



2020 Small Grains Report

Southcentral and Southeast Idaho Cereals Research & Extension Program

*Juliet Marshall, Belayneh A. Yimer, Tod Shelman, Linda Jones, Suzette A. Baldwin,
Jon Hogge, Justin Hatch, Margaret Moll, and Sarah Windes*

Cover Images

Top: A farm in Ashton area, ID. Bottom left and right: Wheat fields in Shelley and Ashton areas, ID.
Photo credit: Top—Tod Shelman; bottom right and left—Juliet Marshall.

Southcentral and Southeastern Idaho Cereals Research and Extension Program
www.uidaho.edu/extension/cereals/scseidaho

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ACKNOWLEDGMENTS

Idaho wheat and barley producers, through cooperative research and extension grants from the Idaho Wheat and Barley Commissions, provided partial funding for these small grain performance evaluations. Support was also provided by the University of Idaho Cooperative Extension System, the Idaho Agricultural Experiment Station, and by fees paid by plant breeding companies. This report represents the collective efforts of many individuals. University of Idaho Extension County Educators coordinated many of the off-station nurseries and field days. Grower-cooperators provided their time, land, and other inputs for management of these trials and appreciation is expressed to them for their support. The UI Wheat Quality Laboratory at Aberdeen analyzed the quality of harvested wheat samples. Appreciation is also expressed to the numerous support personnel who assisted with trial establishment, maintenance, harvest, grain processing, and data analysis. Finally, cereal breeders throughout the Northwest are recognized for their contributions since the nurseries would not be possible without their entries. The authors wish to thank all who have contributed to the success of this project.

Grower Cooperators:

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

Cereals Research and Extension Employees

Martha Carrillo

Other UI Employees

Randy Gamble Kristi Copeland Sherrie Mauroner
Lyona Anderson Ericka Ziebarth Mary Corbridge
Beth Brune

UI Extension Educators

Lance Ellis - Fremont County
Joseph Sagers - Jefferson County
Reed Findlay - Bannock and Bingham Counties
Jason Thomas - Minidoka County
Ron Patterson - Bonneville County
Bracken Henderson - Franklin County
Terrell Sorensen - Power County

About the Authors

Juliet Marshall is the Cereals Cropping Systems Agronomist & Pathologist with the UI SC & SE Idaho Cereals Extension Program.

Belayne A. Yimer is a Postdoc/Research Support Scientist with the UI SC & SE Idaho Cereals Extension Program.

Tod Shelman is a Scientific Aide II with the UI SC & SE Idaho Cereals Extension Program.

Linda Jones is a Technical Aide II with the UI SC & SE Idaho Cereals Extension Program.

Suzette A. Baldwin is a PhD student with the UI SC & SE Idaho Cereals Extension Program.

Jon Hogge is UI Extension Educator, Madison County

Justin Hatch is UI Extension Educator, Caribou County

Margaret Moll is a Senior Research Support Scientist/Senior Diagnostician with the UI

Sarah Windes is the Lab Manager of the UI Wheat Quality Laboratory at Aberdeen.

Peer Reviewed by

John Burns – Washington St Univ., Prof. emeritus
Dr. Dale Clark – Nutrien Ag
Dr. David Hole – Utah State University
Dr. Chris Rogers – USDA-ARS, Kimberly

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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2020 Small Grains Report for Southcentral and Southeastern Idaho

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Additions and Changes:

A location at Ririe was added as a test site for the irrigated winter wheat trials in addition to the previous year's three locations at Aberdeen, Kimberly and Rupert.

Introduction

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 marketplace is a cooperative effort by many individuals.

Varieties are best evaluated by comparing performance over several 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 2020, as well as milling and baking data from trials harvested in 2019.

Materials & Methods

Locations

Cereal trials were established at seven winter and five spring locations throughout SC and SE Idaho during the fall of 2019 and the spring of 2020. For location details, please see the descriptions on pages 6 to 12. The Rockland & Soda Springs winter and spring trials were grown under dryland conditions. At Ririe there were both dryland and irrigated trials. 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-inch 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 double 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 barley: lbs/acre nitrogen needed = 1.7 times the yield goal. Hard wheat nurseries received the remaining balance of nitrogen as urea (46-0-0) topdressed at heading using hand broadcast spreaders. Fertilