---	---	54	58.4	94	7/4	28	0	11.9
Bruneau	87	77	54	58.6	97	7/7	25	0	10.5
Eltan 11-52-0	---	---	54	59.8	99	7/9	29	0	12.3
Purl	---	---	53	58.9	99	6/30	23	0	11.3
IDO1808	---	---	52	57.4	96	7/3	25	0	11.2
OR2X2 CL+	66	64	51	59.1	82	7/8	26	0	12.7
UI Magic CL+	56	71	51	58.8	90	7/2	25	0	12.8
UI Castle CL+	79	60	50	59.9	98	7/7	27	0	12.3
Otto	87	69	50	59.9	99	7/11	28	0	12.2
Appleby CL+	---	---	48	58.8	99	7/1	24	0	12.7
Norwest Tandem	92	70	47	58.5	94	7/1	22	0	11.2
WB1529	79	77	47	59.6	99	7/1	23	0	11.2
IDO1810	---	---	47	58.8	99	7/6	26	0	10.6
Norwest Duet	---	70	45	59.1	100	7/4	28	0	11.3
UIL 17-6834 (CL+)	---	---	42	57.7	100	6/30	22	0	12.8
WB1783	97	76	42	60.9	100	7/2	26	0	13.5
Stephens	59	66	38	57.1	88	7/2	26	0	11.2
WB1376CLP	69	72	38	59.6	87	7/1	25	0	13.8
UIL 17-6546 (CL+)	---	---	37	57.9	88	6/30	23	0	12.4
SY Assure	---	---	36	58.2	97	6/30	22	0	11.4
Average	76	73	52	58.6	96	7/3	25	0	11.6
LSD ($\alpha=.05$)	21.7	11.6	17.3	0.8	8.7	1.6	2.7	0	
CV %	20.2	11.3	21.7	1.0	6.5	0.60	7.8	.	
Pr > F	0.0074	0.0275	0.0151	< 0.0001	0.0012	< 0.0001	< 0.0001	.	

Table 25. Soft White Winter Wheat Yield Percentage of Location Averages, 2019.

Variety	(100% = Average)					Soda	Variety
	Kimberly	Aberdeen	Rupert	Ririe	Rockland	Springs	Average
LCS Ghost	115	119	109	---	---	---	114
LCS Sonic	---	---	---	99	120	123	114
LCS Ghost	---	---	---	105	122	107	111
SY Dayton	---	---	---	112	---	110	111
LCS Blackjack	106	113	109	---	---	---	110
Nixon	106	105	97	112	---	129	110
UIL 17-6451 (CL+)	---	---	---	107	102	116	109
Devote	---	---	---	106	---	109	108
Norwest Duet	101	108	106	116	125	87	107
LCS Hulk	99	106	106	106	115	108	107
Norwest Tandem	96	97	101	110	147	90	107
SY Ovation	105	105	98	111	111	103	106
IDO1810	---	---	---	121	---	90	106
Eltan	---	---	---	108	103	108	106
LCS Artdeco	103	108	104	---	---	---	105
Stingray CL+	---	103	---	98	---	111	104
Rosalyn	97	105	104	100	---	105	102
UIL 11-456031A	107	109	106	102	73	114	102
Otto	---	---	---	102	109	95	102
IDO1708	108	103	94	88	---	111	101
Purl	107	102	97	106	92	101	101
SY Raptor	95	108	98	---	---	---	100
LCS Shark	104	99	97	---	---	---	100
UIL 17-6268 (CL+)	95	98	101	92	98	116	100
UIL15-72223	116	105	111	---	63	---	99
WB1783	106	100	113	96	---	80	99
Appleby CL+	96	98	97	111	---	92	99
Bruneau	102	100	107	94	89	103	99
Jasper	99	105	101	105	79	106	99
UIL 17-6834 (CL+)	85	96	101	88	141	81	99
VI Bulldog	98	98	98	---	---	---	98
UI Castle CL+	112	95	100	101	86	97	98
Eltan 11-52-0	---	---	---	101	89	103	98
LCS Drive	100	98	94	---	---	---	97
UI Sparrow	106	89	96	104	58	122	96
UIL 17-6333 (CL+)	91	101	96	---	91	---	95
Brundage	100	87	103	81	98	---	94
SY Assure	101	95	103	96	---	70	93
UI Magic CL+	96	97	106	82	77	98	93
WB 456	95	92	89	---	---	---	92
WB1529	93	95	88	94	---	90	92
OR2X2CL+	81	94	92	94	---	99	92
Stephens	101	94	95	91	---	74	91
UIL 17-6546 (CL+)	82	87	97	93	109	70	90
WB1376CLP	91	85	85	102	---	72	87
IDO1808	---	---	---	67	---	100	84
Location Average	100	100	100	100	100	100	100

2019 Soft White Winter Wheat Yield Percentage Across All Locations

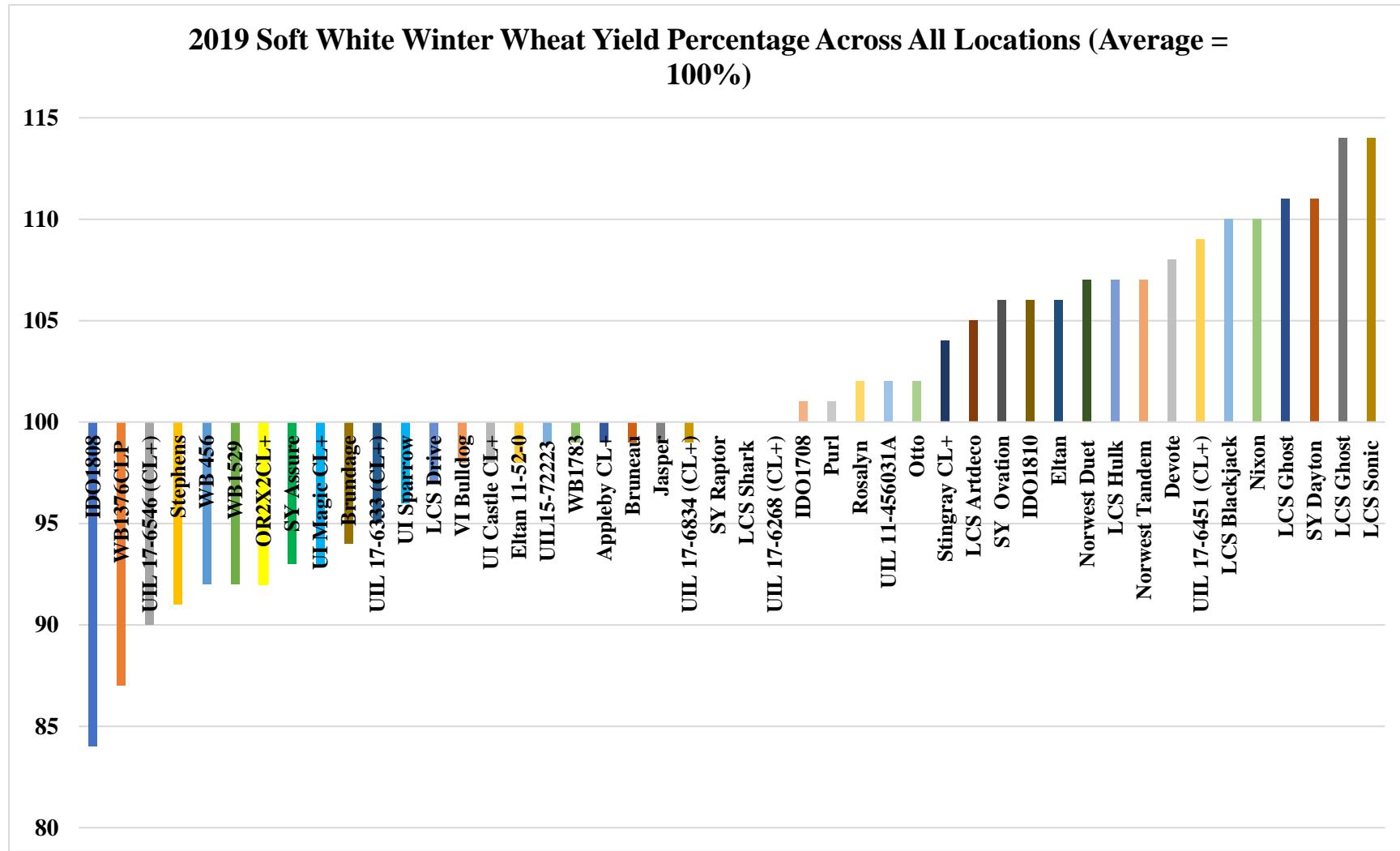


Chart 4. Soft White Winter Wheat Yield Percentage Across All Locations.

Table 26. Winter Barley Irrigated Nurseries, 3-Year Averages (2017-2019; 5 site-years)

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plumps		
								>6/64	>5.5/64	% thin
Thunder	165	51.6	92	5/24	37	36	11.1	93	4	3
Sunstar Pride	159	50.1	86	6/3	36	12	10.4	55	21	22
LCS Calypso	155	52.9	94	5/23	40	3	10.8	96	2	1
UT10201	151	49.6	89	5/24	38	6	11.3	78	14	8
06ARS617-25	149	51.8	88	5/25	37	55	11.9	84	9	6
Endeavor	142	51.4	85	5/28	41	48	11.3	79	11	9
WintMalt	142	50.9	87	5/28	39	28	11.9	90	6	4
05ARS561-208	138	49.2	84	6/1	36	46	11.3	81	8	6
Eight-Twelve	137	49.3	83	5/28	39	35	10.8	63	20	16
Charles	132	48.7	86	5/25	35	60	11.7	86	8	6
Upspring*	123	60.8	63	5/31	40	7	15.3	78	11	6
Buck*	114	60.3	67	5/28	39	30	13.5	42	28	29
Average	141	52.2	84	5/27	38	31	11.9	77	12	10
LSD (a=.05)	19.1	0.9	15.8	3.2	3.2	20.4	1.3	9.1	4.4	4.2
CV%	20.5	2.6	30.4	3.5	13.5	107	8.0	9.2	28.2	34.1
Pr > F	<.0001	<.0001	0.0152	<.0001	0.0040	<.0001	<.0001	<.0001	<.0001	<.0001

*indicates hulless variety

Table 27. Irrigated Winter Barley Data Combined from Rupert and Aberdeen, 2019.

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	>6/64	Plump >5.5/64	% Thin
DH140963	188	51.0	100	5/28	43	12	9.8	94	3	2
KWS Donau	186	52.0	100	5/26	43	14	9.6	95	2	1
LCS Calypso	174	53.1	100	5/24	44	6	9.7	96	2	1
UT10201	171	49.4	100	5/24	44	15	11.6	75	16	9
KWS Somerset	170	52.0	99	5/28	45	16	10.0	95	3	2
KWS Scala	168	49.9	100	5/27	41	35	11.0	92	4	3
FR124/12	167	51.4	99	5/29	45	19	10.2	93	3	2
Thunder	165	51.2	100	5/26	43	45	10.8	92	4	3
Sunstar Pride	165	49.2	100	6/3	40	6	10.7	51	21	23
2WI15-8688	161	51.1	99	5/27	42	35	12.8	85	8	6
2WI14-7577	157	50.7	99	5/23	42	28	10.1	93	3	2
DH130910	152	52.3	99	5/31	42	21	10.8	93	4	2
05ARS561-208	146	48.0	99	6/1	40	54	11.5	66	12	10
06ARS617-25	145	51.6	98	5/26	41	72	13.1	83	9	6
07ARS518-13	144	50.8	100	5/28	42	64	13.1	82	10	7
2WI15-8747	144	49.4	99	5/25	42	40	11.6	89	6	4
WintMalt	138	50.6	100	5/29	43	26	12.6	87	8	6
2WI15-8784	137	51.3	99	5/23	41	52	10.7	91	4	3
Endeavor	137	50.9	99	5/29	44	60	11.8	72	15	12
Upspring*	135	60.7	88	5/31	45	5	15.3	75	9	4
05ARS849-15	131	50.6	99	5/27	43	61	10.7	82	4	3
Charles	127	48.1	99	5/27	41	59	12.5	85	8	6
Eight-Twelve	115	48.9	99	5/29	43	49	11.1	62	21	17
Buck*	111	59.7	78	5/30	40	49	13.6	45	26	27
Average	151	51.4	98	5/28	43	35	11.5	82	9	7
LSD ($\alpha = .05$)	33.2	2.1	6	2.8	3.3	32.8	4.1	15.8	6.0	7.6
CV %	22.1	4.2	6.2	1.9	7.9	94.7	15.5	9.3	33.9	55
Pr > F	<.0001	<.0001	<.0001	<.0001	0.0221	<.0001	0.2496	<.0001	<.0001	<.0001

*indicates hulless variety

Table 28. Agronomic Data for Winter Barley at Rupert, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein	Plump		
	2016	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
KWS Donau	---	---	173	51.1	100	5/23	43	28	11.0	93	3	2
DH140963	---	---	161	50.1	100	5/28	42	8	11.1	93	3	1
LCS Calypso	---	164	151	51.8	100	5/23	44	12	11.1	94	2	1
Sunstar Pride	123	166	149	48.4	99	6/4	39	6	10.2	38	23	29
KWS Somerset	---	154	146	50.7	100	5/19	42	31	11.3	93	3	2
UT10201	143	163	145	48.2	100	5/22	41	29	11.1	66	22	13
FR124/12	---	---	143	49.8	100	5/29	43	31	10.8	90	4	3
KWS Scala	---	154	137	47.9	99	5/24	39	65	11.2	88	6	4
Thunder	134	161	136	49.1	100	5/25	40	70	11.4	90	6	4
2WI14-7577	---	147	126	49.6	99	5/22	41	49	11.4	91	4	2
2WI15-8688	---	154	125	48.6	99	5/29	39	59	11.4	77	12	8
2WI15-8747	---	---	123	47.3	97	5/24	39	51	11.4	83	8	5
05ARS561-208	124	116	120	45.3	99	6/1	37	59	11.0	61	19	16
06ARS617-25	---	131	118	50.6	97	5/26	38	93	11.2	76	13	8
07ARS518-13	---	151	110	48.2	100	5/29	40	95	11.3	71	15	10
WinMalt	132	148	109	48.4	99	5/30	43	36	11.2	81	11	8
DH130910	---	148	109	50.7	99	5/28	38	41	11.2	88	6	3
Endeavor	136	128	109	49.7	99	5/30	42	83	11.0	61	20	15
Eight-Twelve	145	143	105	47	100	5/29	41	98	10.6	46	28	24
Upspring*	124	116	98	60.3	75	5/30	44	2	14.1	81	12	4
05ARS849-15	---	---	97	49	100	5/28	40	98	11.1	89	6	3
2WI15-8784	---	---	94	48.9	99	5/23	41	90	10.8	86	6	5
Buck*	126	122	91	58.3	56	5/30	36	99	13.3	32	28	37
Charles	127	113	88	45.6	98	5/29	39	92	11.1	77	12	8
Average	132	147	124	49.8	96	5/27	40	55	11.3	77	11	9
LSD ($\alpha=.05$)	12.9	17.2	20.55	1.8	4.9	2.0	3.3	33				
CV %	6.9	8.3	11.59	2.6	3.6	1.0	5.8	43				
Pr > F	<.0001	<.0001	0.0011	<.0001	<.0001	<.0001	<.0001	0.105				

*indicates hullless variety

Table 29. Agronomic Data for Winter Barley at Aberdeen, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein	Plump		
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
DH140963	---	---	214	52.0	100	5/29	44	16	11.9	96	3	2
KWS Scala	---	192	200	51.9	100	5/29	44	5	12.3	96	2	2
KWS Donau	---	---	199	53.2	100	5/29	43	0	11.7	97	2	1
UT10201	127	230	198	50.6	100	5/26	48	0	11.6	84	11	5
2WI15-8688	---	207	196	53.6	100	5/26	46	11	11.7	93	4	4
LCS Calypso	135	212	196	54.3	100	5/25	45	0	12.2	98	2	1
Thunder	165	182	194	53.4	100	5/27	46	20	11.9	94	3	2
KWS Somerset	---	202	193	53.4	99	5/30	48	1	12.0	96	2	1
FR124/12	---	---	192	53.0	98	5/29	47	6	11.8	95	2	2
2WI14-7577	---	175	188	51.9	100	5/24	43	8	12.1	95	3	2
DH130910	---	188	184	54.0	100	5/27	46	0	11.8	99	2	1
Sunstar Pride	148	203	180	49.9	100	6/2	41	6	10.7	63	19	18
2WI15-8784	---	---	180	53.8	99	5/22	41	14	11.9	97	3	2
07ARS518-13	---	172	178	53.4	100	5/27	44	34	11.7	92	6	4
06ARS617-25	157	181	172	52.6	100	5/26	44	50	12.3	90	5	5
05ARS561-208	127	153	172	50.6	100	6/2	42	49	11.5	72	4	3
Upspring*	---	---	171	61.2	100	6/1	46	8	16.5	70	7	3
WintMalt	98	187	167	52.8	100	5/29	44	15	12.0	92	4	3
05ARS849-15	---	---	165	52.3	99	5/27	47	24	11.8	74	3	3
2WI15-8747	---	---	165	51.5	100	5/25	45	29	12.2	95	3	2
Charles	102	163	165	50.7	100	5/26	43	27	11.7	93	5	4
Endeavor	112	165	158	52.0	100	5/28	47	44	11.8	82	10	8
Buck*	85	142	132	61.1	100	5/30	45	0	13.8	59	25	18
Eight-Twelve	104	178	126	50.8	99	5/29	46	0	11.1	78	15	9
Average	119	185	178	53.1	100	5/28	45	15	12.1	88	6	4
LSD ($\alpha=.05$)	53.7	22.1	19.7	1.2	1.8	2.1	2.6	25				
CV %	32.2	8.5	7.8	1.6	1.3	1.0	4.1	116				
Pr > F	<.0001	<.0001	0.0011	<.0001	0.816	<.0001	<.0001	<.0001				

*indicates hullless variety

Table 30. Winter Barley Yield Percentage of Location Averages, 2019.

Variety	(100% = Average)		Variety Average
	Aberdeen	Rupert	
KWS Donau	112	140	126
DH140963	120	130	125
LCS Calypso	110	122	116
UT10201	111	117	114
KWS Somerset	108	118	113
FR124/12	108	115	111
KWS Scala	112	110	111
Sunstar Pride	101	121	111
Thunder	109	109	109
2WI15-8688	110	101	106
2WI14-7577	106	101	104
05ARS561-208	96	97	97
2WI15-8747	92	100	96
06ARS617-25	97	95	96
DH130910	103	88	96
07ARS518-13	100	89	94
WintMalt	94	88	91
2WI15-8784	101	76	89
Endeavor	88	88	88
Upspring*	96	79	88
05ARS849-15	93	79	86
Charles	92	71	82
Eight-Twelve	71	85	78
Buck*	74	73	74
Location Average	100	100	100

*indicates hulless variety

2019 Winter barley Yield Percentage Across All Locations

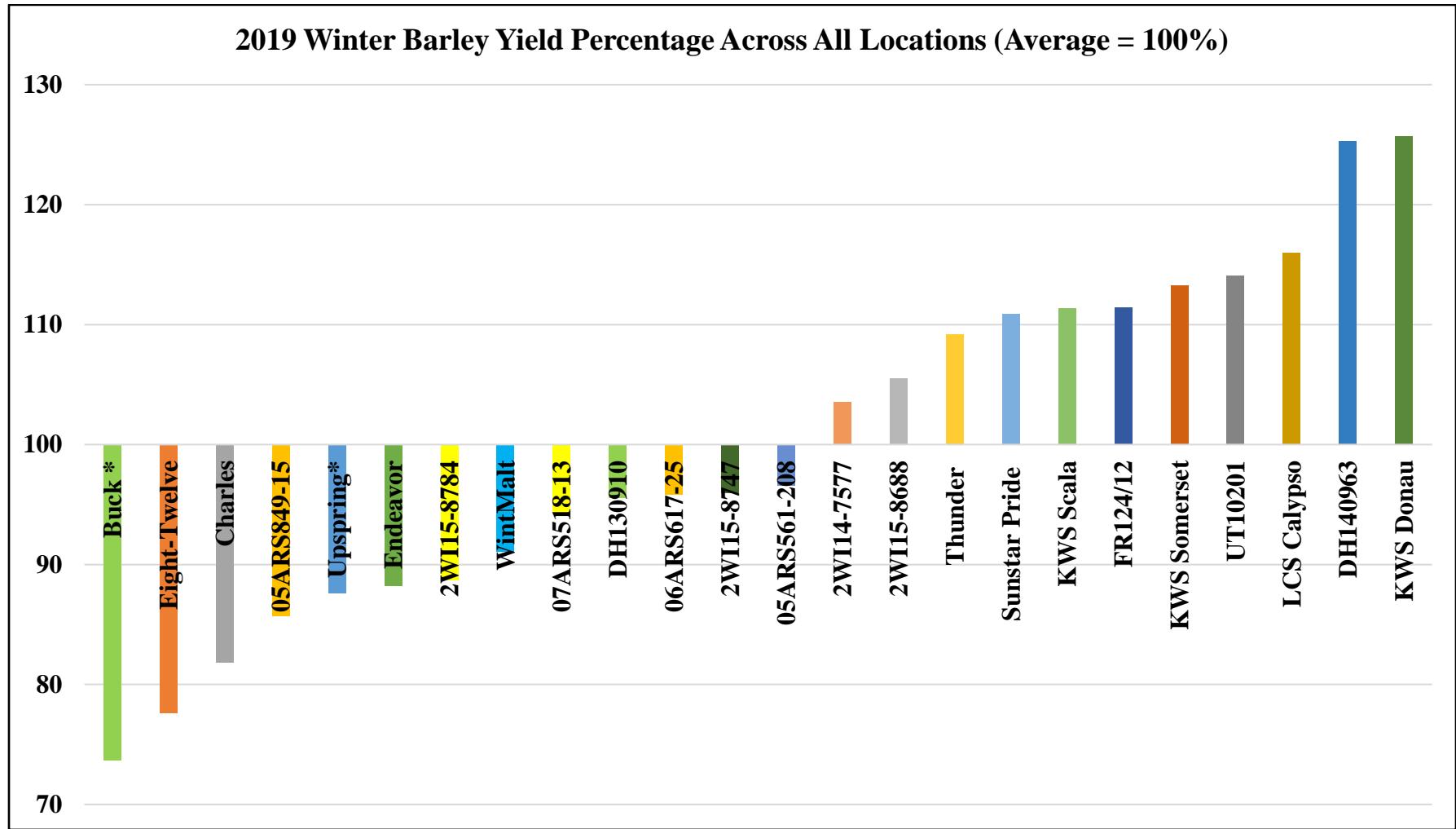


Chart 5. Winter Barley Yield Percentage Across All Locations in 2019.

* Indicates hulless variety

Table 31. Hard Spring Wheat Irrigated Nurseries, 3 Year Averages (2017 - 2019; 12 site-years)

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Dayn (W)	126	62.3	100	6/19	34	0	13.8
SY-Teton (W)	119	60.4	100	6/17	31	0	13.8
SY Coho	116	60.0	100	6/23	33	1	14.7
SY Gunsight	114	61.1	100	6/20	31	0	14.2
Cabernet	113	62.0	100	6/21	29	0	14.1
UI Platinum (W)	113	62.4	100	6/17	30	0	13.4
Alum	112	62.0	100	6/22	36	4	15.3
WB9411	111	61.9	99	6/18	30	0	15.0
Jefferson	109	61.7	100	6/20	34	6	14.3
WB7202CLP (W)	109	61.9	100	6/17	28	1	13.7
WB7589 (W)	108	61.5	100	6/18	26	0	14.8
IDO1603S	107	61.6	99	6/18	31	0	15.3
Klasic (W)	107	62.1	100	6/16	26	0	14.1
Alzada (D)	105	61.4	99	6/18	31	1	14.5
WB9668	105	62.3	100	6/18	29	0	16.1
WB7328 (W)	100	62.1	100	6/17	27	0	15.2
Imperial (D)	89	59.2	100	6/19	32	0	17.1
Average	109	61.5	100	6/19	31	1	14.7
LSD ($\alpha=.05$)	8.3	0.6	0.6	3.6	1.3	2.0	0.5
CV%	18.8	2.4	1.5	5.0	9.8	598.3	4.1
Pr>F	<.0001	<.0001	0.4140	0.0047	<.0001	<.0001	<.0001

(W) = White

(D) = Durum

Table 32. Hard Spring Wheat Dryland Nurseries, 3 Year Averages (2017 - 2019; 3 site-years)

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Dayn (W)	56	60.9	94	7/6	28	0	12.8
WB9411	51	60.8	95	7/6	25	0	12.8
Jefferson	51	60.8	95	7/7	27	0	13.1
SY Selway	49	59.9	95	7/7	27	0	13.2
Alum	49	61.6	93	7/9	27	0	12.2
WB7589 (W)	48	60.9	94	7/6	22	0	12.2
UI Platinum (W)	47	61.1	95	7/5	25	0	12.1
WB9668	44	61.1	95	7/6	24	0	14.4
Klasic (W)	41	59.3	93	7/4	20	0	12.2
WB7328 (W)	40	59.8	96	7/4	22	0	12.5
Average	47	60.6	95	7/6	25	0	12.8
LSD ($\alpha=.05$)	16.5	1.6	4.2	3.4	3.3	0.0	1.3
CV%	29.0	3.2	5.5	2.2	16.6	.	5.7
Pr>F	<.0001	0.1977	0.9744	0.1606	<.0001	.	0.0521

(W) = White

Table 33. Irrigated Hard Spring Wheat Data Combined from Rupert, Idaho Falls, Ashton and Aberdeen, 2019.

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
AP Octane	120	59.4	100	6/17	30	0	13.4
AP Venom	120	58.9	100	6/18	36	0	13.8
Dayn (W)	115	61.4	100	6/21	36	1	13.9
IDO1702S	114	61.9	100	6/20	35	0	11.8
SY-Teton (W)	112	59.9	100	6/20	32	1	13.7
CPX36619	111	61.5	100	6/21	31	0	14.7
UI Platinum (W)	109	62.1	100	6/20	31	0	13.6
SY Gunsight	109	60.6	100	6/24	32	0	14.2
AP Renegade	107	60.7	100	6/25	36	0	14.4
12SB0224 (W)	107	59.0	99	6/27	33	3	13.6
SY Coho	107	58.9	100	6/26	36	4	14.7
WB7328 (W)	106	61.7	100	6/20	28	0	15.1
Alzada (D)	106	60.0	100	6/21	32	8	14.9
WB7696 (W)	106	61.2	100	6/22	31	0	13.7
WB7589 (W)	105	61.1	100	6/21	27	0	15.0
Klasic (W) 1.2	105	61.4	100	6/19	26	0	13.9
WB7202CLP (W)	104	61.6	100	6/20	29	0	13.7
Cabernet	104	61.0	100	6/24	30	0	14.0
WB9668	103	61.6	100	6/22	31	0	16.2
WB9411	103	61.3	100	6/21	31	0	15.3
IDO1603S	102	61.3	100	6/21	32	0	14.9
Glee	101	61.0	100	6/20	35	11	14.6
Net CL+	101	61.1	100	6/26	37	12	15.0
IDO1805S	100	60.1	100	6/25	35	18	14.9
WB9590	100	60.7	100	6/21	32	5	15.5
Alum	99	60.8	100	6/25	38	12	15.5
Jefferson	99	60.5	100	6/24	36	14	14.5
Klasic (W) 1.4	99	60.9	100	6/19	27	0	14.3
IDO1701S	98	62.2	100	6/22	33	12	15.0
Klasic (W)	97	61.0	100	6/19	27	0	14.2
WB9879CLP	97	60.9	99	6/25	37	6	15.4
Imperial QC	95	59.0	100	6/14	34	0	17.4
Imperial (D)	90	58.9	100	6/21	33	0	17.1
Average	104	60.8	100	6/21	32	3	14.6
LSD ($\alpha = .05$)	18.3	1.3	1	8.3	2.2	7.9	0.7
CV%	24.5	2.9	1	5.8	9.8	341	3.4
Pr > F	0.5137	<.0001	0.1129	0.7486	<.0001	<.0001	<.0001

(W) = White

(D) = Durum

Table 34. Agronomic Data for Hard Spring Wheat at Rupert, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in)	(%)	(%)
SY-Teton (W)	123	131	151	60.6	100	6/10	34	0	13.4
Dayn (W)	127	144	145	62.3	100	6/11	41	0	13.4
UI Platinum (W)	108	123	144	63.0	100	6/9	35	0	13.2
Klasic (W) 1.4	---	132	143	63.4	100	6/9	31	0	14.0
IDO1702S	---	---	143	62.8	100	6/11	41	0	11.2
WB7696 (W)	---	---	139	63.2	100	6/12	35	0	13.3
Alzada (D)	110	115	138	61.6	100	6/10	36	0	14.6
CPX36619	---	---	137	62.3	100	6/10	33	0	14.5
SY Gunsight	115	120	137	62.1	100	6/15	37	0	13.3
AP Octane	---	---	137	60.3	100	6/13	33	0	13.0
SY Coho	122	126	136	60.6	100	6/15	41	0	14.2
Klasic (W) 1.2	---	125	135	63.0	100	6/9	30	0	13.7
Klasic (W)	108	118	133	62.8	100	6/10	30	0	13.8
WB9411	117	114	133	62.4	100	6/12	35	0	14.8
AP Venom	---	---	132	60.0	100	6/14	38	0	13.9
Cabernet	115	117	131	62.3	100	6/12	33	0	13.7
AP Renegade	---	---	131	61.0	100	6/16	39	0	14.3
IDO1603S	115	121	131	61.6	100	6/11	35	0	15.0
WB7202CLP (W)	104	118	129	62.9	100	6/10	33	0	13.4
WB9668	102	104	129	61.9	100	6/13	36	0	15.9
Glee	---	115	128	61.4	100	6/11	41	9	14.1
WB9879CLP	---	---	128	62.2	100	6/16	42	0	15.0
IDO1805S	---	---	126	61.3	100	6/14	39	0	14.3
WB9590	---	125	126	62.6	100	6/11	35	0	15.2
12SB0224 (W)	120	131	125	61.0	100	6/15	36	0	13.0
Jefferson	113	122	125	61.8	100	6/12	42	8	14.0
IDO1701S	---	106	124	62.9	100	6/11	37	1	14.4
Net CL+	---	---	123	62.3	100	6/15	44	9	14.0
WB7589 (W)	104	110	123	62.2	100	6/12	30	0	15.3
WB7328 (W)	106	105	123	63.0	100	6/10	31	0	14.9
Alum	115	122	121	61.8	100	6/15	43	1	14.8
Imperial QC	---	---	113	59.8	100	6/10	37	0	17.5
Imperial (D)	81	99	109	59.8	100	6/10	36	0	16.8
Average	110	120	131	61.8	100	6/12	36	1	14.2
LSD ($\alpha=.05$)	12.4	20.2	10.5	0.9	0	1.4	2	7	
CV %	8.0	12.0	5.7	1.0	.	0.6	4	630	
Pr > F	<.0001	0.0123	<0.0001	<0.0001	.	<.0001	<.0001	0.611	

Table 35. Agronomic Data for Hard Spring Wheat at Aberdeen, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
IDO1702S	---	---	119	62.4	100	6/16	35	0	11.5
Dayn (W)	140	142	114	61.5	100	6/19	38	0	14.3
SY-Teton (W)	120	127	112	59.1	100	6/17	33	0	13.2
WB7202CLP (W)	118	121	111	61.2	100	6/16	30	0	13.0
UI Platinum (W)	119	133	106	61.7	100	6/16	32	0	13.4
AP Renegade	---	---	105	60.8	100	6/22	36	0	14.0
Cabernet	115	123	105	61.4	100	6/22	32	0	13.5
WB7589 (W)	106	129	104	60.6	100	6/18	27	0	14.6
SY Gunsight	124	126	104	60.1	100	6/20	32	0	14.7
12SB0224 (W)	126	142	104	58.2	97	6/26	33	0	13.8
AP Octane	---	---	104	57.5	100	6/21	30	0	14.3
IDO1603S	107	122	103	61.2	99	6/18	32	0	14.8
CPX36619	---	---	103	61.7	100	6/18	33	0	14.8
IDO1701S	---	118	103	62.8	100	6/19	35	0	15.3
AP Venom	---	---	103	56.7	100	6/23	36	0	13.7
IDO1805S	---	---	102	60.9	99	6/24	36	13	14.7
WB9668	105	125	101	62.0	99	6/19	31	0	16.8
WB7328 (W)	95	119	97	61.2	100	6/16	29	0	14.6
WB7696 (W)	---	---	95	60.3	100	6/20	32	0	12.9
Glee	---	127	94	60.9	100	6/17	37	13	14.6
WB9411	118	125	94	60.4	100	6/17	32	0	15.8
SY Coho	119	137	91	58.1	100	6/24	37	0	14.6
Net CL+	---	---	90	60.2	100	6/24	37	0	15.7
Imperial (D)	86	106	87	58.9	100	6/18	34	0	17.7
Klasic (W) 1.4	---	129	87	59.5	99	6/16	28	0	13.4
Jefferson	119	135	83	59.4	100	6/21	37	0	14.0
Klasic (W) 1.2	---	121	83	59.0	100	6/16	28	0	13.4
WB9590	---	129	83	59.8	100	6/19	32	0	15.0
Alum	119	127	83	59.8	100	6/22	38	0	15.9
Alzada (D)	114	118	81	57.9	99	6/18	33	0	15.7
Klasic (W)	99	124	79	59.0	99	6/16	28	0	13.3
Imperial QC	---	---	79	57.9	100	6/18	35	0	17.1
WB9879CLP	---	---	76	59.1	97	6/23	38	0	15.3
Average	112	126	96	60.0	99	6/19	33	1	14.5
LSD ($\alpha=0.05$)	7.9	10.9	10.1	1.1	1.7	1.5	2	9	
CV %	5.0	6.2	7.5	1.3	1.2	0.6	4	817	
Pr > F	<.0001	<.0001	<0.0001	<0.0001	0.0068	<.0001	<.0001	<.0001	

All varieties are Hard Red unless annotated.

(W) = Hard White

(D) = Durum

Table 36. Agronomic Data for Hard Spring Wheat, Idaho Falls, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	(in.)	(%)	(%)
Dayn (W)	147	140	139	62.4	32	3	13.0
IDO1702S	---	---	133	62.5	31	0	10.6
SY Coho	136	119	126	60.5	34	5	13.5
AP Venom	---	---	125	59.9	32	0	12.6
Alum	110	130	125	63.2	35	28	14.1
AP Renegade	---	---	124	62.0	34	0	12.2
SY-Teton (W)	130	122	123	61.3	30	0	12.7
12SB0224 (W)	145	139	123	59.9	31	13	12.5
SY Gunsight	125	114	122	61.9	29	0	13.2
CPX36619	---	---	121	62.7	28	0	13.2
AP Octane	---	---	121	60.3	28	0	12.4
WB9590	---	114	119	63.0	29	10	15.3
WB9411	135	118	119	62.5	28	0	13.4
Alzada (D)	129	121	119	61.7	30	27	13.2
Cabernet	133	118	117	62.7	28	0	12.7
Jefferson	122	128	116	62.0	34	25	13.8
Net CL+	---	---	116	62.2	34	19	14.0
Klasic (W) 1.2	---	131	116	63.2	24	0	13.5
WB7589 (W)	120	116	115	61.7	24	0	13.0
IDO1603S	118	120	115	62.2	31	0	14.0
WB9879CLP	---	---	114	62.5	34	23	14.4
UI Platinum (W)	117	120	114	63.1	28	0	13.2
WB7328 (W)	119	126	112	62.8	26	0	14.6
WB7202CLP (W)	---	118	112	62.5	27	0	12.7
Klasic (W) 1.4	---	130	112	62.9	24	0	13.4
WB9668	119	110	112	63.0	27	0	14.9
WB7696 (W)	---	---	109	61.5	28	0	13.1
Klasic (W)	129	132	107	63.0	24	0	13.9
Glee	---	123	105	62.3	31	5	13.8
IDO1701S	---	107	100	63.0	31	25	14.0
IDO1805S	---	---	97	60.6	32	36	13.4
Imperial (D)	110	85	94	59.1	32	0	16.3
Average	126	119	116	61.9	30	7	13.5
LSD ($\alpha=.05$)	15.9	15.3	9.4	1.0	1	19	
CV %	9.0	9.1	5.8	1.1	3	209	
Pr > F	<.0001	<.0001	<0.0001	<.0001	<.0001	0.0003	

All varieties are Hard Red unless annotated.

(W) = Hard White

(D) = Durum

Table 37. Agronomic Data for Hard Spring Wheat at Ashton, Irrigated, 2019.

Variety	Yield (bu/A)	Test Wt.	Spring	Heading	Height (in.)	Lodging (%)	Protein (%)		
	2017	2018	2019	(lb/bu)	Stand (%)	Date			
12SB0224 (W)	113	124	85	56.8	100	7/11	31	0	14.6
SY-Teton (W)	100	110	83	58.8	100	7/4	32	3	14.6
UI Platinum (W)	92	85	82	60.4	100	7/3	29	0	14.4
SY Gunsight	87	105	82	58.5	100	7/5	31	0	15.4
WB9668	78	92	81	59.6	100	7/4	29	0	16.4
Alzada (D)	59	75	80	58.7	100	7/5	30	0	14.7
WB9879CLP	---	---	80	60.1	100	7/7	36	0	16.1
SY Coho	90	114	80	56.5	100	7/9	34	13	15.6
Dayn (W)	106	118	79	59.7	100	7/4	34	0	14.5
WB9590	---	110	79	58.9	100	7/4	30	13	16.5
Klasic (W) 1.2	---	100	78	60.6	100	7/3	24	0	14.9
AP Renegade	---	---	78	59.0	100	7/6	35	2	15.1
Jefferson	76	100	76	59.1	100	7/7	33	32	16.0
Klasic (W) 1.4	---	113	74	57.8	100	7/2	26	0	15.8
IDO1702S	---	---	73	59.9	100	7/4	32	0	13.1
WB7696 (W)	---	---	73	59.9	100	7/4	29	0	15.4
Alum	108	112	73	58.5	100	7/8	37	25	16.5
WB9411	94	100	71	59.8	100	7/4	29	0	16.1
CPX36619	---	---	71	59.4	100	7/5	29	0	15.0
Glee	---	95	71	59.3	100	7/3	33	25	15.5
Klasic (W)	77	104	71	59.4	100	7/2	25	0	15.7
WB7202CLP (W)	93	94	69	59.9	100	7/4	27	1	15.0
Cabernet	90	95	68	57.8	100	7/7	29	0	15.2
IDO1603S	71	72	67	60.1	100	7/5	30	2	14.9
Net CL+	---	---	67	59.7	100	7/9	35	28	16.5
WB7589 (W)	83	93	67	59.7	100	7/4	26	0	15.0
Imperial (D)	53	75	66	58.2	100	7/6	29	0	16.9
IDO1805S	---	---	64	57.8	100	7/7	32	29	16.1
WB7328 (W)	57	72	64	59.9	100	7/5	26	0	16.1
IDO1701S	---	88	58	60.0	100	7/5	30	27	16.1
Average	83	100	74	59.1	100	7/5	30	7	15.5
LSD ($\alpha=.05$)	10.5	20.6	17.0	2.2	0.0	1.5	2.5	25	
CV %	9.0	14.7	14.2	2.6	.	0.49	5.1	226	
Pr > F	<.0001	<.0001	0.203	0.0309	.	<.0001	<.0001	0.0495	

All varieties are Hard Red unless annotated.

(W) = Hard White

(D) = Durum

Table 38. Agronomic Data for Hard Spring Wheat at Soda Springs, Dryland, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
Dagmar	---	---	80	61.5	100	7/12	32	0	15.5
SY-Teton (W)	---	52	78	59.9	100	7/11	32	0	12.8
Dayn (W)	33	60	76	60.9	99	7/10	34	0	12.7
Jefferson	28	48	76	61.5	100	7/13	32	0	14.0
WB7202CLP (W)	29	49	74	62.3	100	7/10	29	0	12.6
Net CL+	---	---	73	61.4	100	7/18	31	0	15.1
DuClair	---	56	72	60.0	100	7/10	31	0	14.2
SY Selway	31	44	71	60.1	100	7/13	33	0	14.3
WB7589 (W)	24	48	71	61.4	100	7/12	26	0	13.7
IDO1702S	---	---	70	61.7	100	7/9	30	0	11.5
WB9411	31	52	70	61.3	100	7/11	29	0	15.1
IDO1805S	---	---	69	61.0	100	7/12	29	0	14.7
IDO1603S	24	42	68	61.3	99	7/11	29	0	15.6
MT 1865	---	---	68	58.4	99	7/14	32	0	14.4
UI Platinum (W)	28	46	68	62.3	100	7/9	29	0	13.2
WB7696 (W)	---	---	67	61.5	100	7/12	29	0	14.1
CPX36619	---	---	66	62.5	100	7/11	30	0	14.0
Glee	---	52	66	61.2	100	7/14	32	0	13.0
Alum	32	49	64	62.2	98	7/15	32	0	14.0
WB9590	---	43	64	60.0	100	7/11	26	0	15.2
WB9879CLP	---	---	63	60.4	100	7/14	28	0	14.2
WB9668	26	43	63	61.9	100	7/11	28	0	15.4
IDO1701S	---	41	63	61.9	100	7/12	32	0	15.3
WB7328 (W)	23	41	62	61.4	100	7/10	23	0	13.8
MT1673	---	47	62	59.6	100	7/12	31	0	15.4
Choteau	---	41	61	60.7	100	7/13	28	0	15.0
BZ902-413W	---	---	59	62.2	100	7/11	32	0	15.4
Klasic (W)	24	40	58	62.0	100	7/9	23	0	13.9
Klasic (W) 1.4	---	42	56	62.9	100	7/10	23	0	13.7
Klasic (W) 1.2	---	44	55	62.0	100	7/10	23	0	13.6
Average	28	46	67	61.2	100	7/12	29	0	14.2
LSD ($\alpha=.05$)	6.3	8.2	10.1	1.1	1.4	2.1	2	0	
CV %	16.0	12.4	10.5	1.1	1.0	0.80	4	.	
Pr > F	0.0027	<.0001	< 0.0001	<.0001	0.5273	< 0.0001	< 0.0001	.	

All varieties are Hard Red unless annotated.

(W) = Hard White

Table 39. Hard Spring Wheat Yield Percentage of Location Averages, 2019.

Variety	(100% = Average)				Soda Springs	Variety
	Aberdeen	Ashton	Idaho Falls	Rupert	Average	
Dagmar	---	---	---	---	119	119
Dayn (W)	118	107	121	110	113	114
SY-Teton (W)	117	112	107	115	117	114
IDO1702S	124	99	116	109	104	111
SY Gunsight	108	111	106	105	---	107
DuClair	---	---	---	---	107	107
UI Platinum (W)	111	111	99	110	101	106
12SB0224 (W)	108	115	107	95	---	106
SY Selway	---	---	---	---	106	106
AP Octane	108	---	105	104	---	106
AP Renegade	110	105	108	100	---	106
AP Venom	107	---	108	101	---	105
SY Coho	95	108	109	104	---	104
WB7202CLP (W)	116	93	97	98	110	103
CPX36619	107	96	105	105	99	102
MT 1865	---	---	---	---	101	101
Cabernet	109	92	102	100	---	101
WB9668	105	110	97	98	94	101
WB9411	97	96	103	102	104	101
Alzada (D)	84	109	103	106	---	100
WB7589 (W)	109	91	100	94	106	100
IDO1603S	108	91	100	100	101	100
Jefferson	86	103	101	95	113	100
WB7696 (W)	98	99	94	106	100	99
Net CL+	93	91	101	94	109	98
WB9590	86	107	104	96	95	98
Alum	86	98	108	93	96	96
Klasic (W) 1.4	90	100	97	109	83	96
Glee	97	96	91	98	98	96
WB9879CLP	79	109	99	98	94	96
Klasic (W) 1.2	86	105	100	103	81	95
IDO1805S	106	86	84	96	102	95
WB7328 (W)	101	86	98	94	93	94
MT1673	---	---	---	---	93	93
IDO1701S	107	78	87	94	93	92
Klasic (W)	82	95	93	102	87	92
Choteau	---	---	---	---	91	91
BZ902-413W	---	---	---	---	88	88
Imperial (D)	90	89	81	83	---	86
Imperial QC	82		82	86	---	83
Location Average	100	100	100	100	100	100

2019 Hard Spring Wheat Yield Percentage Across All Locations (Average = 100%)

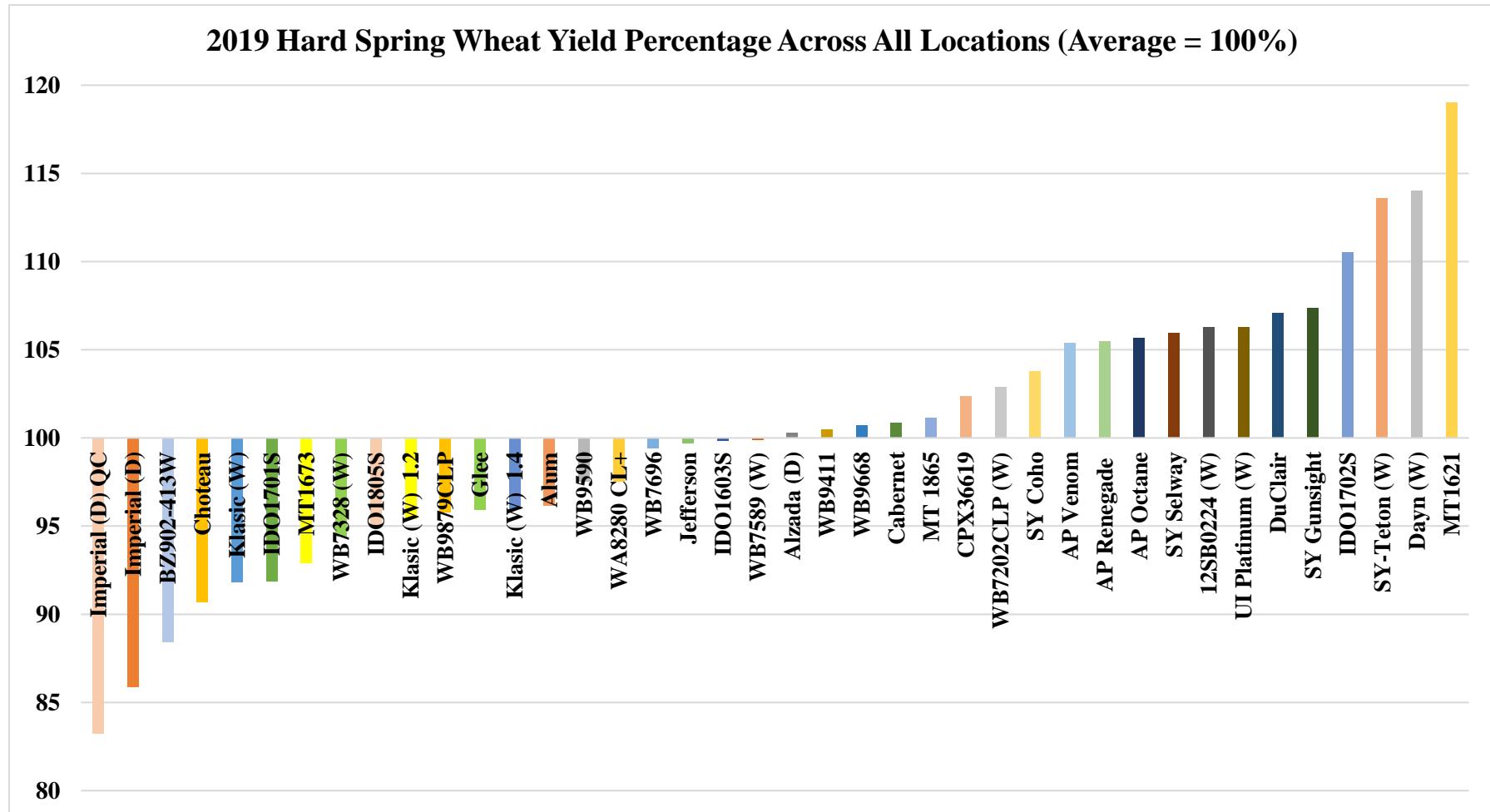


Chart 6. Hard Spring Wheat Yield Percentage Across All Locations.

(D) = Durum

(W) = White

Table 40. Soft White Spring Wheat Irrigated Nurseries, 3 Year Averages (2017 - 2019; 12 site-years*)

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
WB6430	124	61.2	100	6/19	32	0	10.6
Melba**	122	61.4	100	6/26	35	5	10.7
Tekoa	121	61.7	100	6/24	36	3	10.9
Alturas	121	61.2	100	6/22	36	0	10.8
Seahawk	121	61.8	100	6/25	36	5	11.2
UI Cookie	120	60.6	99	6/20	36	0	11.5
SY Saltese	120	61.9	100	6/18	36	4	11.3
UI Stone	119	61.3	100	6/19	35	2	10.7
WB6121	112	62.1	99	6/19	32	0	11.8
UI Pettit	112	60.8	100	6/17	34	2	10.9
Louise	109	60.6	100	6/23	38	16	11.4
Average	118	61.3	100	6/21	35	4	11.1
LSD ($\alpha = .05$)	9.1	0.6	0.8	3.5	1	5	0.5
CV%	19.0	2.4	1.8	4.8	10	370	5.5
Pr>F	0.0162	<.0001	0.2463	<.0001	<.0001	<.0001	<.0001

* Spring stand and heading date are with 11 site-years

** indicates club variety

Table 41. Soft White Spring Wheat Dryland Nurseries, 3 Year Averages (2017 - 2019; 3 site-years)

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Louise	58	60.3	93	7/10	30	0	10.4
UI Pettit	56	60.8	95	7/5	26	0	10.6
UI Stone	56	60.2	94	7/7	27	0	10.1
Alturas	54	59.8	94	7/9	26	0	9.6
WB6121	54	60.4	95	7/6	25	0	10.8
SY Saltese	53	61.2	93	7/6	30	0	10.1
UI Cookie	49	59.5	93	7/6	28	0	11.1
WB6430	48	60.4	94	7/6	24	0	10.2
Average	54	60.3	94	7/7	27	0	10.4
LSD ($\alpha = .05$)	15.2	1.3	4.8	3.6	4	0.0	0.7
CV%	32.6	2.6	6.3	2.3	16	.	3.8
Pr>F	0.9039	0.2202	0.9705	0.1414	0.0017	.	0.0076

Table 42. Irrigated Soft White Spring Wheat Data Combined from Rupert, Idaho Falls, Ashton, and Aberdeen, 2019.

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand** (%)	Heading Date**	Height (in.)	Lodging (%)	Protein (%)
WB6121	117	60.8	100	6/22	34	1	11.8
WA 8303	115	61.8	100	6/19	34	0	11.1
Melba*	115	61.1	100	6/29	37	5	10.7
UI Cookie	112	60.3	100	6/23	38	0	11.1
SY Saltese	110	61.4	100	6/21	38	11	11.5
IDO1401S	109	60.8	100	6/22	36	1	10.9
Tekoa	108	61.6	100	6/27	37	7	11.4
WA 8297 CL+	108	60.2	100	6/24	34	4	12.1
Alturas	108	60.4	100	6/26	38	2	10.7
WB6121	108	62.1	100	6/22	34	1	11.8
UI Stone	107	61.0	100	6/22	37	4	10.5
Seahawk	107	61.1	100	6/28	38	13	11.2
UI Pettit	104	59.9	100	6/21	37	4	11.2
Ryan	101	60.5	100	6/21	35	12	10.8
Louise	97	59.8	100	6/26	39	24	11.4
WB-1035CL+	96	61.0	100	6/22	36	1	12.2
Average	108	60.8	100	6/24	37	5	11.1
LSD ($\alpha = .05$)	18.8	0.9	0.3	8.3	2	11	0.7
CV%	24.4	2.2	0.4	5.9	9	285	4.3
Pr > F	0.688	<.0001	0.5524	0.3602	<.0001	0.0004	<.0001

* Indicates club variety

** No data included from Idaho Falls

Table 43. Agronomic Data for Soft White Spring Wheat at Rupert, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
WB6430	114	126	150	61.8	100	6/12	37	0	10.3
IDO1401S	---	137	150	62.3	100	6/11	41	0	10.9
Tekoa	130	125	150	62.0	100	6/16	45	0	10.5
UI Cookie	123	124	147	61.8	100	6/12	44	0	11.3
WA 8303	---	131	144	62.3	100	6/8	38	0	11.4
WB6121	108	117	143	62.5	100	6/12	37	0	12.1
Melba*	---	---	142	61.0	100	6/18	41	14	9.7
SY Saltese	117	122	142	62.0	100	6/11	42	8	11.0
UI Pettit	119	118	142	61.8	100	6/10	41	0	10.7
Alturas	124	115	142	62.1	100	6/14	43	0	10.6
Seahawk	118	137	141	61.5	100	6/16	44	11	11.3
Melba* QC	118	108	139	61.7	100	6/18	42	13	10.4
UI Stone	128	125	138	61.3	100	6/12	42	0	11.1
WB-1035CL+	---	101	135	61.9	100	6/12	41	3	12.7
WA 8297 CL+	---	130	128	60.8	100	6/14	38	0	11.7
Louise	109	124	127	61.3	100	6/15	44	30	10.6
Ryan	---	133	121	61.0	100	6/11	38	16	10.9
Average	119	123	140	61.7	100	6/13	41	5	11.0
LSD ($\alpha=.05$)	18.1	21.4	18.0	1.0	0.0	1.3	3	21	
CV %	10.7	12.3	8.8	1.2	.	0.56	5	276	
Pr > F	0.5068	0.2083	0.078	0.0495	.	<.0001	<.0001	0.191	

*= indicates club wheat

Table 44. Agronomic Data for Soft White Spring Wheat at Aberdeen, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
WA 8303	---	144	116	61.3	100	6/19	33	0	11.5
Seahawk	134	145	108	60.6	100	6/24	40	3	11.4
WB6121	104	131	107	61.8	100	6/26	38	0	12.7
UI Cookie	127	139	106	59.0	100	6/19	36	3	11.3
Melba* QC	133	143	104	60.4	100	6/22	38	0	11.3
Tekoa	133	137	104	61.0	100	6/27	39	3	12.4
WB6430	121	154	103	60.5	100	6/25	38	0	11.4
SY Saltese	128	141	102	60.9	100	6/18	36	0	12.3
Melba*	---	---	101	60.9	100	6/24	35	0	11.4
WA 8297 CL+	---	137	101	59.1	100	6/19	35	0	13.3
Ryan	---	145	100	60.4	100	6/27	38	0	11.1
IDO1401S	---	139	95	59.4	100	6/16	34	0	11.3
UI Stone	129	153	91	59.8	99	6/26	38	0	10.8
Louise	123	133	87	58.6	100	6/27	37	0	12.0
Alturas	126	132	80	57.6	100	6/19	36	0	11.2
Alturas QC	---	---	77	57.3	100	6/17	37	0	11.6
WB-1035CL+	---	122	76	59.3	100	6/19	36	0	12.2
UI Pettit	110	126	71	57.8	100	6/21	36	0	11.4
Average	124	138	96	59.7	100	6/22	37	0	11.7
LSD ($\alpha=.05$)	7.8	14.9	10.8	1.2	0.95	1.1	2	3	
CV %	4.5	7.6	7.9	1.4	0.67	0.44	4	460	
Pr > F	<.0001	0.0005	<.0001	<.0001	0.543	<.0001	<.0001	0.474	

*= indicates club wheat

Table 45. Agronomic Data for Soft White Spring Wheat, Idaho Falls, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	(in.)	(%)	(%)
WB6430	148	136	143	61.2	33	3	9.9
Melba*	134	136	133	62.5	36	8	10.0
Alturas	148	144	131	61.6	38	10	10.1
IDO1401S	---	141	130	61.1	37	0	10.2
UI Cookie	141	128	127	61.1	37	0	10.2
Alturas QC	---	---	125	61.5	38	5	9.8
UI Stone	140	137	125	61.5	35	15	9.7
WA 8303	---	133	121	61.9	33	0	10.2
WB6121	135	117	117	62.8	33	3	10.9
UI Pettit	139	131	117	60.3	37	18	10.8
WA 8297 CL+	---	137	117	60.8	33	15	11.0
Tekoa	139	129	114	62.1	37	28	10.7
SY Saltese	140	141	111	62.2	36	38	10.8
WB-1035CL+	---	115	109	61.8	35	0	11.2
Seahawk	139	127	108	61.0	37	39	11.0
Louise	121	119	102	60.3	37	63	11.2
Ryan	---	148	97	61.0	34	30	10.2
Average	138	132	120	61.5	36	16	10.4
LSD ($\alpha=.05$)	10.7	11.6	17.6	1.3	1	26	
CV %	5.5	6.1	10.3	1.4	2	117	
Pr > F	0.0008	<.0001	0.0001	0.0056	<.0001	0.0001	

*= indicates club wheat

Table 46. Agronomic Data for Soft White Spring Wheat at Ashton, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)
UI Stone	98	90	94	61.4	100	7/4	35	0	10.3
WA 8297 CL+	---	98	87	60.1	100	7/6	31	0	12.4
WB6430	105	102	84	59.8	100	7/4	31	0	10.8
Alturas QC	---	---	83	60.7	100	7/9	34	0	10.4
SY Saltese	108	99	83	60.6	100	7/5	36	0	11.8
Seahawk	110	103	81	61.2	100	7/10	34	0	11.3
WA 8303	---	108	81	61.6	100	7/4	31	0	11.2
UI Cookie	96	97	81	59.4	100	7/6	34	0	11.6
WB-1035CL+	---	93	80	61.1	100	7/4	31	0	12.4
Ryan	---	103	79	59.7	100	7/4	32	0	10.8
Tekoa	118	98	79	61.3	100	7/9	35	0	11.9
WB6121	100	90	77	61.2	100	7/4	33	0	11.3
IDO1401S	---	105	74	60.4	100	7/5	31	0	12.2
UI Pettit	92	88	74	59.6	100	7/4	34	0	12.1
Louise	98	93	72	59.1	100	7/8	35	0	12.0
Melba*	110	102	75	60.1	100	7/13	34	0	11.5
Alturas	113	115	71	60.1	100	7/9	34	0	10.8
Average	103	99	79	60.4	100	7/7	33	0	11.5
LSD ($\alpha=.05$)	7.4	19.7	14.9	1.5	0	1.4	3	0	
CV %	5.1	14.0	13.1	1.7	.	0.51	6	.	
Pr > F	0.0001	0.6321	0.194	0.0172	.	<.0001	0.0044	.	

*= indicates club wheat

Table 47. Agronomic Data for Soft White Spring Wheat at Soda Springs, Dryland, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height (in.)	Lodging (%)	Protein (%)
	2017	2018	2019	(lb/bu)	Stand (%)	Date			
WA 8303	---	56	91	62.0	100	7/11	30	0	11.1
AP Coachman	---	---	90	58.8	100	7/17	34	0	11.4
Tekoa	---	74	89	62.8	100	7/17	32	0	11.2
WA 8297 CL+	---	57	88	61.5	99	7/14	29	0	11.4
Seahawk	---	56	87	61.7	100	7/15	31	0	11.0
Melba*	---	66	86	60.3	99	7/18	30	0	10.9
SY Saltese	37	62	86	62.5	100	7/12	34	0	11.3
Ryan	---	50	85	60.8	100	7/13	32	0	11.0
WB6430	35	58	84	61.3	100	7/11	28	0	10.9
UI Cookie	35	53	83	60.0	99	7/13	32	0	12.5
UI Stone	33	60	83	61.8	100	7/12	31	0	10.6
IDO1401S	---	53	81	60.9	98	7/13	31	0	11.2
Alturas	35	61	80	60.4	100	7/16	31	0	10.4
Louise	38	58	79	61.0	98	7/16	34	0	11.3
WB6121	34	54	76	60.4	100	7/11	28	0	12.2
WB-1035CL+	---	51	75	60.4	100	7/13	30	0	13.3
UI Pettit	33	55	74	61.3	100	7/11	31	0	11.1
Average	34	58	83	61.0	99	7/14	31	0	11.3
LSD ($\alpha=.05$)	4.1	10.2	12.8	1.1	2.2	2.1	2	0	
CV %	8.4	12.5	10.1	1.3	1.5	0.7	5.6	.	
Pr > F	0	0	0	< 0.0001	0.1282	< 0.0001	< 0.0001	.	

*= indicates club wheat

Table 48. Soft White Spring Wheat Yield Percentage of Location Averages, 2019.

Variety	(100% = Average)				Soda	Variety
	Aberdeen	Ashton	Idaho Falls	Rupert	Springs	Average
AP Coachman	---	---	---	---	109	109
WB6430	108	107	119	107	102	108
WA 8303	120	103	101	103	110	107
UI Cookie	110	102	106	105	99	104
Tekoa	108	100	95	107	107	103
UI Stone	94	119	104	98	99	103
Seahawk	113	103	90	101	105	102
WA 8297 CL+	105	110	98	91	105	102
Melba*	107	94	111	101	95	102
SY Saltese	106	105	93	102	103	102
IDO1401S	99	93	108	107	97	101
WB6121	112	97	98	102	92	100
Ryan	104	100	80	86	102	95
Alturas	82	98	107	101	96	97
WB-1035CL+	79	102	91	96	90	92
UI Pettit	73	93	98	101	89	91
Louise	90	91	85	91	95	90
Location Average	100	100	100	100	100	100

* indicates club wheat

2019 Soft White Spring Yield Percentage Across All locations (Average = 100%)

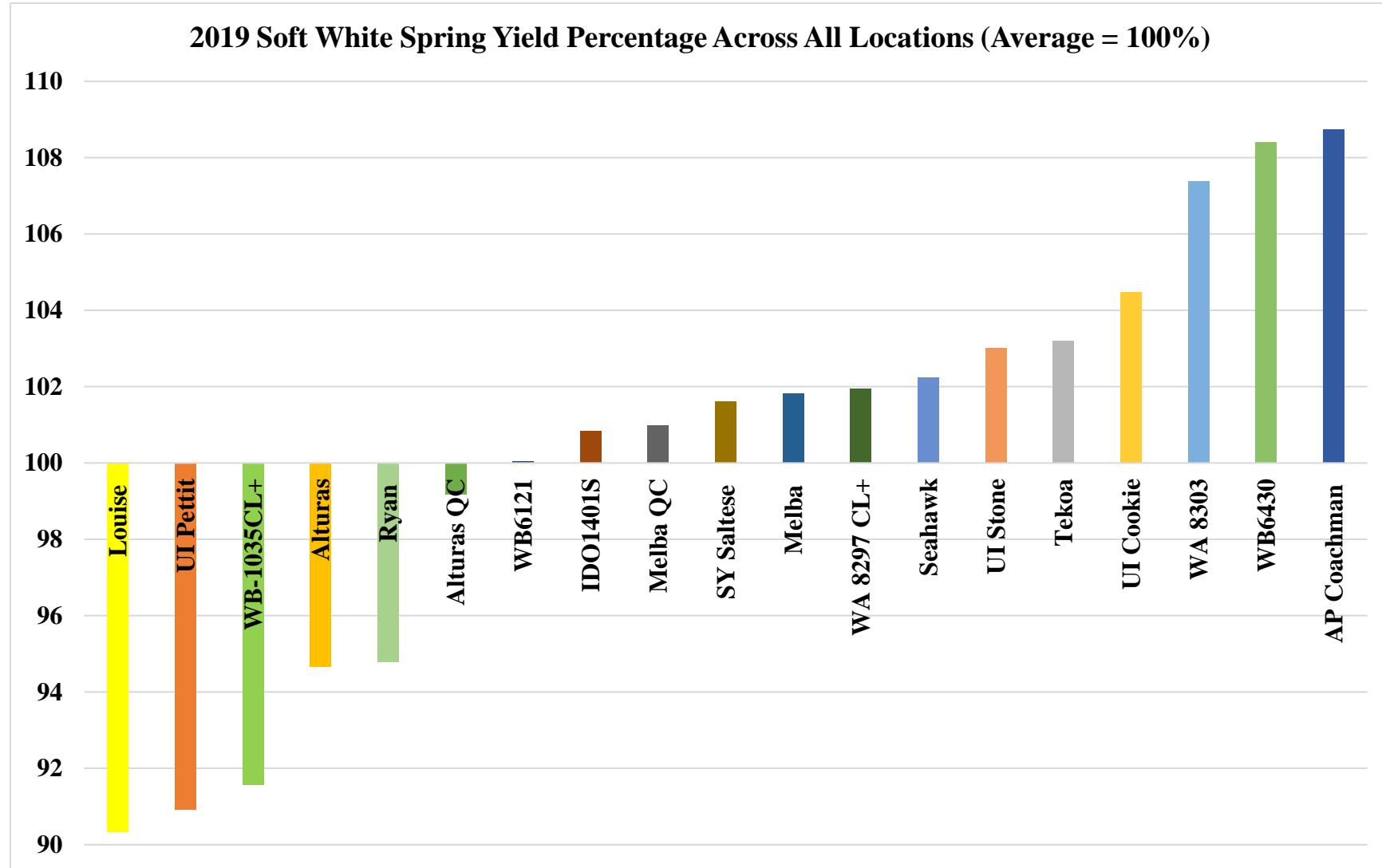


Chart 7. Soft White Spring Yield Percentage Across All Locations.

Table 49. Spring Malt Barley Irrigated Nurseries, 3 Year Averages (2017 - 2019; 12 site-years)

Variety	Yield	Test Wt.	Spring	Heading	Height	Lodging	Protein	Plump		
	(bu/A)	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
LCS Odyssey	136	50.0	100	6/26	29	21	11.4	88	7	5
LCS Genie	133	51.5	100	6/26	29	20	11.3	86	8	6
Explorer	131	51.1	99	6/24	28	16	11.4	87	8	6
Moravian 69	131	50.6	99	6/25	29	27	11.2	81	12	8
ABI Voyager	129	52.5	100	6/22	35	27	11.0	95	3	2
ABI Eagle	127	52.2	99	6/24	33	21	11.5	89	7	5
AAC Synergy	125	52.0	100	6/23	35	38	11.3	91	6	4
ABI Growler	124	51.2	100	6/25	33	16	11.3	88	7	6
Conrad	122	52.5	99	6/24	33	29	11.3	92	5	3
CDC Copeland	119	51.4	100	6/25	39	37	11.4	87	8	5
GemCraft	119	50.3	99	6/24	33	40	11.1	83	10	7
AC Metcalfe	117	52.1	99	6/23	36	30	11.6	88	7	6
Average	126	51.4	99	6/24	33	27	11.3	88	7	5
LSD ($\alpha = .05$)	9.3	1.0	0.8	4	1.9	13.3	0.3	6.5	3.6	3.1
CV%	17.6	4.6	2.0	5.2	13.7	116.0	2.9	8.9	59	73
Pr>F	0.0003	<.0001	0.8583	0.7793	<.0001	0.0004	0.0074	0.0037	0.0019	0.0230

Table 50. Irrigated Spring Malt Barley Data Combined from Rupert, Idaho Falls, Ashton, and Aberdeen, 2019.

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand* (%)	Heading Date*	Height (in.)	Lodging (%)	Protein (%)	>6/64	Plump >5.5/64)	% Thin
Fandaga	143	49.8	100	6/21	32	55	11.2	90	6	5
Bente	143	51.1	100	6/20	34	11	11.2	92	6	2
Moravian 179	141	52.1	100	6/16	32	26	11.1	93	4	4
Full Pint	135	51.0	99	6/20	33	25	11.0	87	9	5
Esma	131	49.7	100	6/26	31	1	11.0	84	11	5
10ARS191-3	131	52.3	100	6/24	36	35	11.0	83	10	7
LCS Odyssey	130	50.4	100	6/29	30	26	11.2	86	9	6
2IM14-8212	125	51.1	100	6/24	34	37	10.9	88	7	5
Moravian 69	122	49.6	100	6/22	32	64	11.0	78	13	9
LCS Genie	122	51.7	100	6/28	31	25	11.3	81	11	9
Sangria	121	50.9	100	6/28	32	0	11.2	90	7	4
Manta	120	51.1	98	6/28	35	0	11.6	87	8	5
Explorer	118	51.2	100	6/26	30	15	11.1	85	9	7
ABI Voyager	118	52.5	100	6/25	37	38	10.8	95	3	2
ABI Eagle	116	51.7	99	6/26	34	29	11.3	84	10	6
AD120341	114	51.3	100	6/26	27	33	11.2	67	17	17
Conrad	113	52.4	99	6/27	36	38	11.0	92	6	3
AAC Connect	113	52.3	100	6/26	37	42	11.5	90	6	4
ABI Growler	113	50.4	100	6/27	35	23	11.2	88	7	5
2IK14-8413	113	51.4	100	6/25	36	42	11.4	89	7	4
Idagold II	112	52.4	100	7/1	34	33	10.9	85	8	5
AC Metcalfe	111	52.1	100	6/26	40	23	11.3	87	9	5
AAC Synergy	110	51.9	100	6/26	37	41	11.0	91	6	5
DH120058	109	49.3	100	6/30	30	56	10.5	69	20	12
CDC Fraser	109	51.2	100	6/27	38	32	11.2	92	5	4
DH120285	108	49.9	100	6/28	29	37	11.0	82	12	7
GemCraft	107	50.0	100	6/27	35	49	11.0	83	11	7
CDC Bow	104	52.7	99	6/28	39	34	10.9	92	5	4
Merit 57	103	50.6	95	6/29	36	31	11.2	81	12	8
Fangio	102	49.6	92	6/30	31	21	11.3	84	8	6
CDC Copeland	102	50.1	100	6/28	40	49	11.3	82	11	8
Average	116	51.2	99	6/26	34	34	11.1	85	9	6
LSD ($\alpha = .05$)	19.6	1.6	1.5	9.9	4	29	0.5	13	7	7
CV%	19.3	3.5	1.6	5.8	13	98	2.4	9	43	64
Pr > F	<.0001	<.0001		<.0001	0.4241	<.0001	0.0017	0.0079	0.0006	<.0001
										0.0067

* No data included from Idaho Falls

Table 51. Agronomic Data for Two-row Spring Malt Barley at Rupert, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein	Plump		
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
Bente	---	---	179	52.4	100	6/13	34	5	11.1	96	3	1
Moravian 179	---	147	169	53.4	100	6/16	36	6	11.0	96	3	2
10ARS191-3	---	---	165	54.0	100	6/12	42	8	11.5	93	3	3
LCS Odyssey	159	156	164	50.6	99	6/15	36	9	11.5	91	7	3
Explorer	130	153	159	51.0	99	6/14	35	3	11.3	95	3	3
2IM14-8212	---	---	153	52.4	100	6/12	40	36	11.2	93	4	3
Fandaga	---	---	151	51.0	100	6/15	33	82	11.4	94	4	3
AAC Connect	---	160	150	53.4	100	6/14	44	41	11.3	94	3	2
Moravian 69	145	159	149	51.8	100	6/16	34	65	10.9	94	4	3
DH120058	---	141	148	52.1	100	6/18	33	46	10.7	93	5	3
LCS Genie	148	161	147	52.5	100	6/14	36	14	11.4	90	6	4
Full Pint	---	143	146	53.6	99	6/14	33	45	11.1	96	2	2
AAC Synergy	156	144	145	53.3	99	6/12	43	38	11.0	95	3	2
ABI Eagle	144	147	142	53.0	98	6/13	40	11	11.6	92	4	3
Fangio	---	---	141	50.5	96	6/18	38	4	11.2	93	4	3
ABI Voyager	140	151	140	53.0	100	6/12	42	40	10.7	94	3	2
ABI Growler	133	151	140	51.9	100	6/14	42	18	11.4	94	3	2
AD120341	---	146	139	52.8	100	6/14	31	24	11.0	90	7	4
DH120285	---	134	136	52.0	100	6/15	34	50	11.2	96	3	2
AC Metcalfe	134	129	135	53.6	100	6/11	42	35	11.4	96	3	2
GemCraft	144	149	135	51.5	99	6/15	40	43	11.0	93	4	3
CDC Fraser	---	157	134	52.7	100	6/14	43	23	11.4	97	2	2
2IK14-8413	---	---	132	52.5	100	6/14	41	30	11.4	92	4	4
Conrad	138	147	132	52.2	99	6/13	41	43	11.6	93	4	4
CDC Bow	---	137	123	53.2	99	6/13	43	25	10.9	94	3	3
CDC Copeland	139	138	123	50.8	100	6/14	47	56	11.8	84	8	8
Merit 57	---	130	115	50.8	92	6/16	44	19	11.4	85	8	7
Average	138	148	144	52.3	99	6/14	39	30	11.2	93	4	3
LSD ($\alpha=.05$)	21.4	17.7	19.2	1.6	1.5	1.1	3	45				
CV %	11.0	8.4	9.4	2.1	1.1	0.46	6	106				
Pr > F	0.0390	0.0004	<.0001	<.0001	<.0001	<.0001	<.0001	0.0586				

Table 52. Agronomic Data for Two-row Spring Malt Barley, Aberdeen, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein		Plump	
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
10ARS191-3	---	---	137	52.2	100	6/25	39	25	11.2	87	9	3
Fandaga	---	---	136	48.6	100	6/27	32	29	10.9	85	9	6
LCS Odyssey	157	136	132	50.2	100	6/29	34	0	11.0	91	6	3
Esma	---	174	131	49.7	100	6/26	31	1	11.0	84	11	5
Bente	---	---	130	49.7	100	6/26	33	16	11.2	87	9	4
AD120341	---	133	130	50.3	100	6/27	31	23	10.9	79	15	7
2IM14-8212	---	---	128	49.7	100	6/24	36	20	11.0	85	9	6
Full Pint	---	150	123	49.1	100	6/27	33	5	10.9	78	16	7
2IK14-8413	---	---	123	50.2	100	6/24	38	24	11.5	87	9	4
Sangria	---	170	121	50.9	100	6/28	32	0	11.2	90	7	4
Manta	---	168	120	51.1	98	6/28	35	0	11.6	87	8	5
Explorer	146	154	119	50.4	100	6/27	31	0	11.2	89	7	4
LCS Genie	148	155	117	50.7	100	6/30	33	0	11.5	81	13	7
ABI Voyager	129	134	114	51.5	100	6/25	43	28	11.1	94	4	2
Idagold II	---	---	114	52.2	100	6/26	38	24	11.4	90	7	4
DH120058	---	138	114	47.1	100	6/30	33	83	11.0	51	31	18
Conrad	150	118	113	51.9	100	6/26	37	36	11.0	92	6	3
Moravian 69	119	139	112	48.5	100	6/29	35	45	11.1	71	18	11
DH120285	---	140	112	47.6	100	6/29	31	23	10.9	77	15	7
ABI Eagle	131	118	108	50.4	100	6/26	38	35	11.5	80	13	7
CDC Fraser	---	139	104	50.7	100	6/28	39	14	11.3	94	4	2
AAC Synergy	129	131	103	51.7	100	6/27	39	30	10.8	93	4	2
ABI Growler	136	133	102	48.8	100	6/26	39	9	11.3	86	9	5
AC Metcalfe	104	122	101	50.8	99	6/26	42	23	11.3	84	11	5
CDC Bow	---	125	101	52.5	99	6/30	41	20	10.9	93	5	2
AAC Connect	---	136	100	51.5	100	6/25	40	9	11.6	91	6	3
Merit 57	---	117	98	49.9	99	6/29	40	16	11.3	79	13	8
CDC Copeland	123	126	97	48.8	100	6/29	43	68	11.8	80	13	8
GemCraft	136	129	91	49.0	100	6/27	39	39	11.2	79	15	6
Fangio	---	---	91	48.1	95	6/29	34	3	11.4	79	13	9
Average	132	138	114	50.1	100	6/27	36	22	11.2	84	10	6
LSD ($\alpha=0.05$)	17.4	22.2	14.9	1.5	1.2	0.6	3	34				
CV %	9.3	11.4	9	2.1	0.85	1.39	6	113				
Pr > F	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0003				

Table 53. Agronomic Data for Two-row Spring Malt Barley at Idaho Falls, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Height	Lodging	Protein		Plump	
	2017	2018	2019	(lb/bu)	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
LCS Odyssey	118	148	130	47.5	26	79	11.3	83	10	8
10ARS191-3	---	---	129	51.7	34	70	10.6	86	9	6
ABI Growler	119	127	128	50.7	31	63	11.1	91	6	5
2IM14-8212	---	---	126	51.7	31	69	10.5	94	4	4
ABI Voyager	159	153	126	53.1	32	60	10.7	98	2	2
ABI Eagle	149	146	117	51.2	29	60	11.2	86	9	6
Merit 57	---	117	116	50.0	32	78	11.2	80	13	9
Explorer	130	138	114	48.7	27	48	11.1	81	11	10
Moravian 179	---	153	112	50.8	28	46	11.2	91	6	5
2IK14-8413	---	---	108	51.3	34	85	11.2	92	6	3
DH120058	---	---	107	47.6	27	83	10.1	62	25	14
Idagold II	---	---	107	51.2	32	63	10.9	77	10	8
AAC Synergy	141	130	106	51.1	32	74	11.1	92	5	4
Moravian 69	127	123	105	47.2	28	81	11.1	69	19	14
Conrad	134	119	104	51.2	33	71	10.8	89	7	5
AAC Connect	---	---	103	51.7	32	79	11.6	90	6	5
CDC Fraser	---	138	103	49.6	33	83	11.3	85	9	7
CDC Bow	---	141	100	51.0	36	75	11.2	87	8	7
CDC Copeland	147	120	96	49.5	37	73	10.9	79	11	11
AD120341	---	---	96	45.6	23	83	11.7	47	22	33
LCS Genie	128	135	94	46.6	29	65	11.7	69	14	18
DH120285	---	---	92	46.8	26	76	11.0	73	16	12
GemCraft	113	125	82	49.7	31	89	11.1	82	10	9
Fangio	---	---	82	45.6	29	55	11.7	69	14	11
Average	134	136	108	49.6	30	71	11.1	81	10	9
LSD ($\alpha=.05$)	19.6	18.3	19.1	3.7	2	29				
CV %	10.4	9.5	11.5	5.2	6	29				
Pr > F	<.0001	<.0001	<.0001	0.0007	<.0001	0.2267				

Table 54. Agronomic Data for Two-row Spring Malt Barley at Ashton, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein	Plump		
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
Idagold II	---	---	115	53.8	99	7/7	32	13	10.5	88	8	5
LCS Genie	107	113	110	52.4	99	7/11	27	20	10.5	83	10	6
ABI Eagle	101	102	107	52.3	100	7/10	27	9	11.1	79	13	9
GemCraft	114	103	107	49.7	100	7/8	29	25	10.8	77	15	9
LCS Odyssey	106	118	105	50.9	100	7/12	27	18	11.1	80	13	8
Conrad	106	103	104	54.3	99	7/11	31	4	10.6	94	5	2
LCS Genie QC	---	---	103	53.4	100	7/12	28	18	11.0	89	8	3
ABI Voyager	121	101	102	52.6	100	7/7	32	23	10.6	94	4	3
AAC Connect	---	91	99	52.5	99	7/10	32	40	11.3	84	10	7
10ARS191-3	---	---	99	51.5	100	7/6	32	38	10.6	66	18	16
CDC Copeland	125	99	97	51.4	100	7/12	38	0	10.6	84	12	6
Merit 57	---	88	96	51.8	99	7/13	30	11	10.8	79	13	9
Fangio	---	---	93	52.5	99	7/13	26	21	10.9	95	3	2
DH120285	---	---	93	50.9	100	7/9	25	0	10.8	81	12	8
CDC Bow	---	75	92	54.2	100	7/13	36	16	10.7	95	5	2
AC Metcalfe	102	86	91	51.9	100	7/9	35	12	11.3	80	13	8
ABI Growler	101	113	91	50.3	100	7/11	27	3	11.0	83	11	8
2IK14-8413	---	---	88	51.7	100	7/6	31	30	11.5	84	8	5
CDC Fraser	---	95	87	51.9	100	7/10	35	9	11.0	91	7	3
2IM14-8212	---	---	85	50.8	100	7/6	30	21	10.8	81	10	7
AD120341	---	---	84	51.7	100	7/7	25	4	10.9	51	25	25
Explorer	103	98	83	50.8	100	7/6	28	11	10.8	74	16	11
DH120058	---	---	80	50.4	100	7/14	27	13	10.4	70	19	12
AAC Synergy	108	89	77	51.8	100	7/10	33	21	11.2	82	10	9
Average	107	101	96	51.9	99	7/10	30	16	10.9	82	11	8
LSD ($\alpha=0.05$)	21.7	15.4	15.1	2.0	2.30	1.1	3	28				
CV %	14.4	10.8	10.4	2.7	1.7	0.42	6	126				
Pr > F	<.0001	<.0001	<.0001	0.0003	<.0001	<.0001	<.0001	0.2928				

Table 55. Agronomic Data for Two-row Spring Malt Barley at Soda Springs, Dryland, 2019.

Variety	Yield (bu/A)		Test Wt.	Spring	Heading	Height	Lodging	Protein	Plump		
	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
10ARS191-3	---	125	52.0	100	7/14	31	0	11.0	96	2	1
Sangria	---	119	52.2	100	7/15	33	0	11.2	97	1	0
GemCraft	63	117	51.1	100	7/14	30	0	10.6	98	1	1
Esma	---	117	51.7	100	7/14	32	0	11.1	98	1	1
ABI Growler	55	115	50.5	100	7/14	30	0	10.8	98	1	1
ABI Eagle	68	114	51.6	99	7/15	30	0	11.6	97	2	1
LCS Genie	---	114	51.8	100	7/19	30	0	11.4	98	1	1
CDC Copeland	---	113	51.5	100	7/15	28	0	10.9	97	2	1
AAC Connect	61	110	52.0	100	7/13	30	0	11.3	97	2	1
2IM14-8212	---	109	50.1	100	7/12	34	0	11.0	98	1	1
LCS Odyssey	---	108	51.2	100	7/17	32	0	11.3	98	1	1
Merit 57	59	107	51.2	99	7/14	29	0	11.6	95	2	1
Fangio	---	106	51.4	98	7/17	32	0	11.5	98	1	1
AAC Synergy	---	101	51.5	100	7/13	30	0	11.1	98	2	1
ABI Voyager	73	101	50.9	100	7/12	30	0	11.4	99	1	0
AC Metcalfe	---	100	52.2	100	7/12	27	0	11.2	99	1	1
Manta	---	99	52.1	100	7/15	33	0	11.5	96	1	1
2IK14-8413	---	98	50.9	100	7/14	32	0	11.0	98	1	1
Conrad	---	95	51.2	100	7/15	30	0	10.9	98	1	1
Full Pint	---	93	52.9	100	7/15	30	0	11.1	99	1	0
Average		108	51.5	100	7/14	31	0	11.2	98	1	1
LSD ($\alpha=0.05$)		13	0.7	2	1.3	1	0				
CV		8	0.9	1	0.46	2	.				
P>F		0.0002	< 0.0001	0.1035	< 0.0001	< 0.0001	.				

1-rep demonstration plots

Moravian 69	52	122	51	100	7/18	29	0	---	---	---	---
Bente	---	106	52	100	7/12	31	0	---	---	---	---
AD120341	66	104	52	100	7/13	29	0	---	---	---	---
CDC Fraser	74	98	51	100	7/14	27	0	---	---	---	---
Moravian 179	46	89	51	100	7/17	34	0	---	---	---	---
CDC Bow	59	89	52	100	7/15	32	0	---	---	---	---
Explorer	66	80	52	100	7/13	26	0	---	---	---	---
Fandaga	---	76	51	95	7/15	27	0	---	---	---	---
DH120058	---	73	51	100	7/17	36	0	---	---	---	---
DH120285	---	57	45	100	7/16	27	0	---	---	---	---
Average	60	89	51	100	7/15	30	0				

Table 56. Two-Row Spring Malt Barley Yield Percentage of Location Averages, 2019.

Variety	(100% = Average)					Soda Springs	Variety Average
	Aberdeen	Rupert	Idaho Falls	Ashton			
Bente	114	124	---	---	---	---	119
10ARS191-3	120	115	121	104	116	115	
LCS Odyssey	116	114	121	111	100	112	
Fandaga	119	105	---	---	---	---	112
Esma	115	---	---	---	108	112	
Moravian 179	---	118	105	---	---	---	111
Sangria	106	---	---	---	110	108	
Idagold II	100	---	100	121	---	107	
2IM14-8212	112	106	118	90	101	105	
ABI Eagle	94	99	109	112	106	104	
ABI Voyager	100	97	118	108	94	103	
LCS Genie	103	102	87	116	105	103	
Explorer	104	110	106	87	---	102	
ABI Growler	89	97	119	95	106	101	
Moravian 69	98	103	98	---	---	100	
AD120341	114	97	---	88	---	100	
AAC Connect	88	104	96	104	102	99	
Full Pint	108	101	---	---	86	99	
Manta	105	---	---	---	92	98	
Conrad	99	91	97	110	88	97	
2IK14-8413	107	92	101	92	91	97	
DH120058	100	103	100	84	---	97	
Merit 57	86	80	108	101	99	95	
GemCraft	80	93	77	112	108	94	
DH120285	98	94	86	97	---	94	
CDC Copeland	85	85	90	102	105	93	
AAC Synergy	90	101	99	81	94	93	
CDC Fraser	91	93	96	92	---	93	
AC Metcalfe	88	94	89	96	93	92	
CDC Bow	88	85	93	97	---	91	
Fangio	79	98	76	98	99	90	
Location Average	100	100	100	100	100	100	

2019 2-Row Spring Barley Malt Yield Percentage Across All locations (Average = 100%)

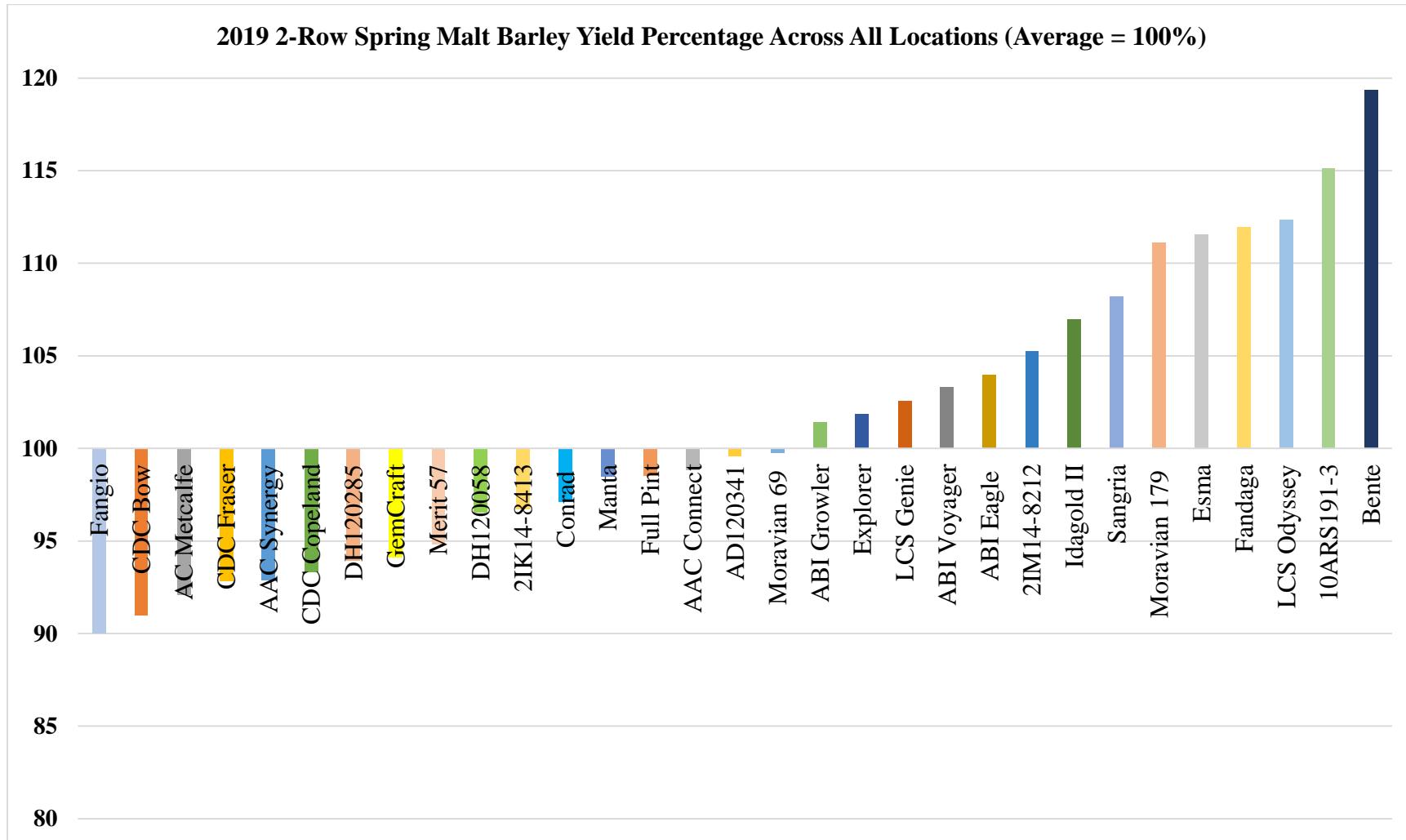


Chart 8. 2-Row Spring Barley Malt Yield Percentage Across All Locations.

Table 57. Two-Row Spring Feed Barley Irrigated Nurseries, 3-Year Averages (2017-2019; 12 site-years)

Variety	Yield (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	> 6/64	Plump (5.5/64)	% Thin
Millennium (SB6)	143	49.5	100	6/16	37	6	11.6	74	17	10
Altorado	140	53.3	100	6/22	34	21	10.8	87	8	5
Oreana	140	52.3	100	6/25	31	25	11.3	82	11	8
Claymore	135	51.4	100	6/24	36	30	10.8	83	10	7
Champion	129	53.5	100	6/21	35	29	11.3	88	7	5
Xena	129	52.5	100	6/22	35	26	11.1	86	8	6
UTSB10905-72 (SB6)	128	50.2	100	6/18	37	11	11.0	90	7	3
Lenetah	124	52.6	99	6/19	37	35	11.2	88	7	6
Idagold II	121	52.4	99	6/23	33	21	11.1	83	11	6
Julie*	117	55.5	99	6/25	35	15	12.3	86	9	6
Kardia	113	49.8	100	6/26	36	44	11.4	75	14	12
Transit*	106	54.9	99	6/24	36	22	11.9	85	10	6
Goldenhart*	94	58.9	98	6/24	34	32	14.8	86	9	6
Average	124	52.9	99	6/22	35	25	11.6	84	10	7
LSD ($\alpha = .05$)	9.4	0.9	0.8	4.8	2	13	0.6	5	3	3
CV%	18.8	4.2	2.0	6.6	14	122	6.1	7	39	47
Pr > F	<.00001	<.00001	<.00001	0.0002	<.00001	<.00001	<.00001	<.00001	<.00001	<.00001

*indicates hulless variety

(SB6) = 6-row barley

Table 58. Irrigated Two-Row Spring Feed Barley Data Combined from Rupert, Idaho Falls, Ashton, and Aberdeen, 2019.

Variety	Yield	Test	Spring	Heading	Height	Lodging	Protein	Plumps		
	(bu/A)	(lb/bu)	Stand (%)	Date	(in)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
Oreana	129	52.1	100	6/27	32.3	48	8.4	77	13	10
Altorado	127	52.5	100	6/23	35.6	37	7.9	80	11	8
BZ512-319	120	50.5	100	6/22	35.3	52	8.2	73	14	12
Champion	117	52.7	100	6/22	36.6	50	8.4	80	10	9
Millennium (SB6)	117	49.3	100	6/18	40.6	10	8.0	64	22	15
Claymore	116	50.4	100	6/25	37.8	54	7.9	77	13	10
Xena	116	52.2	100	6/24	37.9	40	7.9	84	10	7
UT11302-11 (SB6)	112	48.6	100	6/20	35.9	35	7.8	78	14	9
Idagold II	111	51.9	100	6/24	35.8	44	7.9	80	12	8
Julie*	109	53.7	100	6/26	36.1	27	10.1	82	11	8
Lenetah	108	52.5	100	6/25	39.0	52	8.2	88	7	5
Transit*	104	52.7	100	6/25	37.4	42	8.6	83	10	7
UTSB10905-72 (SB6)	101	48.9	100	6/21	39.1	24	8.1	85	10	6
Kardia	96	49.2	100	6/29	37.9	60	8.6	68	19	15
Goldenhart*	82	57.2	99	6/27	36.1	51	14.4	79	12	9
Average	111	51.6	100	6/24	36.9	42	8.7	78	13	9
LSD ($\alpha = .05$)	15.5	1.2	0.4	9.4	3.2	22	0.6	9	4	5
CV%	20.1	3.3	0.5	6.6	12.7	75	5.1	8	24	39
Pr > F	<.00001	<.00001	0.0142	0.6801	0.0005	0.0004	<.00001	<.00001	0.0105	0.0105

*indicates hulless variety

(SB6) = 6-row barley

Table 59. Agronomic Data for Spring Feed and Food Barley at Rupert, Irrigated, 2019

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein	Plump		
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
2-Row Spring Feed Barley												
Millennium (SB6)	145	172	163	50.9	100	6/4	43	1	11.1	82	12	6
Oreana	151	170	155	53.6	100	6/15	37	45	11.5	88	7	6
Altorado	142	142	146	53.9	100	6/11	41	25	11.1	90	6	6
Xena	146	150	143	54.0	100	6/12	43	29	11.2	92	5	4
BZ512-319	---	---	142	51.5	100	6/9	38	76	11.4	82	10	9
Champion	123	139	142	53.7	100	6/10	41	56	11.1	91	4	6
Claymore	153	163	134	52.0	100	6/13	42	64	11.2	86	8	7
Lenetah	133	137	130	54.2	100	6/11	46	69	11.3	93	4	4
UTSB10905-72 (SB6)	149	152	126	48.7	100	6/7	44	41	11.3	88	7	6
Idagold II	135	131	126	52.7	100	6/12	40	73	11.5	93	4	4
UT11302-11 (SB6)	---	145	125	50.0	100	6/6	41	48	10.7	---	---	---
Feed Average	142	151	139	52.3	100	6/10	41	48	11.2	89	7	6
2-Row Spring Food Barley												
Julie*	115	132	137	54.4	100	6/12	42	28	10.8	86	8	7
Transit*	97	128	128	53.4	100	6/13	42	65	15.0	88	7	7
Kardia	123	129	116	49.3	100	6/15	44	76	9.0	72	17	12
Goldenhart*	104	112	108	58.0	100	6/13	40	68	9.3	88	7	6
Food Average	110	125	122	53.8	100	6/13	42	59	11.0	83	10	8
LSD ($\alpha=.05$)	20.1	18.6	21.4	1.7	0.0	1.4	3	39				
CV %	11.0	9.0	11.1	2.3	.	0.59	4	54				
Pr > F	<.0001	<.0001	0.0004	<.0001	.	<.0001	<.0001	0.0064				

*indicates hullless variety

(SB6) = Six-row barley

Table 60. Agronomic Data for Spring Feed and Food Barley, Aberdeen, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein	Plump		
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
2-Row Spring Feed Barley												
UT11302-11 (SB6)	---	152	129	48.4	100	6/19	39	6	11.2	75	16	10
Champion	150	157	129	53.1	100	6/21	40	13	11.3	85	7	3
Altorado	151	174	128	53.0	100	6/23	39	0	11.0	85	7	3
Oreana	156	155	123	51.9	100	6/29	35	35	11.3	82	13	6
Xena	159	144	121	52.8	100	6/24	42	33	10.9	92	6	4
BZ512-319	---	---	120	51.1	100	6/20	38	24	11.1	83	9	4
Lenetah	150	138	117	52.7	100	6/25	42	35	11.2	89	8	4
Claymore	163	140	116	50.4	100	6/25	41	49	10.5	76	15	8
Idagold II	152	116	110	52.1	100	6/25	39	8	11.0	84	10	7
Millennium (SB6)	170	158	102	49.0	100	6/14	44	0	11.4	64	24	13
UTSB10905-72 (SB6)	166	141	98	49.1	100	6/20	42	8	11.1	85	11	5
Feed Average	157	147	118	51.2	100	6/22	40	19	11.1	82	11	6
2-Row Spring Food Barley												
Transit*	103	131	108	54.1	100	6/24	41	24	8.5	91	8	2
Julie*	128	140	97	54.0	100	6/26	39	6	9.9	86	10	5
Kardia	123	124	87	47.8	100	7/1	42	55	11.3	56	24	22
Goldenhart*	118	77	71	57.3	100	6/27	40	49	15.1	85	9	5
Food Average	118	118	91	53.3	100	6/27	41	33	11.2	79	13	8
LSD	14	22	16	1.6	1	1.5	2	30				
CV	7.5	11.0	10.1	2.1	0.51	0.6	4	93				
P>F	<.0001	<.0001	<.0001	<.0001	0.659	<.0001	<.0001	0.002				

*indicates hulless variety

(SB6) = Six-row barley

Table 61. Agronomic Data for Spring Feed and Food Barley at Idaho Falls, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Height	Lodging	Protein		Plump	
	2017	2018	2019	(lb/bu)	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
2-Row Spring Feed Barley										
Altorado	147	157	146	52.2	33	64	10.2	83	9	7
Oreana	157	145	137	52.4	28	61	11.1	83	11	8
Millennium (SB6)	176	143	120	49.1	42	38	10.7	67	20	13
UT11302-11 (SB6)	---	134	120	47.3	34	81	11.0	74	16	11
BZ512-319	---	---	116	50.3	32	74	11.0	71	15	12
Idagold II	132	132	116	51.8	33	69	10.5	87	9	5
Claymore	169	126	116	50.5	34	74	10.5	82	11	6
Champion	138	137	105	51.9	33	66	11.2	76	12	11
UTSB10905-72 (SB6)	204	133	102	48.5	38	49	11.2	86	10	5
Xena	135	130	97	50.5	34	80	11.0	80	12	9
Lenetah	138	127	94	51.7	36	78	11.0	88	7	5
Feed Average	156	137	115	50.6	34	67	10.8	80	12	8
2-Row Spring Food Barley										
Julie*	123	131	114	52.6	35	68	9.8	82	11	7
Kardia	116	130	96	49.7	34	77	11.1	77	14	10
Transit*	109	120	94	51.0	34	73	8.8	79	11	11
Goldenhart*	115	106	70	54.9	33	83	13.3	71	17	11
Food Average	116	122	93	52.1	34	75	10.7	77	13	10
LSD ($\alpha=.05$)	19.5	16.3	18.8	3.0	2	17				
CV %	10.4	8.6	10.9	4.2	3	17				
Pr > F	<.0001	0.0002	<.0001	0.0021	<.0001	0.0001				

*indicates hulless variety

(SB6) = Six-row barley

Table 62. Agronomic Data for Spring Feed and Food Barley at Ashton, Irrigated, 2019.

Variety	Yield (bu/A)			Test Wt.	Spring	Heading	Height	Lodging	Protein	Plump		
	2017	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
2-Row Spring Feed Barley												
Claymore	132	113	98	48.7	100	7/9	34	31	11.3	63	19	20
Altorado	124	132	95	50.9	100	7/6	30	60	11.3	61	23	17
BZ512-319	---	---	94	49.3	100	7/6	34	35	10.9	58	22	22
Xena	117	105	94	51.5	100	7/7	33	20	10.5	72	17	12
Idagold II	102	112	93	51.1	100	7/7	32	28	10.5	71	17	13
Lenetah	118	112	93	51.4	99.5	7/8	32	25	10.9	80	11	9
Champion	126	121	92	52.0	100	7/6	33	64	11.2	69	18	14
Oreana	118	105	90	50.5	100	7/8	29	50	11.0	57	23	21
UT11302-11 (SB6)	---	122	85	48.8	100	7/5	31	6	10.5	71	18	11
Millennium (SB6)	119	97	81	48.2	100	7/5	35	0	10.6	41	32	28
UTSB10905-72 (SB6)	127	120	78	49.5	100	7/6	33	0	10.5	81	13	7
Feed Average	118	109	90	50.2	100	7/6	32	29	10.8	66	19	16
2-Row Spring Food Barley												
Kardia	122	103	94	49.9	100	7/12	32	31	11.2	67	20	15
Julie*	106	91	95	53.9	100	7/9	29	5	9.7	74	16	11
Goldenhart*	78	90	86	58.9	99.5	7/10	32	5	14.0	72	16	13
Transit*	83	89	86	52.2	100	7/8	33	8	7.8	76	15	10
Food Average	97	93	90	53.7	100	7/9	31	12	10.7	72	17	12
LSD ($\alpha=.05$)	15.1	28.1	13.3	1.7	0.96	1.2	3	34				
CV %	9.7	18.8	10.0	2.4	0.67	0.45	7	97				
Pr > F	<.0001	0.0018	0.0937	<.0001	0.0565	<.0001	0.0219	0.0018				

*indicates hullless variety

(SB6) = Six-row barley

Table 63. Agronomic Data for Spring Feed and Food Barley at Soda Springs, Dryland, 2019.

Variety	Yield (bu/A)		Test Wt.	Spring	Heading	Height	Lodging	Protein	Plump		
	2018	2019	(lb/bu)	Stand (%)	Date	(in.)	(%)	(%)	(>6/64)	(>5.5/64)	% Thin
2-Row Spring Feed Barley											
BZ512-319	---	105	51.5	100	7/10	32	0	10.9	94	3	1
Oreana	66	104	51.8	100	7/18	31	0	11.0	97	3	1
Altorado	96**	101	52.3	100	7/13	33	0	10.4	95	3	1
Champion	64	97	52.5	100	7/13	29	0	10.9	96	2	1
UT11302-11 (SB6)	---	97	48.7	97.8	7/10	35	0	11.0	98	1	0
Claymore	57	96	50.8	100	7/13	32	0	10.3	95	3	1
Millennium (SB6)	66	96	48.4	99.3	7/8	31	0	11.0	90	7	3
Xena	58	94	52.2	97.3	7/14	33	0	10.7	98	2	1
Idagold II	65	93	52.2	99.3	7/15	30	0	10.9	96	2	1
Lenetah	71	92	51.7	98.5	7/17	34	0	10.8	97	2	1
UTSB10905-72 (SB6)	63	91	48.8	97.3	7/11	36	0	10.8	98	1	0
Feed Average	64	97	51.0	99	7/12	32	0	10.8	96	3	1
2-Row Spring Food Barley											
Julie*	---	99	53.1	99.8	7/15	31	0	9.1	96	3	1
Transit*	---	92	53.0	99.3	7/15	30	0	7.9	95	4	1
Kardia	---	79	50.1	100.0	7/18	31	0	11.4	96	3	1
Goldenhart*	---	72	57.6	94.8	7/17	31	0	14.9	92	5	2
Food Average		85	53.5	98.5	7/16	31	0	10.8	95	4	1
LSD ($\alpha=.05$)	14.5	8.7	0.6	2.2	1.6	2	0				
CV %	15.8	6.5	0.8	1.6	0.56	5	.				
Pr > F	0.0002	< 0.0001	< 0.0001	0.0003	< 0.0001	< 0.0001	.				

*indicates hulless variety

(SB6) = Six-row barley

** 1-rep demonstration plot

Table 64. Two-Row Spring Feed Barley Yield Percentage of Location Averages, 2019.

(100% = Average)

Variety	Aberdeen	Rupert	Idaho Falls	Ashton	Soda Springs	Variety average
Feed Barley						
Altorado	117	108	133	106	108	114
BZ512-319	109	105	106	105	111	107
Champion	117	105	95	103	104	105
Claymore	105	99	105	109	102	104
Idagold II	100	93	105	104	98	100
Lenetah	107	96	86	103	98	98
Millennium (SB6)	93	121	109	90	102	103
Oreana	112	115	125	100	110	112
UT11302-11 (SB6)	117	93	109	94	103	103
UTSB10905-72 (SB6)	89	93	93	87	96	92
Xena	110	106	88	105	100	102
Food Barley						
Goldenhart*	65	80	63	95	76	76
Julie*	88	101	103	106	105	101
Kardia	79	86	88	105	84	88
Transit*	98	95	85	96	98	94
Location Average	100	100	100	100	100	100

*indicates hulless varieties

(SB6) = Six-row barley

2019 Spring Feed and Food Barley Yield Percentage Across All Locations

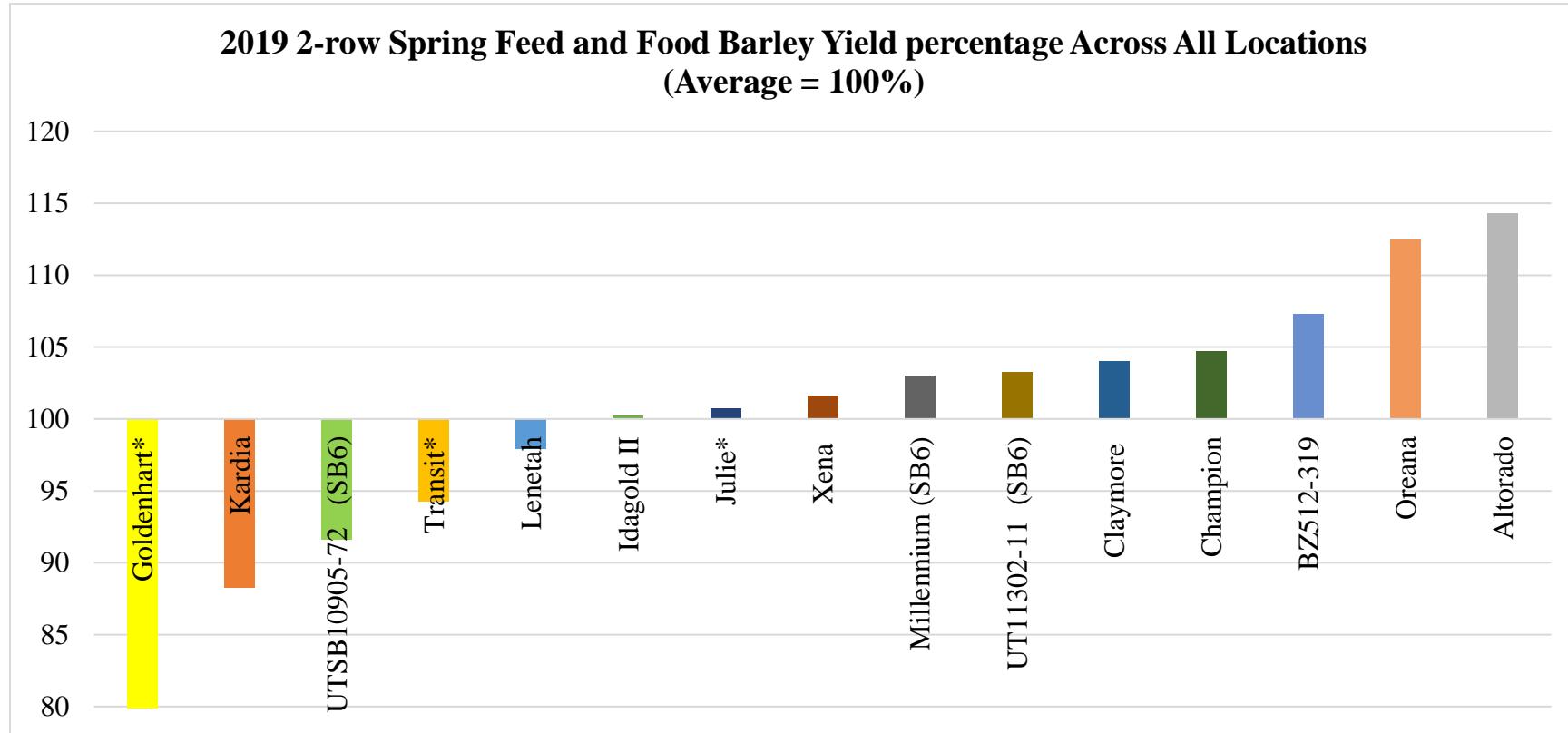


Chart 9. 2-Row Spring Feed and Food Barley Yield Percentage Across All Locations.

* indicates hulless varieties.

(SB6) = 6-row barley.

Table 65. Hard Winter Wheat Grain Protein & Kernel Hardness, 2018.

Variety	Grain Protein %							Kernel Hardness 0-100						
	Kimberly	Aberdeen	Rupert	Ririe	Rockland	Soda Springs	Average	Kimberly	Aberdeen	Rupert	Ririe	Rockland	Soda Springs	Average
ACC Wildfire	11.9	14.4	13.3	13.6	12.1	14.7	13.3	66	73	77	55	62	62	65.8
Greenville	11.8	13.9	13.2	13.1	12.2	14.2	13.1	62	58	64	53	54	55	57.7
IDO1101 (W)	12.4	13.6	13.2	13.5	11.6	14.1	13.1	68	73	75	70	64	70	70.0
IDO1506 (W)	12.3	14	13	---	---	---	13.1	68	58	71	---	---	---	65.7
IDO1607	11.8	14.4	13.2	13.2	11.7	14.8	13.2	62	62	69	55	57	60	60.8
UI Bronze Jade (W)	11.3	14	12.5	13.4	11.3	14.5	12.8	60	76	72	64	65	73	68.3
Irv (W)	12	13.6	13.1	13.9	11.9	14.5	13.2	68	68	74	62	62	67	66.8
Keldin	11.7	13.6	12.5	13.3	11.6	13.4	12.7	62	66	71	55	61	60	62.5
Keldin + 11-52-0	10.9	13.7	12.8	12.9	10.9	13.3	12.4	54	62	76	66	59	54	61.8
LCS Jet	11.1	13.1	12.8	13.1	11.8	13.4	12.6	65	63	78	54	56	57	62.2
Loma	11.9	14.3	13.6	13.6	12.4	15.2	13.5	69	67	74	70	68	78	71.0
LCS Zoom	11.8	13.5	12.6	12.5	11	14.5	12.7	72	64	74	60	57	60	64.5
Ray	11.3	14.6	13.4	13.7	12.2	14.5	13.3	64	77	82	68	63	76	71.7
MTF1435	12.8	14.1	13.5	13.7	12.3	14.6	13.5	69	64	79	68	66	66	68.7
Northern	11.8	14.4	13.1	13.8	12.2	14.4	13.3	70	70	81	74	67	82	74.0
Norwest 553	11.7	13.8	13.2	14.3	11.8	14.4	13.2	62	61	68	63	56	62	62.0
Norwest 553/Yellowstone (50/50)	11.7	13.5	13	13.5	11.6	14.7	13.0	63	62	73	65	60	71	65.7
LCS Rocket	11.3	13.4	12.2	12.6	11	14	12.4	65	62	71	57	66	65	64.3
OR2120358H	11.8	14.5	13.3	13.7	12.2	15	13.4	56	59	65	55	57	55	57.8
OR2130021R	11.6	14	12.8	14.5	12.7	14.7	13.4	65	71	76	59	73	59	67.2
Millie (W)	12.2	13.6	12.6	14	11.7	14	13.0	65	61	71	58	66	59	63.3
Sequoia	---	13.5	---	13.3	12	14.7	13.4	---	52	---	56	64	63	58.8
SY Touchstone	12.6	14.2	12.7	14.5	12.2	14.7	13.5	62	68	71	63	75	61	66.7
Utah 100	11.8	13.5	12.9	13.6	12.8	14.9	13.3	74	77	81	69	75	73	74.8
WA8252 (W)	10.9	13.5	12.3	---	---	---	12.2	62	70	76	---	---	---	69.3
Scorpio	10.8	13.7	12.3	---	---	---	12.3	60	61	69	---	---	---	63.3
WA8294	11.9	13.7	12.8	13.6	13.1	14.2	13.2	62	60	64	53	66	56	60.2
Warhorse	12.6	15.2	13.7	14.3	13.4	14.9	14.0	69	76	77	63	75	69	71.5
WB4269	13.8	13.1	12.8	14.3	13.6	13.8	13.6	83	71	85	72	78	72	76.8
WB4311	12.3	13.4	13	13.4	12.3	14.3	13.1	65	70	79	61	72	62	68.2
WB4418	13.2	13.1	12.5	13.1	---	13.9	13.2	75	80	82	67	---	69	74.6
WB4623CLP	12.1	14.6	14.1	14.1	11.4	14.4	13.5	60	70	77	53	40	58	59.7
Whetstone	12.8	14.3	12.9	13.6	13.1	14.2	13.5	63	68	76	57	72	62	66.3
XB4542	12.5	13.1	12.6	13.6	11.7	13.6	12.9	71	71	82	60	71	68	70.5
Yellowstone	11.6	14.1	12.7	13.5	12.4	14.5	13.1	62	62	75	64	71	81	69.2
Keldin (QC)	11.7	13.7	12.1	13.3	11.8	13.6	12.7	63	65	67	58	63	52	61.3
Mandala	11.8	---	13.3	---	---	---	12.6	72	---	79.0	---	---	---	75.5
Metropolis	14.5	---	13.9	---	---	---	14.2	70	---	76.0	---	---	---	73.0
Rebelde	12.9	---	13.6	---	---	---	13.3	66.0	---	---	---	---	---	66.0
Bearpaw	---	---	---	13.6	12.9	15.1	13.9	---	---	---	62	69	65	65.3
Curlew	---	---	---	13.7	12.1	14.4	13.4	---	---	---	59	68	62	63.0
Deloris	---	---	---	13.6	11.9	14.1	13.2	---	---	---	63	72	59	64.7
Eltan (SWW)	---	---	---	13.1	11.5	14.6	13.1	---	---	---	20	27	21	22.7
Golden Spike (W)	---	---	---	13.2	11.9	14.2	13.1	---	---	---	52	61	59	57.3
Juniper	---	---	---	15	12.4	15.5	14.3	---	---	---	71	78	78	75.7
LCS Yeti (W)	---	---	---	13.6	13.3	14.8	13.9	---	---	---	54	69	64	62.3
Lucin-CL	---	---	---	13.9	11.9	14.6	13.5	---	---	---	63	70	67	66.7
Promontory	---	---	---	12.9	12.3	14.4	13.2	---	---	---	66	67	69	67.3
SY Clearstone 2CL (W)	---	---	---	13.3	12.6	14.3	13.4	---	---	---	57	64	62	61.0
UI Silver	---	---	---	13.5	11.6	14.2	13.1	---	---	---	72	71	80	74.3
UI SRG	---	---	---	14.1	12.5	14.4	13.7	---	---	---	72	77	69	72.7
UICF Grace (HW imi)	---	---	---	13.8	12.1	14.3	13.4	---	---	---	70	72	75	72.3
Location Average	12.0	13.9	13.0	13.6	12.1	14.4	13.2	65.6	66.6	74.5	60.8	64.9	64.3	65.7

(W) = White

(SWW) = Soft White Winter

(QC) = Double entry for data quality analysis

Table 66. Percent Flour Protein and Flour Yield for Hard Winter Wheat at Aberdeen, Kimberly, Ririe, Rockland, and Soda Springs, 2018.

Variety	Flour Protein (14% mb)							Flour Yield (%)						
	Kimberly	Aberdeen	Rupert	Ririe	Rockland	Soda Springs	Average	Kimberly	Aberdeen	Rupert	Ririe	Rockland	Soda Springs	Average
Hard Red Winter Wheat														
ACC Wildfire	10.4	13.1	11.9	12.4	11.0	13.0	12.0	76.4	76.4	77.8	74.9	75.0	71.7	75.4
Greenville	10.0	12.3	10.9	11.7	10.4	12.7	11.2	71.9	69.2	72.0	71.6	68.7	66.3	69.9
IDO1607	10.4	13.0	11.3	11.7	9.6	13.4	11.6	76.2	74.6	75.9	72.6	70.9	66.6	72.8
Keldin	10.2	12.1	10.5	12.0	10.1	12.4	11.2	76.6	76.7	77.0	74.5	73.8	70.9	74.9
Keldin + 11-52-0	9.8	12.1	10.3	11.8	9.4	12.3	11.0	77.2	76.8	77.4	74.8	73.1	71.0	75.0
LCS Jet	9.3	11.3	10.2	11.5	9.6	11.9	10.6	75.9	75.2	76.8	73.9	73.1	70.5	74.2
Loma	10.4	12.7	11.0	12.1	10.5	12.9	11.6	76.5	74.9	77.2	75.3	75.1	73.6	75.4
LCS Zoom	9.9	12.0	10.4	11.2	9.4	12.9	11.0	75.3	71.8	74.6	72.7	72.3	69.2	72.7
Ray	9.9	12.9	11.4	12.0	10.3	12.7	11.5	75.8	76.1	76.7	73.9	73.4	73.1	74.8
MTF1435	10.9	12.4	11.5	12.3	10.4	13.3	11.8	75.3	74.9	74.9	73.6	72.8	72.6	74.0
Northern	9.8	12.2	11.1	12.3	10.5	12.8	11.5	74.1	75.1	77.4	74.3	71.5	73.0	74.2
Norwest 553	10.0	12.0	11.2	12.9	10.4	13.1	11.6	75.8	74.2	76.1	74.0	76.7	72.6	74.9
Norwest 553/Yellowstone (50/50)	10.0	12.0	11.4	12.2	10.2	13.0	11.5	75.3	75.4	76.7	74.7	74.4	72.8	74.9
LCS Rocket	9.2	11.5	10.1	11.2	9.4	12.6	10.7	75.7	74.1	76.8	74.9	74.8	73.7	75.0
OR2120358H	10.3	12.9	11.4	12.5	10.8	13.8	12.0	73.3	72.4	75.3	72.7	71.6	68.3	72.3
OR2130021R	9.9	12.1	10.6	13.3	10.5	13.6	11.7	76.5	76.0	75.9	76.5	75.4	72.6	75.5
Sequoia	---	12.5	---	12.2	9.7	13.1	11.9	---	76.7	---	76.6	75.8	73.6	75.7
Utah 100	9.6	11.7	10.6	11.8	10.4	13.4	11.3	76.3	76.3	74.6	74.5	72.9	71.7	74.4
Scorpio	9.0	11.8	10.3	---	---	---	10.4	74.8	73.5	74.8	---	---	---	74.4
WA8294	10.1	12.1	10.8	12.5	11.2	13.4	11.7	76.2	76.2	75.8	76.3	75.9	73.3	75.6
Warhorse	10.8	13.1	11.6	13.0	11.9	13.3	12.3	75.7	75.7	75.0	75.5	74.0	71.5	74.6
WB4269	11.9	11.3	10.6	12.8	11.5	12.2	11.7	75.3	75.0	75.9	72.4	70.6	70.4	73.3
WB4311	11.3	11.7	10.9	12.0	10.7	12.6	11.5	76.2	78.3	76.6	74.9	73.1	70.8	75.0
WB4418	11.0	11.0	10.2	11.6	---	11.6	11.1	73.1	75.6	74.2	71.4	---	72.7	73.4
WB4623CLP	11.0	13.2	12.4	12.9	9.6	12.8	12.0	72.2	74.6	73.1	70.1	69.9	69.3	71.5
Whetstone	10.8	12.7	11.0	12.4	10.9	12.7	11.8	75.2	74.6	75.9	74.9	74.9	73.9	74.9
XB4542	10.6	11.5	10.5	12.1	9.6	12.1	11.1	76.8	77.8	78.6	76.7	74.6	73.1	76.3
Yellowstone	10.0	12.3	10.8	12.2	10.4	12.8	11.4	76.1	75.4	77.0	75.2	74.8	73.1	75.3
Keldin (QC)	10.6	12.0	10.1	12.1	9.9	12.3	11.2	76.3	76.3	78.2	74.3	74.2	70.2	74.9
Mandala	10.1	---	11.2	---	---	---	10.7	76.2	---	74.3	---	---	---	75.3
Metropolis	12.6	---	12.0	---	---	---	12.3	76.9	---	76.9	---	---	---	76.9
Rebelde	11.7	---	11.9	---	---	---	11.8	76.3	---	76.1	---	---	---	76.2
Bearpaw	---	---	---	12.0	11.1	13.4	12.2	---	---	---	74.0	74.5	71.5	73.3
Curlew	---	---	---	12.5	10.3	13.2	12.0	---	---	---	75.2	74.1	71.4	73.6
Deloris	---	---	---	12.6	10.7	13.2	12.2	---	---	---	75.9	75.5	74.0	75.1
Juniper	---	---	---	13.1	10.5	14.1	12.6	---	---	---	74.2	75.3	73.3	74.3
Lucin-CL	---	---	---	12.8	10.5	13.6	12.3	---	---	---	75.7	75.3	74.7	75.2
SY Touchstone	10.4	12.1	10.7	12.8	10.4	13.2	11.6	76.6	77.4	75.4	75.6	74.1	72.4	75.3
SY Clearstone 2CL	---	---	---	11.9	10.6	12.7	11.7	---	---	---	72.7	72.4	69.9	71.7
Promontory	---	---	---	11.6	10.9	12.9	11.8	---	---	---	75.9	75.3	73.0	74.7
UI SRG	---	---	---	12.5	10.5	12.6	11.9	---	---	---	74.7	74.7	73.0	74.1
Location Average	10.4	12.2	11.0	12.2	10.4	12.9	11.6	75.6	75.2	76.0	74.4	73.7	71.8	74.4
Hard White Winter Wheat														
IDO1101 (W)	10.6	12.0	11.2	11.6	9.8	12.6	11.3	74.3	74.0	74.2	74.1	72.7	71.3	73.4
IDO1506	10.7	12.5	11.0	---	---	---	11.4	75.9	71.5	74.8	---	---	---	74.1
UI Bronze Jade	9.8	12.3	10.6	11.7	9.5	12.9	11.1	77.2	74.4	75.9	75.9	75.8	72.4	75.3
Irv	9.7	11.8	11.0	12.1	9.8	12.7	11.2	76.9	74.4	76.1	74.3	74.3	72.2	74.7
Millie	10.3	11.7	10.6	12.7	9.9	12.9	11.4	73.1	74.9	74.5	73.4	72.9	71.5	73.4
WA8252	8.8	11.6	10.1	---	---	---	10.2	74.9	76.0	74.9	---	---	---	75.3
Eltan (SWW)	---	---	---	11.2	9.2	12.1	10.8	---	---	---	64.9	66.0	58.4	63.1
Golden Spike	---	---	---	12.0	10.3	12.9	11.7	---	---	---	74.5	74.1	72.0	73.5
LCS Yeti	---	---	---	12.3	11.6	13.2	12.4	---	---	---	72.8	73.3	72.3	72.8
UI Silver	---	---	---	12.0	9.9	12.4	11.4	---	---	---	74.8	75.0	72.7	74.2
UICF Grace (HW imi)	---	---	---	12.2	10.1	12.8	11.7	---	---	---	71.8	70.6	69.9	70.8
Location Average	10.0	12.0	10.8	12.0	10.0	12.7	11.2	75.4	74.2	75.1	72.9	72.8	70.3	73.4
mb = moisture basis														

(SWW) = Soft white winter wheat

(QC) = Double entry for data quality analysis

Table 67. Bake Volume for Hard Winter Wheat at Aberdeen, Kimberly, Rupert, Ririe, 2018.

Variety	Aberdeen	Kimberly	Rupert	Ririe	Rockland	Soda Springs	Bake Volume (cc)	Average
Hard Red Winter Wheat								
ACC Wildfire	1025	825	950	950	1025	1100	979	
Greenville	975	725	850	900	825	1125	900	
IDO1607	975	875	875	925	800	1075	921	
Keldin	925	800	750	900	825	1050	875	
Keldin + 11-52-0	825	750	750	825	750	1025	821	
LCS Jet	925	675	750	850	775	900	813	
Loma	1100	900	900	1025	900	1100	988	
LCS Zoom	975	725	775	825	725	1000	838	
Ray	1050	825	875	875	875	975	913	
MTF1435	1050	800	850	900	850	1050	917	
Northern	975	775	800	925	875	1100	908	
Norwest 553	1000	775	875	1000	900	1050	933	
Norwest 553/Yellowstone (50/50)	975	775	900	925	875	1050	917	
LCS Rocket	925	750	775	900	800	1075	871	
OR2120358H	1000	800	725	875	800	1000	867	
OR2130021R	975	825	800	1025	850	1050	921	
Sequoia	1000	---	---	950	775	950	919	
Utah 100	950	750	875	1000	800	1075	908	
Scorpio	1000	750	850	---	---	---	867	
WA8294	1100	800	900	950	925	1075	958	
Warhorse	1000	825	850	975	950	1000	933	
WB4269	775	725	675	725	800	800	750	
WB4311	850	775	775	800	800	900	817	
WB4418	775	725	700	750	---	825	755	
WB4623CLP	1025	850	900	950	---	1025	950	
Whetstone	1025	825	825	950	900	1025	925	
XB4542	875	825	725	925	800	1000	858	
Yellowstone	1100	825	775	975	875	1075	938	
Keldin (QC)	950	900	750	950	775	1025	892	
Mandala	---	700	---	---	---	---	700	
Metropolis	---	1025	---	---	---	---	1025	
Rebelde	---	950	---	---	---	---	950	
Bearpaw	---	---	---	925	800	1000	908	
Curlew	---	---	---	1000	900	1050	983	
Deloris	---	---	---	1025	900	1125	1017	
Juniper	---	---	---	900	825	1150	958	
Lucin-CL	---	---	---	1050	875	1100	1008	
Promontory	---	---	---	825	875	1125	942	
SY Clearstone 2CL	---	---	---	900	775	1125	933	
SY Touchstone	975	800	825	950	775	950	879	
UI SRG	---	---	---	925	825	1075	942	
Location Average	969	802	815	920	840	1032	905	
Hard White Winter Wheat								
IDO1101	950	700	800	875	825	1050	867	
IDO1506	975	775	775	925	---	---	863	
UI Bronze Jade	975	775	825	900	800	1075	892	
Irv	925	725	825	875	825	975	858	
Millie	1000	800	825	925	800	1025	896	
WA8252	875	675	725	---	---	---	758	
Golden Spike	---	---	---	925	875	1125	975	
LCS Yeti	---	---	---	950	925	1100	992	
UI Silver	---	---	---	950	850	1100	967	
UICF Grace (HW imi)	---	---	---	875	700	1050	875	
Location Average	950	742	796	911	825	1063	881	

(QC) = Double entry for data quality analysis

Table 68. Soft White Winter Wheat Grain Protein & Kernel Hardness, 2018.

Variety	Grain Protein %							Kernel Hardness 0-100						
	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average
Brundage	6.6	12.4	10.2	12.3	---	---	10.4	22	29	26	22	---	---	24.8
Bruneau	6.5	11.6	10.9	12.8	11.9		10.7	18	27	18	20	17		20.0
IDN07-28017B	7.1	12.6	11.6	12.9	12.7	11.6	11.4	16	29	17	21	19	30	22.0
IDN09-15702A	7	13.1	11.2	13.7	13.9	12	11.8	26	37	26	30	25	31	29.2
IDN10-08606A	6.4	12.3	10.6	12.5	13.4	11.4	11.1	17	30	21	24	22	26	23.3
IDO1005	7.6	11.7	11.2	14	14.1	12.3	11.8	22	34	24	28	24	33	27.5
IDO1708	6.2	11.6	10.7	12.1	13.5	10.8	10.8	15	24	15	19	20	24	19.5
Jasper	6	13	11	13.3	13.6	11.4	11.4	19	34	17	23	18	30	23.5
LCS Artdeco	6.9	11.8	10.3	---	---	---	9.7	14	25	16	---	---	---	18.3
LCS Drive	7.9	12.7	10.6	---	---	---	10.4	28	27	21	---	---	---	25.3
LCS Shark	8.4	12.8	10.6	---	---	---	10.6	28	34	17	---	---	---	26.3
LCS Shine	7.3	11.4	10.4	11.3	12.9	10	10.6	26	25	20	23	19	22	22.5
LCS Hulk	7.1	11.4	10.2	12.4	14.5	11.3	11.2	31	26	24	24	22	28	25.8
LCS Ghost	6.7	11.9	9.8	---	---	---	9.5	21	27	13	---	---	---	20.3
Norwest Tandem	7.9	12	11.2	13.1	12.7	11.6	11.4	33	39	29	26	17	33	29.5
OR2101043	7.3	11.4	10.7	12.5	13	---	11.0	27	31	21	24	26	---	25.8
Nixon	7.7	12.7	10.9	13.4	12.6	---	11.5	29	33	25	25	17	---	25.8
OR2121285	7.7	13	11	14.3	14.2	---	12.0	28	29	20	22	19	---	23.6
OR2X2CL+	7.7	12.6	11.6	13.5	14.6	---	12.0	26	30	20	21	18	---	23.0
ORI2150061Cl+	9.4	13.6	12.1	14	14.3	---	12.7	32	32	22	28	22	---	27.2
Rosalyne	6.7	11.9	10.8	12.3	13.1	---	11.0	23	27	19	24	21	---	22.8
Stephens	7.2	12.5	11.3	13.1	14.4	---	11.7	27	29	22	27	21	---	25.2
SY Ovation	6.9	10.4	10.3	---	---	---	9.2	28	21	23	---	---	---	24.0
SY Assure	7.9	11.7	10.3	---	---	---	10.0	34	26	16	---	---	---	25.3
SY Dayton	7	11.3	10.4	---	---	---	9.6	25	25	25	---	---	---	25.0
UI Castle CL+	7.8	14.2	11	13.9	15	12	12.3	29	26	23	25	20	30	25.5
UI Magic CL+	7.6	11.7	10.9	14.2	13.7	12.3	11.7	27	22	19	34	20	32	25.7
UI Sparrow	7.2	12.2	10.7	12.9	12.9	11.2	11.2	29	27	24	32	22	28	27.0
UIL14-75044	7.8	12	11.3	13.8	13.4	11.2	11.6	29	26	23	30	17	28	25.5
UIL15-72223	6.8	10.8	10.5	13.4	13.2	11.1	11.0	23	18	20	27	13	24	20.8
WA8232	6.8	---	10.4	---	---	---	8.6	28	---	22	---	---	---	25.0
WB 456	7.8	12.2	11.6	---	---	---	10.5	31	27	32	---	---	---	30.0
WB1376CLP	8.5	12	11.9	14.9	13.8	---	12.2	29	29	27	35	22	---	28.4
WB1529	7.4	11.9	11	13	13.5	---	11.4	27	21	28	29	19	---	24.8
WB1604	7.3	11.4	11.1	13.2	13.7	---	11.3	22	26	22	21	19	---	22.0
WB1783	7	11.1	10.9	14.5	13	---	11.3	29	31	25	42	25	---	30.4
XAI801	6.4	---	10.9	13.7	14.4	---	11.4	19	---	28	37	23	---	26.8
XB1104	7.9	12.4	10.9	12.9	14.5	---	11.7	30	29	32	34	29	---	30.8
Bobtail	6.9	11.2	10.7	---	---	10.8	9.9	23	18	17	---	---	22	20.0
Devote	---	13.4	---	13.1	12.9	11.3	12.7	---	20	---	23	20	21	21.0
Norwest Duet	---	---	---	13.1	14.4	11.1	12.9	---	---	---	30	24	36	30.0
LCS Sonic	---	---	---	13.1	13.8	11.6	12.8	---	---	---	27	17	28	24.0
Otto	---	---	---	13.7	14.2	---	14.0	---	---	---	29	18	---	23.5
SY Banks	---	---	---	13.7	12.9	11.3	12.6	---	---	---	32	18	27	25.7
SY Command	---	---	---	12.6	12.2	10.5	11.8	---	---	---	23	14	24	20.3
Eltan	---	---	---	13.1	13.3	---	13.2	---	---	---	22	20	---	21.0
Average	7.3	12.1	10.9	13.2	13.5	11.3	11.4	25.4	27.6	22.0	26.8	20.2	27.9	25.0

Table 69. Percent Flour Protein and Flour Yield for Soft White Winter Wheat at Kimberly, Ririe, and Aberdeen, 2018.

Variety	Flour Protein (%)							Flour Yield (%)						
	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average
Brundage	7.4	10.5	8.8	10.6	---	---	9.3	67.4	73.7	72.4	67.0	---	---	70.1
Bruneau	7.1	9.7	9.2	11	10.4	---	9.5	67.3	65.4	72.1	64.9	65.1	---	67.0
IDN07-28017B	7.7	10.1	9.9	11	11	9.9	9.9	68.6	66.1	73.9	69.8	63.3	67.3	68.2
IDN09-15702A	7.7	10.5	9.7	11.6	11.9	10.1	10.3	67.7	65.9	75.2	70.2	68.0	68.9	69.3
IDN10-08606A	6.7	10.5	9.2	11.1	11.8	9.6	9.8	68.2	70.7	74.6	71.6	62.3	67.0	69.0
IDO1005	7.7	9.4	9.1	11.9	11.3	10.2	9.9	68.3	66.3	74.7	70.3	67.5	69.9	69.5
IDO1708	7.3	9.4	9.3	11	12.2	9.3	9.8	66.6	60.7	70.9	69.6	62.8	67.5	66.4
Jasper	6.7	10.2	9.4	11.6	11.5	9.5	9.8	69.1	63.7	72.2	65.4	63.3	67.5	66.9
LCS Artdeco	7.4	9.6	9	---	---	---	8.7	65.6	63.7	71.0	---	---	---	66.8
LCS Drive	7.3	9.8	8.8	---	---	---	8.6	64.8	59.6	66.3	---	---	---	63.6
LCS Shark	8.3	10.4	8.9	---	---	---	9.2	65.8	64.7	70.2	---	---	---	66.9
LCS Shine	6.7	9.2	8.6	10.3	11	8.5	9.1	66.4	65.1	76.6	68.5	62.8	65.0	67.4
LCS Hulk	7	9.4	8.5	10.7	12.1	8.9	9.4	66.3	66.5	75.1	66.0	56.9	67.7	66.4
LCS Ghost	6.6	9.1	8.1	---	---	---	7.9	67.4	66.6	73.2	---	---	---	69.1
Norwest Tandem	7.2	9.5	8.8	11.3	10.7	9.3	9.5	65.2	72.3	74.7	70.2	65.8	74.1	70.4
OR2101043	7.2	9.4	8.7	11	10.9	---	9.4	70.4	69.9	72.6	67.8	62.7	---	68.7
Nixon	7.4	9.6	8.7	11.8	10.6	---	9.6	70.8	70.2	74.0	69.8	63.1	---	69.6
OR2121285	7.8	10.2	8.7	12.2	11.6	---	10.1	67.9	71.0	68.8	63.5	60.9	---	66.4
OR2X2CL+	7.5	9.9	9.6	11.9	11.7	---	10.1	70.1	75.4	74.1	70.1	61.8	---	70.3
ORI2150061Cl+	9.2	10.6	10.1	12.4	12.4	---	10.9	69.0	74.9	74.8	72.0	64.8	---	71.1
Rosalyn	6.7	9.5	9	11.2	11.3	---	9.5	67.8	73.3	73.1	68.0	67.3	---	69.9
Stephens	7.1	10.1	9	11.2	11.9	---	9.9	67.0	71.5	72.7	73.1	62.3	---	69.3
SY Ovation	6.7	8.8	8.4	---	---	---	8.0	67.7	75.5	76.0	---	---	---	73.0
SY Assure	7.8	9.5	8.2	---	---	---	8.5	68.1	74.3	73.0	---	---	---	71.8
SY Dayton	6.8	9.3	8.4	---	---	---	8.2	68.1	76.0	74.5	---	---	---	72.9
UI Castle CL+	7.8	11.6	9	12.1	12.7	10	10.5	73.1	74.8	78.4	72.7	58.1	72.3	71.6
UI Magic CL=	7.1	10	8.7	12.1	11.8	10.2	10.0	67.7	72.8	73.7	73.2	62.2	70.0	69.9
UI Sparrow	6.6	10.4	8.8	11	10.9	9.3	9.5	65.9	73.4	75.3	72.0	68.0	74.6	71.5
UIL14-75044	7.1	9.8	9.1	11.9	11.3	9.2	9.7	67.6	73.6	73.3	68.2	61.5	70.6	69.1
UIL15-72223	6.9	9.3	8.8	11.7	11.2	9.4	9.6	69.4	73.6	73.9	62.5	60.7	67.8	68.0
WA8232	6.6	---	9.2	---	---	---	7.9	66.5	---	76.1	---	---	---	71.3
WB 456	7.7	10.3	9.6	---	---	---	9.2	68.3	78.6	76.8	---	---	---	74.6
WB1376CLP	8.2	9.9	9.9	12.6	11.8	---	10.5	66.2	75.2	73.2	68.5	65.2	---	69.7
WB1529	7.4	9.9	9.5	11.3	12.1	---	10.0	64.8	73.2	72.4	63.2	61.1	---	66.9
WB1604	7.2	9.6	9.6	11.5	12.3	---	10.0	67.4	73.6	72.7	67.3	63.4	---	68.9
WB1783	6.8	8.9	9.1	11.9	11.6	---	9.7	66.5	76.7	76.1	71.9	70.5	---	72.4
XA1801	6.4	---	8.9	11.5	12.3	---	9.8	64.4	---	73.6	70.2	66.1	---	68.6
XB1104	7.7	10.8	8.7	11.1	12.6	---	10.2	64.6	68.6	73.8	68.6	61.8	---	67.5
Bobtail	6.6	10.1	9.2	---	---	9.0	8.7	70.1	73.7	75.3	---	---	69.0	72.0
Devote	---	10.8	---	11.4	11.6	9.4	10.8	---	72.3	---	63.3	65.7	67.0	67.1
Norwest Duet	---	---	---	11.1	12.1	9.4	10.9	---	---	---	73.1	64.3	74.5	70.6
LCS Sonic	---	---	---	---	12.2	9.6	10.9	---	---	---	---	60.6	68.5	64.5
Otto	---	---	---	11.6	12.4	---	12.0	---	---	---	64.0	56.1	---	60.1
SY Banks	---	---	---	11.7	11.5	9.3	10.8	---	---	---	62.5	64.3	70.4	65.8
SY Command	---	---	---	11.1	11.1	8.8	10.3	---	---	---	68.4	64.0	67.7	66.7
Eltan	---	---	---	11.6	11.9	---	11.8	---	---	---	65.7	59.7	---	62.7
Location average	7.3	9.9	9.0	11.5	11.6	9.4	9.8	67.5	70.6	73.6	68.4	63.3	69.4	68.8

Table 70. Percent Break Flour Yield and Cookie Diameter for Soft White Winter Wheat at Kimberly, Ririe, and Aberdeen, 2018.

Variety	Break Flour Yield (%)						Cookie Diameter (cm)							
	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average
Brundage	39.2	27.7	33.0	32.1	---	---	33.0	9.1	8.5	8.8	8.9	---	---	8.8
Bruneau	39.2	27.1	33.3	30.9	31.7	---	32.4	9.6	9.1	9.2	9.0	8.8	---	9.2
IDN07-28017B	38.9	30.1	35.5	32.9	30.8	31.0	33.2	9.2	8.9	8.9	8.9	8.8	8.7	8.9
IDN09-15702A	43.0	29.5	36.3	35.5	34.2	33.9	35.4	9.3	8.9	8.9	8.8	8.8	9.2	9.0
IDN10-08606A	39.6	30.4	35.7	30.9	29.7	31.5	33.0	9.7	9.0	9.1	8.8	8.4	9.0	9.0
IDO1005	40.1	28.7	37.1	32.4	32.1	34.0	34.1	9.9	9.1	9.0	9.0	8.9	8.9	9.1
IDO1708	40.0	24.5	31.3	30.3	29.0	31.2	31.1	9.5	9.0	9.2	8.7	8.4	8.8	8.9
Jasper	42.2	29.9	33.8	30.5	27.3	31.2	32.5	9.7	8.9	9.3	9.0	8.8	9.1	9.1
LCS Artdeco	37.2	27.2	31.9	---	---	---	32.1	9.3	8.6	8.7	---	---	---	8.9
LCS Drive	37.0	25.3	30.5	---	---	---	30.9	9.5	8.8	9.1	---	---	---	9.1
LCS Shark	36.9	28.0	32.0	---	---	---	32.3	9.8	8.8	9.4	---	---	---	9.3
LCS Shine	41.7	27.2	37.7	30.8	29.5	30.7	33.0	9.6	9.0	9.1	8.8	8.9	9.0	9.1
LCS Hulk	36.3	29.3	36.1	29.5	25.6	30.7	31.2	9.3	8.9	8.8	8.8	8.5	8.7	8.8
LCS Ghost	43.3	31.0	34.5	---	---	---	36.3	9.5	8.7	9.0	---	---	---	9.1
Norwest Tandem	35.6	31.1	35.6	34.0	30.6	36.8	33.9	9.3	8.8	9.0	8.7	8.8	8.4	8.8
OR2101043	41.4	30.6	33.9	32.7	28.3	---	33.4	9.2	8.7	8.6	8.8	8.8	---	8.8
Nixon	39.5	31.1	34.2	31.8	27.9	---	32.9	9.5	8.9	9.0	8.9	8.9	---	9.1
OR2121285	42.0	29.7	32.2	29.1	27.4	---	32.1	9.6	8.9	9.3	8.8	8.7	---	9.1
OR2X2CL+	40.1	31.8	34.9	32.5	27.3	---	33.3	9.6	8.8	9.1	8.5	8.6	---	8.9
ORI2150061Cl+	38.3	33.4	35.3	32.6	28.8	---	33.7	9.2	8.6	8.7	8.6	8.3	---	8.7
Rosalyn	40.7	31.7	33.5	31.9	31.2	---	33.8	9.1	8.4	8.7	8.7	8.6	---	8.7
Stephens	38.3	30.4	31.9	31.7	26.0	---	31.7	9.4	8.6	9.0	7.7	8.5	---	8.7
SY Ovation	39.4	33.2	35.2	---	---	---	35.9	9.4	8.8	9.3	---	---	---	9.2
SY Assure	38.5	32.2	34.6	---	---	---	35.1	9.4	8.8	9.2	---	---	---	9.1
SY Dayton	39.6	34.5	34.4	---	---	---	36.2	9.4	8.6	8.9	---	---	---	9.0
UI Castle CL+	41.6	34.5	39.2	32.0	25.4	37.6	35.1	9.4	8.7	9.0	8.7	8.5	8.7	8.8
UI Magic CL+	39.1	31.5	35.2	35.1	28.0	32.7	33.6	9.4	8.7	8.8	8.6	8.5	8.5	8.7
UI Sparrow	37.3	33.3	36.3	33.6	32.9	34.9	34.7	9.1	8.5	8.6	8.9	8.6	8.8	8.8
UIL14-75044	37.6	30.9	34.5	30.3	26.8	32.4	32.1	9.7	8.8	9.1	9.0	8.8	9.0	9.1
UIL15-72223	42.7	30.9	35.0	29.2	25.3	32.0	32.5	9.5	8.7	9.0	8.9	8.8	9.0	9.0
WA8232	37.8	---	38.3	---	---	---	38.0	9.4	---	8.9	---	---	---	9.2
WB 456	36.0	38.2	37.4	---	---	---	37.2	9.3	8.6	8.7	---	---	---	8.9
WB1376CLP	36.3	33.6	34.2	33.0	31.0	---	33.6	9.1	8.5	8.6	8.6	8.5	---	8.6
WB1529	38.6	31.7	33.8	28.9	27.5	---	32.1	9.3	8.7	8.9	8.7	8.7	---	8.8
WB1604	41.0	33.0	35.3	32.3	29.9	---	34.3	9.5	8.9	9.0	8.4	8.9	---	8.9
WB1783	36.3	33.7	34.5	32.1	32.0	---	33.7	9.1	8.4	8.3	8.4	8.3	---	8.5
XA1801	37.2	---	33.1	30.9	29.2	---	32.6	9.2	---	8.6	8.5	8.4	---	8.7
XB1104	33.8	31.4	33.4	30.0	26.9	---	31.1	9.2	8.3	8.7	8.3	8.2	---	8.5
Bobtail	44.0	36.5	36.9	---	---	33.6	37.8	9.7	8.9	8.9	---	---	9.0	9.1
Devote	---	32.2	---	31.5	31.3	31.3	31.6	---	8.8	---	8.6	8.7	8.6	8.7
Norwest Duet	---	---	---	35.5	28.9	35.1	33.2	---	---	---	8.6	8.6	8.2	8.5
LCS Sonic	---	---	---	28.5	25.0	30.9	28.2	---	---	---	8.8	8.8	8.7	8.8
Otto	---	---	---	29.8	26.5	---	28.2	---	---	---	8.5	8.7	---	8.6
SY Banks	---	---	---	30.1	27.6	31.6	29.8	---	---	---	8.5	8.5	8.6	8.5
SY Command	---	---	---	29.0	26.5	30.5	28.7	---	---	---	8.9	9.0	9.0	8.9
Eltan	---	---	---	30.2	27.7	---	28.9	---	---	---	9.0	8.6	---	8.8
Location average	39.2	31.0	34.6	31.5	28.7	32.7	33.0	9.4	8.8	8.9	8.7	8.7	8.8	8.9

Table 71. SRC (Solvent Retention Capacity) data for Soft White Winter Wheat at Aberdeen, Kimberly, Rupert, Ririe, Rockland and Soda Springs, 2018.

Variety	Aberdeen				Kimberly				Rupert			
	Water	Sucrose	Na ₂ CO ₃	LacticAcid	Water	Sucrose	Na ₂ CO ₃	LacticAcid	Water	Sucrose	Na ₂ CO ₃	LacticAcid
Bruneau	51.7	92.5	69.7	71.5	48.9	81.1	61.3	69.1	52.1	92.8	69.3	67.3
IDO1005	51.4	91	68.3	68.7	46.6	80.2	57.4	67.1	53	93.1	68.3	64.2
IDO1708	53.2	97.2	71.1	76.4	49.1	85.9	60.2	70.2	53.8	98.4	71.1	70.5
SY Ovation	52.8	90.1	68.4	63.2	49.4	81.1	60.2	62.3	52.7	91.3	66.2	58.2
UI Sparrow	55.6	93.2	71.9	79.7	50.8	82.4	62.8	73.1	55.2	94.6	69.5	75.3
WB1783	58.9	102	79.9	76.2	53.2	93.8	66.9	71.8	59	105	77.4	71
Location average	53.9	94.3	71.6	72.6	49.7	84.1	61.5	68.9	54.3	95.9	70.3	67.8

	Ririe				Rockland				Soda Springs			
	Water	Sucrose	Na ₂ CO ₃	LacticAcid	Water	Sucrose	Na ₂ CO ₃	LacticAcid	Water	Sucrose	Na ₂ CO ₃	LacticAcid
Bruneau	52.6	98.5	69.9	102.2	---	---	---	---	52.6	100.3	71.9	101
IDO1005	50.9	94.3	64.2	87.8	52	94.3	67	87.6	52	98.5	69.5	96.4
IDO1708	53.4	99.9	69.3	96.6	53.1	97.8	71	93.1	54.1	110.3	70.9	116.7
UI Sparrow	53.3	96.2	71.7	101.7	53.8	93.6	74.1	94.8	54.1	101.2	70.8	117
WB1783	56.6	103.5	73.1	95.9	---	---	---	---	86.1	108.7	72.5	102.4
Location average	53.4	98.5	69.6	96.8	53.0	95.2	70.7	91.8	59.8	103.8	71.1	106.7

Table 72. Hard Spring Wheat Grain Protein & Kernel Hardness, 2018.

Variety	Grain Protein %					Kernel Hardness 0-100						
	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average
Hard Red Spring												
12SB0197	13.9	14.4	13.7	13.3	14	13.9	60	70	77	74	71	70.4
Alum	14.8	15.9	14.7	14.9	14.7	15.0	70	80	77	72	67	73.2
Cabernet	14.8	14.9	15	14.2	---	14.7	63	67	75	63	---	67.0
Glee	14.7	14.9	14.7	14.7	14.6	14.7	66	6	78	69	64	56.6
IDO1603S	4.8	15.3	15.2	15	15.4	13.1	66	66	75	63	63	66.6
IDO1701S	14.9	15.1	15.3	14.9	15.1	15.1	59	61	68	60	64	62.4
IDO1703S	15.2	15.3	15.4	15.3	15.6	15.4	64	71	77	62	63	67.4
Jefferson	14.3	14.6	15.1	14.6	15.7	14.9	71	78	80	70	70	73.8
LCS Iron	13.9	14.8	14.5	14.2	14.3	14.3	74	79	81	82	76	78.4
LCS Luna	14	14.3	14.6	14.1	14.4	14.3	63	69	81	71	71	71.0
SY Coho	14.7	15.3	15.3	14.5	---	15.0	75	76	94	80	---	81.3
SY Gunsight	14.6	14.4	14.9	13.7	---	14.4	66	62	74	66	---	67.0
SY3017-9	---	14.3	14.5	14.2	---	14.3	---	72	86	70	---	76.0
WA 8285	15	15.4	15.3	14.9	15	15.1	73	77	85	77	67	75.8
WB9411	15	15.5	15.2	15	14.6	15.1	71	78	82	72	69	74.4
WB9433	14.5	14.5	15.2	14.3	14.7	14.6	66	69	73	71	71	70.0
WB9578	15.7	14.9	14.9	15	15.5	15.2	76	76	83	73	73	76.2
WB9590	15.4	15.9	15.7	15.3	15.7	15.6	74	79	83	79	80	79.0
WB9668	16	15.9	15.9	15.5	16.1	15.9	72	78	84	67	76	75.4
XB9240	15.2	15.4	15.2	15.1	15.8	15.3	81	86	84	82	81	82.8
XB9551	14.5	14.5	15	14.3	14.6	14.6	67	72	75	73	59	69.2
XB9610	15.3	15.4	15.6	15.1	14.6	15.2	80	85	90	79	83	83.4
12SB0224 (W)	13.9	13.8	14.4	13.5	14.6	14.0	72	75	82	68	68	73.0
Alzada (D)	14.7	14.1	14.7	14.5	---	14.5	90	94	---	88	---	90.7
Dayn (W)	13.9	15.2	14.6	13.9	14.2	14.4	69	82	89	76	73	77.8
IDO1602S	14.1	14.4	14.7	13.9	14.9	14.4	53	59	65	58	54	57.8
IDO1604S	14.7	14.7	14.9	14.9	14.4	14.7	62	64	67	66	57	63.2
Imperial (D)	16.7	17.1	16.8	15.3	---	16.5	98	99	---	94	---	97.0
Klasic (W)	14.2	13.4	14.1	13.9	14	13.9	55	50	59	53	45	52.4
Klasic (W) Incr seeding rate 1.2	14.5	13.6	13.8	13.9	14.3	14.0	53	49	59	53	47	52.2
Klasic (W) Incr seeding rate 1.4	14.2	14.2	13.9	13.8	14.8	14.2	52	54	58	49	46	51.8
SY-Teton	13.7	14.2	13.9	13.3	14.4	13.9	59	53	61	54	53	56.0
UI Platinum (W)	14.1	13.7	14.2	14.2	14.1	14.1	65	60	65	58	49	59.4
WB7202CLP (W)	14.2	14.3	14.7	14	13.7	14.2	64	77	76	71	64	70.4
WB7328 (W)	15.3	15.1	15.2	14.7	14.2	14.9	57	60	66	58	46	57.4
WB7589 (W)	15.4	14.9	15.1	14.7	14.7	15.0	69	70	77	70	70	71.2
XB7610	12.8	13.1	13.5	13	13.6	13.2	22	32	39	27	29	29.8
NS Presser CLP	---	---	---	15	14.4	14.7	---	---	---	80	71	75.5
PSP2 ENT 1	---	---	---	---	14.9	14.9	---	---	---	---	70	70.0
PSP2 ENT 3	---	---	---	---	14.7	14.7	---	---	---	---	55	55.0
Choteau	---	---	---	---	15.7	15.7	---	---	---	---	75	75.0
DuClair	---	---	---	---	14.5	14.5	---	---	---	---	66	66.0
SY Selway	---	---	---	---	15.5	15.5	---	---	---	---	74	74.0
MT1673	---	---	---	---	15.6	15.6	---	---	---	---	65	65.0
Location Average	14.4	14.8	14.8	14.4	14.8	14.7	66.6	68.5	75.0	68.4	64.3	69.0

(W) = White

(D)= Durum

Table 73. Percent Flour Protein and Flour Yield for Hard Spring Wheat at Rupert, Aberdeen, Idaho Falls, Ashton, and Soda Springs, 2018.

Variety	Flour Protein (14% mb)						Flour Yield (%)					
	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average
Hard Red Spring												
12SB0197	12.5	12.2	11.9	11.7	12.4	12.1	72.5	73.0	73.4	75.6	70.7	73.0
Alum	13.4	14.4	13.3	13.2	13.8	13.6	76.1	74.0	76.3	76.5	71.0	74.8
Cabernet	13.6	13.8	13.4	13.1	---	13.5	75.4	76.1	76.5	76.1	---	76.0
Glee	13.2	13.4	13.1	13.1	13.6	13.3	77.0	77.4	76.4	78.0	71.4	76.0
IDO1603S	13.6	14.4	13.8	14.4	14.1	14.1	73.3	74.2	74.8	73.6	66.3	72.4
IDO1701S	13.9	14.5	14.3	14	14.4	14.2	74.1	74.6	74.6	74.6	66.4	72.8
IDO1703S	14.2	14.2	14.1	14	14.5	14.2	74.3	74.2	73.3	73.9	67.7	72.7
Jefferson	12.9	13.2	13.3	13	14.7	13.4	76.0	76.7	76.3	76.7	72.4	75.6
LCS Iron	12.5	13.2	12.8	12.6	13.1	12.8	75.1	76.7	74.7	75.9	69.9	74.5
LCS Luna	12.4	13	12.9	12.6	13.5	12.9	76.3	76.5	76.2	76.5	72.2	75.5
SY Coho	13.3	13.8	13.6	13	---	13.4	75.5	77.1	76.1	76.5	---	76.3
SY Gunsight	13.5	13.3	13.5	13	---	13.3	74.6	75.4	75.8	74.8	---	75.1
SY3017-9	---	12.8	12.8	12.4	---	12.7	---	75.4	76.4	74.9	---	75.6
WA 8285	13.9	14.1	14	13.4	13.6	13.8	74.5	76.1	76.4	75.2	71.1	74.7
WB9411	13.6	14	13.7	13.7	13.2	13.6	74.2	74.9	74.8	74.9	72.5	74.3
WB9433	13.3	13.1	13.6	13.1	13.5	13.3	75.9	74.5	75.3	75.5	71.4	74.5
WB9578	14.6	13.7	13.6	13.6	14.4	14.0	76.6	76.4	75.5	76.4	71.2	75.2
WB9590	14.3	14.6	14	14	14.5	14.3	74.4	74.1	74.9	74.4	70.5	73.7
WB9668	14.9	14.4	14.5	14.5	15.1	14.7	74.1	74.4	74.4	75.3	69.9	73.6
XB9240	13.9	13.9	13.5	13.9	14.6	14.0	76.1	74.9	76.2	76.9	71.2	75.1
XB9551	13.3	13.4	13.4	13.4	13.9	13.5	76.8	76.8	77.4	78.0	73.0	76.4
XB9610	14.4	14.3	13.8	14	13.2	13.9	74.3	76.4	75.6	75.3	72.0	74.7
NS Presser CLP	---	---	---	13.5	12.8	13.2	---	---	---	76.5	75.5	76.0
PSP2 ENT 1	---	---	---	---	14.1	14.1	---	---	---	---	71.0	71.0
PSP2 ENT 3	---	---	---	---	14.1	14.1	---	---	---	---	67.2	67.2
Choteau	---	---	---	---	14.3	14.3	---	---	---	---	68.7	68.7
DuClair	---	---	---	---	13.1	13.1	---	---	---	---	70.6	70.6
SY Selway	---	---	---	---	14.2	14.2	---	---	---	---	68.6	68.6
MT1673	---	---	---	---	14.3	14.3	---	---	---	---	69.6	69.6
Location Average	13.6	13.7	13.5	13.4	13.9	13.7	75.1	75.4	75.5	75.7	70.5	73.6
Hard White Spring												
12SB0224	12.8	12.2	12.5	12.2	13.4	12.6	71.0	72.0	72.4	74.7	68.1	71.6
Dayn	12.8	13.4	12.7	12.8	12.8	12.9	74.3	74.6	75.4	76.1	71.0	74.3
IDO1602S	13.1	13.5	13.3	13	13.7	13.3	70.3	71.3	71.9	75.1	66.4	71.0
IDO1604S	13.6	13.6	13.4	13.6	13.3	13.5	73.0	74.5	72.4	74.2	68.4	72.5
Klasic	13.5	12.1	12.8	13.1	13.5	13.0	75.6	71.8	74.9	75.3	65.2	72.5
Klasic 1.2	13.5	12.5	12.7	12.9	13.3	13.0	76.6	71.3	75.6	74.2	64.1	72.4
Klasic 1.4	13.8	13.2	12.4	12.9	13.6	13.2	76.3	72.2	76.1	74.9	65.4	73.0
SY-Teton	12.5	12.5	12.3	12.1	13	12.5	74.5	74.8	73.9	74.3	68.5	73.2
UI Platinum	12.7	12.2	12.6	12.9	13.3	12.7	76.0	78.1	76.8	76.7	70.8	75.7
WB7202CLP	12.7	12.5	12.5	12.5	12.3	12.5	72.7	76.0	73.1	73.5	69.4	72.9
WB7328	14.4	14.2	13.9	13.7	13.5	13.9	71.6	72.6	74.8	71.2	62.7	70.6
WB7589	14.5	13.6	13.6	13.5	13.8	13.8	77.3	74.6	75.0	74.4	72.1	74.7
XB7610 (SWS)	11.1	12	10.6	10.8	11.9	11.3	59.9	52.3	65.5	64.8	56.8	59.9
Location Average	13.2	12.9	12.7	12.8	13.2	12.9	73.0	72.0	73.7	73.8	66.8	71.9

(SWS) - Soft white spring

mb = moisture basis

Table 74. Bake Volume for Hard Spring Wheat, 2018.

Variety	Bake Volume (cc)					
	Aberdeen	Ashton	Idaho Falls	Rupert	Soda Springs	Average
Hard Red Spring Wheat						
12SB0197	1000	1025	950	975	1000	990
Alum	1125	1100	1050	1075	1125	1095
Cabernet	1175	1150	1100	1100	---	1131
Glee	1150	1050	1050	1125	1125	1100
IDO1603S	1300	1225	1100	1225	1075	1185
IDO1701S	1200	1200	1100	1125	1100	1145
IDO1703S	1250	1150	1050	1175	1125	1150
Jefferson	1125	1125	1100	1125	1125	1120
LCS Iron	1075	1050	1000	1125	975	1045
LCS Luna	1000	1050	1025	1125	1025	1045
SY Coho	1150	1050	1025	1125	---	1088
SY Gunsight	1075	1075	1025	---	---	1058
SY3017-9	1075	975	950	1150	---	1038
WA 8285	1125	1075	1025	1150	---	1094
WB9411	1075	1125	1050	1050	1125	1085
WB9433	1225	1150	1200	1150	1100	1165
WB9578	1175	1150	1150	1175	1150	1160
WB9590	1150	1125	1075	1125	1150	1125
WB9668	1225	1150	1125	1200	1175	1175
XB9240	1225	1175	1175	1175	1400	1230
XB9551	1175	1125	1150	1100	1150	1140
XB9610	1175	1150	1075	1150	1050	1120
NS Presser CLP	---	1025	---	---	1025	1025
PSP2 ENT 1	---	---	---	---	1125	1125
PSP2 ENT 3	---	---	---	---	1075	1075
Choteau	---	---	---	---	1000	1000
DuClair	---	---	---	---	1050	1050
SY Selway	---	---	---	---	1075	1075
MT1673	---	---	---	---	1125	1125
Location Average	1148	1108	1070	1130	1102	1102

Hard White Spring Wheat

12SB0224 (W)	1025	975	975	1050	1150	1035
Dayn	1075	975	950	1075	1075	1030
IDO1602S	1075	1125	1175	1150	1150	1135
IDO1604S	1125	1075	1125	1150	1050	1105
Klasic	1075	1125	1125	1200	1150	1135
Klasic 1.2	1125	1200	1125	1225	1200	1175
Klasic 1.4	1100	1175	1150	1200	1125	1150
SY-Teton	1050	1100	1075	1025	1075	1065
UI Platinum	1075	1100	1100	1025	1150	1090
WB7202CLP	1000	1025	1050	---	1075	1038
WB7328	1200	1175	1200	1200	1225	1200
WB7589	1175	1150	1175	1175	1125	1160
Location Average	1098	1111	1114	1143	1127	1117

Table 75. Soft White Spring Wheat Grain Protein & Kernel Hardness, 2018.

Variety	-----Grain Protein %-----						-----Kernel Hardness 0-100-----					
	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average
14-FAC-2043	14.1	12.7	12	12.6	13.2	12.9	17	18	27	15	17	18.8
14-SSW-1059	12.9	14.2	12.1	12.4	---	12.9	21	22	22	25	---	22.5
Alturas	12.6	12.5	11.8	11.6	12.4	12.2	21	19	26	18	22	21.2
IDO1401S	12.3	11.9	11.3	11.1	13.3	12.0	24	26	35	23	23	26.2
IDO1403S	13.4	12.7	12.6	12.2	13	12.8	22	21	32	19	26	24.0
UI Cookie	13.1	13.1	12.1	12	13.1	12.7	24	17	26	12	19	19.6
IDO1702S	12.5	12.2	12.5	12	12.5	12.3	19	20	29	20	20	21.6
Louise	12.9	12.7	12.5	12	12.4	12.5	29	24	31	23	20	25.4
Melba*	12.4	11.1	11.9	11.3	12.5	11.8	26	24	34	24	21	25.8
Ryan	12.9	12.6	12.3	12.3	12.9	12.6	28	21	32	20	19	24.0
Seahawk	13.1	13	12.1	12	13.4	12.7	23	26	26	24	28	25.4
SY Saltese	12.5	12.2	12	11.9	12	12.1	25	22	35	18	18	23.6
Tekoa	13.1	12.6	11.9	12.2	11.8	12.3	20	25	35	22	24	25.2
UI Pettit	12.7	11.8	11.4	12.2	12.6	12.1	23	21	25	25	22	23.2
UI Stone	12.9	12	11.2	12	12.4	12.1	14	18	23	12	13	16.0
WA 8297 CL+	12.7	12.7	10.9	13.3	12.5	12.4	22	22	28	20	21	22.6
WA 8303 CL+	15.1	11.8	11.8	12	12.3	12.6	32	27	34	30	23	29.2
WB-1035CL+	13.4	13	13.5	14.1	14	13.6	24	25	35	34	33	30.2
WB6121	13	13	13	13.2	13.1	13.1	32	20	31	30	27	28.0
WB6341	12	11.3	11.4	12.1	12.1	11.8	23	22	29	27	20	24.2
WB6430	12.9	12	11.9	12.5	12.4	12.3	21	21	26	27	20	23.0
Location Average	13.0	12.4	12.0	12.2	12.7	12.5	23.3	22.0	29.6	22.3	21.8	23.8

* Indicates club wheat

Table 76. Percent Flour Protein and Flour Yield for Soft White Spring Wheat at Rupert, Aberdeen, Idaho Falls, Ashton, and Soda Springs, 2018.

Variety	Flour Protein (14% mb)						Flour Yield (%)					
	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average
14-FAC-2043	10.9	11.7	9.7	11	11.1	10.9	62.4	63.5	67.2	63.0	60.2	63.3
14-SSW-1059	10.7	12	9.6	11.1	---	10.9	63.3	54.0	67.5	61.2	---	61.5
Alturas	10.4	11.2	9.7	10.5	10.5	10.5	66.6	58.7	73.5	64.3	59.8	64.6
IDO1401S	10	10.5	9	10.2	11.3	10.2	70.0	68.0	72.0	67.6	60.7	67.7
IDO1403S	10.9	11.1	9.7	10.8	11.2	10.7	70.0	60.1	71.1	64.4	60.3	65.2
UI Cookie	10.6	11.4	9.4	10.5	11.3	10.6	65.6	62.1	68.1	63.4	60.0	63.8
IDO1702S	10.5	11.1	9.8	10.7	10.9	10.6	68.1	63.1	70.5	65.9	61.7	65.9
Louise	10.2	11.1	9.8	10.5	10.9	10.5	70.0	71.8	72.8	68.4	66.1	69.8
Melba*	10.3	10	9.2	9.5	10.7	9.9	73.5	74.6	77.2	70.0	67.3	72.5
Ryan	10.5	11	9.6	10.3	10.8	10.4	72.4	72.6	75.7	71.7	64.6	71.4
Seahawk	10.3	11.4	9.7	10.3	11.2	10.6	73.4	71.4	75.0	72.7	66.9	71.9
SY Saltese	10.2	10.9	9.5	10	10.4	10.2	68.5	71.3	72.0	66.9	65.0	68.7
Tekoa	11.2	10.7	8.8	10.1	9.9	10.1	69.2	71.9	76.7	67.5	67.5	70.6
UI Pettit	11.2	10.6	9.1	10.5	10.7	10.4	73.8	72.6	76.0	72.2	69.4	72.8
UI Stone	11.1	10.5	9.2	10.3	10.7	10.4	73.4	71.2	75.3	66.5	63.4	69.9
WA 8297 CL+	11	11.1	9.1	11	10.9	10.6	68.8	71.6	75.5	65.1	66.5	69.5
WA 8303 CL+	11	10.4	9.1	9.7	10.5	10.1	67.9	66.4	68.3	68.3	67.0	67.6
WB-1035CL+	12.6	11.5	10.6	11.1	12.1	11.6	65.9	64.0	69.5	66.7	65.9	66.4
WB6121	11.9	11.5	10.9	10.7	11.1	11.2	66.2	65.2	69.2	69.9	66.7	67.4
WB6341	10.8	10.3	9.2	9.9	10.6	10.2	68.7	69.4	73.8	69.7	64.7	69.3
WB6430	8.4	10.4	9.2	9.9	10.8	9.7	71.9	70.9	74.1	70.0	69.7	71.3
Location Average	10.7	11.0	9.5	10.4	10.9	10.5	69.0	67.3	72.4	67.4	64.7	68.2

mb = moisture basis

*= indicates club wheat

Table 77. Percent Break Flour and Cookie Diameter for Soft White Spring Wheat at Rupert, Aberdeen, Idaho Falls, Ashton, and Soda Springs, 2018.

Variety	Break Flour (%)						Cookie Diameter (cm)					
	Idaho Falls			Soda Springs			Idaho Falls			Soda Springs		
	Rupert	Aberdeen	Ashton	Springs	Average	Rupert	Aberdeen	Ashton	Springs	Average		
14-FAC-2043	29.5	25.5	30.9	27.4	28.4	28.3	8.7	8.6	9.0	8.9	8.9	8.8
14-SSW-1059	29.6	22.6	30.2	28.3	---	27.7	8.8	8.6	8.9	8.7	---	8.8
Alturas	30.8	23.4	32.7	29.4	28.2	28.9	8.8	8.7	9.0	8.8	9.1	8.9
IDO1401S	34.6	28.7	35.9	32.9	29.6	32.3	9.2	9.0	9.0	9.1	9.0	9.1
IDO1403S	32.6	27.0	34.0	30.5	27.0	30.2	8.9	9.1	9.2	8.9	8.8	9.0
UI Cookie	30.9	26.1	32.1	28.6	28.0	29.1	9.2	9.1	9.3	9.2	9.0	9.1
IDO1702S	33.0	28.1	32.9	32.0	29.5	31.1	9.0	8.9	8.7	8.9	8.8	8.9
Louise	32.9	34.3	34.1	33.6	31.7	33.3	9.0	9.0	9.0	8.9	8.9	8.9
Melba*	36.4	35.6	37.9	35.2	33.1	35.6	9.2	8.7	9.2	8.9	9.0	9.0
Ryan	34.4	34.4	36.3	35.2	30.5	34.2	8.9	8.4	9.1	8.7	8.6	8.7
Seahawk	35.4	35.1	36.2	36.1	31.2	34.8	9.0	8.9	8.9	8.8	8.7	8.9
SY Saltese	32.4	34.4	34.0	33.5	31.7	33.2	9.2	8.9	8.9	8.8	9.0	9.0
Tekoa	36.8	34.5	39.7	34.3	33.2	35.7	8.8	8.7	9.1	9.0	9.1	8.9
UI Pettit	37.7	34.9	38.6	35.3	32.2	35.7	8.9	9.0	9.2	8.9	8.8	9.0
UI Stone	37.2	33.6	38.5	32.8	31.9	34.8	9.0	9.0	9.2	9.2	9.1	9.1
WA 8297 CL+	35.2	34.0	38.9	31.9	32.9	34.6	8.9	8.8	9.0	8.9	8.9	8.9
WA 8303 CL+	32.1	31.9	33.9	35.2	32.4	33.1	8.9	8.9	9.2	8.9	8.7	8.9
WB-1035CL+	28.6	28.8	30.2	31.9	31.2	30.1	8.3	8.5	8.8	8.4	8.5	8.5
WB6121	31.0	29.9	31.5	32.8	32.4	31.5	8.7	8.8	8.7	8.8	8.7	8.7
WB6341	32.5	33.2	36.3	33.3	32.2	33.5	8.8	9.0	9.1	8.8	9.0	8.9
WB6430	35.7	34.2	36.7	34.3	34.9	35.2	9.1	8.9	9.3	8.9	9.1	9.1
Location Average	33.3	31.0	34.8	32.6	31.1	32.5	8.9	8.8	9.0	8.9	8.9	8.9

*= indicates club wheat

Table 78. SRC (Solvent Retention Capacity) data for Soft White Spring Wheat at Rupert, Aberdeen, Idaho Falls, 2018.

Variety	Rupert				Aberdeen				Idaho Falls			
	Water	Sucrose	Na ₂ CO ₃	LacticAcid	Water	Sucrose	Na ₂ CO ₃	LacticAcid	Water	Sucrose	Na ₂ CO ₃	LacticAcid
Alturas	51.4	99.3	64.3	96.3	51.4	100	67.6	99.6	51.8	94	64.6	83.7
UI Cookie	51.6	96.8	63.7	87.6	49.1	98.2	66.6	96.7	49.5	92.7	65.1	75.9
IDO1702S	52	101.6	66.2	90.1	53.4	102.1	69.9	98.2	52.2	99	67.4	85.6
SY Saltese	49.8	93.7	65.1	79.7	49.6	93.4	68.6	83.7	50.6	90.4	66.2	78.6
UI Pettit	51.9	95.3	65.9	76	49.7	91.3	65.3	84.3	52.2	89.3	67	73.6
UI Stone	51	94.6	63.6	85.4	49.2	93.1	65.6	89.1	49.7	90	64.7	78.9
Location average	51.3	96.9	64.8	85.9	50.4	96.4	67.3	91.9	51.0	92.6	65.8	79.4

	Ashton				Soda Springs			
	Water	Sucrose	Na ₂ CO ₃	LacticAcid	Water	Sucrose	Na ₂ CO ₃	LacticAcid
Alturas	51.7	99.8	70.3	99.5	49.9	99.8	66.4	110
UI Cookie	50.6	98.7	69.1	96.9	49.9	98.9	66.8	113.4
IDO1702S	51.8	104.8	71.5	100.9	51.1	103.6	68.2	109.5
SY Saltese	50.1	98.9	71.1	98.8	49.4	98.3	67	102.7
UI Pettit	52.1	98.2	68.4	92.2	50.4	93.8	65.4	88.5
UI Stone	51.6	100.5	68.3	106.8	48.6	96.5	67.2	106.8
Location average	51.3	100.2	69.8	99.2	49.9	98.5	66.8	105.2

Addendum 1. Stripe rust (*Puccinia striiformis* f. sp. *tritici*) ratings for 2019 winter wheat.

Ratings were based on an index of percent tissue affected by stripe rust multiplied by infection type.

2019 Disease Ratings in Aberdeen

Hard winter wheat under naturally occurring infection

Variety	Stripe Rust Infection Type	Percent Leaf Area Infected	IT x PLAI %	Stripe Rust Rating
AP Nugrain (W)	6.0	40	2.40	S
Bobcat	0.0	0	0.00	R
FourOsix	6.0	1	0.06	R
Greenville	6.0	45	2.40	VS
IDO1506 (W)	6.0	20	1.20	S
IDO1607	6.0	70	4.20	VS
IDO1806 (W)	6.0	50	3.00	VS
Irv (W)	0.0	0	0.00	R
Keldin	6.0	40	2.40	S
Keldin + 11-52-0	6.0	40	2.40	S
LCS Jet	7.0	20	1.40	S
LCS Rocket	0.0	0	0.00	R
LCS Yeti (W)	7.0	20	1.40	S
LCS Zoom	0.0	0	0.00	R
Millie (W)	0.0	0	0.00	R
Norwest 553*	0/7	0/60	0/2.4	R/S
Ray	5.0	20	1.00	S
Scorpio	7.0	5	0.35	MR
Sequoia	7.0	60	4.20	VS
UI Bronze Jade (W)	7.0	50	3.50	VS
Utah 100	6.0	60	3.60	VS
WA8252 (W)	6.0	20	1.20	S
WA8289	6.0	30	1.80	S
WB4311	0.0	0	0.00	R
WB4623CLP	0.0	0	0.00	R
WB4792	6.0	40	2.40	S
Whetstone	7.0	70	4.90	VS
Yellowstone	6.0	40	2.40	S
Average	4.7	28	1.80	

* Mixture

(W) = White

Infecton Type: on a scale from 0 to 9, where 0 is immune, 1 is resistant, and 8 to 9 is very susceptible.

TIPS:

R to MR - should not need fungicides

R to MR - should not need fungicides unless disease pressure becomes high

MR to MS - consider spraying with protective fungicides under medium to high disease pressure

S = will need protective fungicide application when stripe rust is present

VS = will need fungicides in the presence of stripe rust, at times up to three applicatons in severe years

2019 Disease Ratings in Aberdeen

Soft white winter wheat under naturally occurring infection

Variety	Stripe Rust Infection	Percent Leaf Area Infected	IT x PLAI	Stripe Rust Rating
Appleby CL+	6.0	2	0.12	R
Brundage	8.0	80	6.40	VS
Bruneau	6.0	10	0.60	MS
IDO1708	7.0	1	0.07	MR
Jasper	7.0	1	0.07	MR
LCS Artdeco	0.0	0	0.00	R
LCS Blackjack	0.0	0	0.00	R
LCS Drive	0.0	0	0.00	R
LCS Ghost	6.0	1	0.06	R
LCS Hulk	0.0	0	0.00	R
LCS Shark	0.0	0	0.00	R
Nixon	0.0	0	0.00	R
Norwest Duet	0.0	0	0.00	R
Norwest Tandem	0.0	0	0.00	R
OR2X2CL+	0.0	0	0.00	R
Purl	6.0	2	0.12	R
Rosaly	6.0	5	0.30	MR
Stephens	6.0	40	2.40	S
Stingray CL+	0.0	0	0.00	R
SY Ovation	8.0	10	0.80	MS
SY Assure	0.0	0	0.00	R
SY Raptor	0.0	0	0.00	R
UI Castle CL+	6.0	5	0.30	MR
UI Magic CL+	6.0	50	3.00	VS
UI Sparrow	7.0	50	3.50	VS
UIL 11-456031A	0.0	0	0.00	R
UIL 17-6268 (CL+)	6.0	1	0.06	R
UIL 17-6333 (CL+)	0.0	0	0.00	R
UIL 17-6546 (CL+)	0.0	0	0.00	R
UIL 17-6834 (CL+)	0.0	0	0.00	R
UIL15-72223	0.0	0	0.00	R
VI Bulldog	0.0	0	0.00	R
WB 456	6.0	10	0.60	MS
WB1376CLP	7.0	10	0.70	MS
WB1529	0.0	0	0.00	R
WB1783	7.0	2	0.14	MR
Average		3.1	8	0.53

Addendum 2. Stripe rust (*Puccinia striiformis* f. sp. *tritici*) ratings for 2019 spring wheat.

Ratings were based on an index of percent tissue affected by stripe rust multiplied by infection type.

2019 Disease Ratings in Aberdeen

Hard spring wheat under naturally occurring infection

Variety	Stripe Rust Infection Type (IT)	Percent Leaf Area Infected (PLAI)	IT x PLAI %	Stripe Rust Rating
I2SB0224 (W)	0	0	0.0	R
Alum	0	0	0.0	R
Alzada (D)	6	1	0.1	R
AP Octane	0	0	0.0	R
AP Venom	6	5	0.3	MR
APRenegade	0	0	0.0	R
Cabernet	6	1	0.1	R
CPX36619	0	0	0.0	R
Dayn (W)	0	0	0.0	R
Glee	0	0	0.0	R
IDO1603S	6	2	0.1	R
IDO1701S	0	0	0.0	R
IDO1702S	6	1	0.1	R
IDO1805S	0	0	0.0	R
Imperial (D)	3	5	0.2	R
Jefferson	7	30	2.1	S
Klasic (W)	6	30	1.8	S
Klasic (W) 1.2	6	30	1.8	S
Klasic (W) 1.4	6	30	1.8	S
SY Coho	6	10	0.6	MS
SY Gunsight	0	0	0.0	R
SY-Teton (W)	6	10	0.6	MS
UI Platinum (W)	5	20	1.0	S
WA8280 CL+	6	1	0.1	R
WB7202 CLP	0	0	0.0	R
WB7328 (W)	6	20	1.2	S
WB7589 (W)	6	1	0.1	R
WB7696	6	30	1.8	S
WB9411	0	0	0.0	R
WB9590	6	40	2.4	S
WB9668	0	0	0.0	R
WB9879CLP	7	30	2.1	S
Average	3.5	9.2	0.55	

(W) = White

(D) = Durum

(CLP) = 2-gene Clearfield

2019 Disease Ratings in Aberdeen

Soft white spring wheat under naturally occurring infection

Variety	Stripe Rust Infection Type (IT)	Percent Leaf Area Infected (PLAI)	IT x PLAI %	Stripe Rust Rating
Alturas	6	40	2.4	S
IDO1401S	6	60	3.6	VS
Louise	4	5	0.2	R
Melba	0	0	0.0	R
Ryan	6	2	0.1	R
Seahawk	0	0	0.0	R
SY Saltrese	6	1	0.1	R
Tekoa	6	1	0.1	R
UI Cookie	4	40	1.6	S
UI Pettit	7	50	3.5	VS
UI Stone	6	40	2.4	S
WA 8297 CL+	0	0	0.0	R
WA 8303	0	0	0.0	R
WB 6121	0	0	0.0	R
WB 6430	0	0	0.0	R
WB-1035CL+	7	50	3.5	VS
Average	3.6	18.3	1.1	

Infection Type: on a scale from 0 to 9, where 0 is immune, 1 is resistant, and 8 to 9 is very susceptible.

TIPS:

R to MR - should not need fungicides

MR - should not need fungicides unless disease pressure becomes high

MR to MS - consider spraying with protective fungicides under medium to high disease pressure

S = will need protective fungicide application when stripe rust is present

VS = will need fungicides in the presence of stripe rust, at times up to three applications in severe years consider spraying at herbicide timing to prevent infection in S and VS varieties.

**Addendum 3a. Results from the 2018 FHB Spring Wheat Screening nursery,
Aberdeen, ID, where plots were inoculated with corn spawn colonized with
Fusarium graminearum. Results are based on one year's data.**

Rankings may change from year to year and with high disease pressure.

Lines with the same letter behind the ratings are not significantly different.

Table 1. Screening (32) hard red spring wheat varieties for FHB resistance

Variety	Resistance rating	FHB Index*	FDK (%)	DON (ppm)
HRS3419	MR	0.2	J	0.4
Rollag	MR	0.8	IJ	0.3
SY Gunsight	MR	1.8	IJ	2.8
WB9411	MR	3.9	IJ	1.5
WB9590	MR	3.1	IJ	0.9
12SB0197	MS	6.6	HIJ	6.7
AP Renegade	MS	10.5	F-J	3.9
DuClair	MS	10.6	E-J	1.1
IDO1603S	MS	14.3	D-I	2.5
IDO1701S	MS	12.4	E-J	3.5
IDO1703S	MS	17.3	D-I	4.5
LCS Iron	MS	8.8	F-J	2.4
LCS Luna	MS	13.9	D-J	1.9
MT1673	MS	5.6	HIJ	0.5
NS Presser	MS	12.4	E-J	0.7
WA 8285	MS	11.9	E-J	1.9
WB9578	MS	21.5	C-G	4.8
XB9240	MS	5.7	HIJ	4.4
XB9610	MS	7.5	G-J	1.7
Alum	S	19.4	C-H	3.6
Cabernet	S	21.9	C-F	3.9
Choteau	S	33.9	BC	3.8
Glee	S	17.1	D-I	3.5
Kelse	S	27.5	BCD	4.7
SY Basalt	S	24.5	B-E	8.3
SY Coho	S	19.2	C-H	6.3
SY Selway	S	37.4	B	3.0
WB936	S	33.4	BC	12.0
WB9433	S	37.4	B	8.8
WB9668	S	13.5	D-J	6.9
XB9551	S	17.4	C-I	4.7
Jefferson	VS	52.9	A	6.4
<i>P</i> (<i>a</i> =0.05)		<0.0001	<0.0001	<0.0001

* FHB Index = (% Severity x % Incidence)/100

Data analyzed using PROC GLYMMIX in SAS

Resistance rating was calculated using the formula: DISK = (0.3DON + 0.2 Incidence + 0.2 Severity + 0.3 FDK)

Resistance Rating	DISK
MR	0 - 10
MS	10.1 - 18
S	18.1 - 30
VS	> 30

Addendum3b. Results from the 2018 FHB Spring Wheat Screening nursery, Aberdeen, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*.

Results are based on one year's data. Rankings may change from year to year and with high disease pressure. Lines with the same letter behind the ratings are not significantly different.

Table2. Screening (15) hard white spring wheat and (2) durum varieties for FHB resistance

Variety	Resistance Rating	FHB Index*		FDK (%)		DON (ppm)	
12SB0224	MS	7.9	G	4.1	D-H	3.5	CD
Dayn	MS	7.6	G	1.5	I	3.0	D
LCS Star	MS	7.1	G	1.8	HI	4.0	CD
WB7328	MS	7.2	G	3.0	F-I	6.0	BCD
Alzada(D)	S	24.1	CD	7.0	BC	13.7	AB
IDO1202S	S	20.5	C-F	3.7	E-I	5.1	CD
IDO1203-A	S	23.7	CDE	5.5	B-F	7.6	BCD
IDO1602S	S	20.2	C-F	2.4	GHI	6.1	BCD
Imperial(D)	S	14.7	D-G	5.7	B-E	11.3	BC
Klasic	S	12.6	FG	9.6	A	19.5	A
Snow Crest	S	12.3	FG	4.1	D-H	7.7	BCD
SY-Teton	S	24.7	CD	2.8	GHI	6.1	BCD
UI Platinum	S	26.4	C	5.4	C-F	6.7	BCD
WB7202CLP	S	13.0	EFG	4.8	C-G	8.8	BCD
WB7589	S	28.3	BC	6.6	BCD	6.3	BCD
IDO1604S	VS	44.7	A	4.8	C-G	8.4	BCD
WB-Paloma	VS	38.1	AB	8.0	AB	11.3	BC
<i>P</i> ($\alpha=0.05$)		<.0001		0.0002		0.0502	

(D)=durumwheat

* FHB Index = (% Severity x % Incidence)/100

Data analyzed using PROC GLYMMIX in SAS

Resistance rating was calculated using the formula: DISK = (0.3DON + 0.2 Incidence + 0.2 Severity + 0.3 FDK)

Resistance Rating	DISK
MR	0 - 10
MS	10.1 - 18
S	18.1 - 30
VS	> 30

Addendum 3c. Results from the 2018 FHB Spring Wheat Screening nursery, Aberdeen, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*.

Results are based on one year's data. Rankings may change from year to year and with high disease pressure. Lines with the same letter behind the ratings are not significantly different.

Table 3. Screening (22) soft white spring wheat varieties for FHB resistance

Variety	Resistance Rating	FHB Index*		FDK (%)		DON (ppm)	
Alturas	MR	2.9	GH	2.0	ABC	3.5	CDE
IDO1401S	MR	3.0	GH	0.3	C	0.5	E
Melba	MR	4.2	FGH	0.5	C	1.1	DE
WB6121	MR	0.5	H	0.4	C	1.1	DE
WB6341	MR	4.8	E-H	0.8	C	1.5	DE
XB7610	MR	1.5	GH	0.5	C	0.5	E
14-SSW-1059	MS	10.9	D-H	2.1	ABC	5.9	ABC
IDO1702S	MS	3.8	GH	1.0	C	2.7	DE
Ryan	MS	7.2	E-H	1.2	BC	3.7	CD
Tekoa	MS	14.2	C-G	0.9	C	1.8	DE
UI Cookie	MS	18.0	CDE	0.8	C	1.9	DE
UI Pettit	MS	13.5	C-H	0.9	C	2.2	DE
UI Stone	MS	17.5	C-F	0.6	C	1.7	DE
WA 8303 CL+	MS	10.1	D-H	1.3	BC	3.6	CDE
WB-1035CL+	MS	3.7	GH	3.1	AB	7.8	A
WB6430	MS	13.4	C-H	1.3	BC	2.8	CDE
14-FAC-2043	S	23.3	BCD	1.5	BC	3.9	CD
IDO1403S	S	11.5	D-H	0.8	C	1.5	DE
Louise	S	42.1	A	3.6	A	4.2	BCD
Seahawk	S	25.8	BC	0.8	C	1.8	DE
SY Saltese	S	21.3	BCD	1.9	ABC	2.8	CDE
WA 8297 CL+	S	32.0	AB	3.6	A	7.1	AB
P ($\alpha=0.05$)		0.0001**		0.0455**		0.0026**	

* FHB Index = (% Severity x % Incidence)/100

Data analyzed using PROC GLYMMIX in SAS

Resistance rating was calculated using the formula: DISK = (0.3DON + 0.2 Incidence + 0.2 Severity + 0.3 FDK)

Resistance Rating	DISK
MR	0 - 10
MS	10.1 - 18
S	18.1 - 30
VS	> 30

Addendum 4a. Results from the 2018 FHB Spring Barley Screening nursery, Aberdeen, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*. Results are based on one year's data. Rankings may change from year to year and with high disease pressure.
Lines with the same letter behind the ratings are not significantly different.

Table 1. Screening (37+2) two-rowed malt barley varieties for FHB resistance

Variety	Resistance rating	FHB Index (%)	DON (ppm)	
08ARS116-91	MR	1.3	DEF	3.6 J-M
2Ab08-X05M010-82	R	0.7	EF	2.4 LM
2B13-6991	MR	1.0	EF	2.7 LM
AAC Connect	R	0.4	EF	1.3 M
ABI Eagle	MR	1.8	C-F	2.9 KLM
ABI Balster	MR	0.7	EF	3.4 J-M
ABI Growler	MR	0.7	EF	2.6 LM
ABI Voyager	MR	0.7	EF	3.2 KLM
AC Metcalfe	MR	1.4	DEF	2.3 M
ACC Synergy	MR	0.8	EF	4.4 I-M
AD120341	MS	3.6	B-E	11.9 B-F
CDC Bow	R	0.2	EF	0.9 M
CDC Copeland	R	0.4	EF	2.7 LM
CDC Fraser	R	0.5	EF	2.4 LM
Clho 4196	R	0.1	F	3.3 J-M
Conlon	R	0.2	EF	1.7 M
Conrad	MR	0.8	EF	5.2 H-M
DH120058	MR	0.6	EF	9.7 D-H
DH120285	MS	2.4	C-F	6.3 F-M
Esma	MS	2.1	C-F	9.1 E-J
Explorer	MS	2.2	C-F	8.7 E-K
Far15-52A	MS	2.4	C-F	3.1 KLM
Full Pint	MS	3.0	B-F	8.7 E-K
Garnet	MS	1.8	C-F	5.1 H-M
GemCraft	MR	1.9	C-F	5.8 G-M
Golden Promise	MS	2.5	C-F	4.3 I-M
Harrington	MS	1.8	C-F	8.2 E-L
ICB 111809	MS	5.1	ABC	10.7 C-H
LCS Genie	S	4.6	BCD	19.9 A
LCS Odyssey	S	4.8	BC	11.7 B-G
LCS Opera	S	3.3	B-F	16.3 ABC
LCS Sienna	MR	0.9	EF	5.3 H-M
Manta	MS	4.7	BCD	9.5 E-H
Merit 57	MR	1.1	EF	4.6 I-M
Moravian 69	MS	5.0	BC	13.7 B-D
Moravian 165	MS	1.2	EF	1.4 M
Moravian 179	S	6.2	AB	10.7 C-H
Sangria	S	4.6	BCD	16.8 AB
SY Sirish	S	8.5	A	15.5 A-D
<i>P</i> (<i>a</i> =0.05)		0.0013**	<.0001**	

* FHB Index = (% Severity x % Incidence)/100

Data analyzed using PROC GLYMMIX in SAS

Resistance rating was calculated using the formula: DIS = (0.6DON + 0.2 Incidence + 0.2 Severity)

Resistance Rating	DIS
R	0 - 4.9
MR	4.9 - 10
MS	10.1 - 20
S	20.1 - 30
VS	> 30

Addendum 4b. Results from the 2018 FHB Spring Barley Screening nursery, Aberdeen, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*. Results are based on one year's data. Rankings may change from year to year and with high disease pressure. Lines with the same letter behind the ratings are not significantly different.

Table 2. Screening (13+2) two-rowed feed barley varieties for FHB resistance

Variety	Resistance rating	Index		DON (ppm)	
Altorado	MS	2.4	ABC	5.2	BCD
Champion	MR	1.5	ABC	4.2	CD
Claymore	MR	2.0	ABC	2.6	D
Clho 4196	R	0.1	C	3.3	D
Goldenhart	MR	2.1	ABC	4.4	CD
ICB 111809	MS	5.1	A	10.7	ABC
Idagold II	MS	4.2	AB	11.7	AB
Julie	MR	1.5	ABC	2.9	D
Kardia	MR	1.5	ABC	1.9	D
LCS Vespa	MS	2.2	ABC	8.3	A-D
Lenetah	R	0.5	C	2.0	D
Oreana	MS	1.8	ABC	13.3	A
Otis	MS	1.7	ABC	12.2	A
Transit	MR	0.8	BC	1.9	D
Xena	MR	1.9	ABC	3.7	D
<i>P</i> ($\alpha=0.05$)		0.5392 ^{ns}		0.0161**	

* FHB Index = (% Severity x % Incidence)/100

Data analyzed using PROC GLYMMIX in SAS

Resistance rating was calculated using the formula: DIS = (0.6DON + 0.2 Incidence + 0.2 Severity)

Resistance Rating	DIS
R	0 - 4.9
MR	4.9 - 10
MS	10.1 - 20
S	20.1 - 30
VS	> 30

Addendum 4c. Results from the 2018 FHB Spring Barley Screening nursery, Aberdeen, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*.

Results are based on one year's data. Rankings may change from year to year and with high disease pressure. Lines with the same letter behind the ratings are not significantly different.

Table 3. Screening (9) six-rowed barley varieties for FHB resistance

Variety	Resistance rating	FHB Index (%)		DON (ppm)	
Chevron	R	0.1	B	0.3	B
Millennium	MS	3.3	B	7.1	B
PI383933	S	24.0	A	7.5	B
Quest	MR	0.6	B	2.7	B
Stander	MS	3.3	B	6.8	B
UT11302-11	MS	2.2	B	8.5	B
UTSB10902-91	MS	3.6	B	8.3	B
UTSB10905-72	MS	4.4	B	9.2	B
YU510-510	VS	24.3	A	32.7	A
<i>P</i> ($\alpha=0.05$)		0.0665 ^{ns}		0.0958 ^{ns}	

* FHB Index = (% Severity x % Incidence)/100

Data analyzed using PROC GLYMMIX in SAS

Resistance rating was calculated using the formula: DIS = (0.6DON + 0.2 Incidence + 0.2 Severity)

Resistance Rating	DIS
R	0 - 4.9
MR	4.9 - 10
MS	10.1 - 20
S	20.1 - 30
VS	> 30

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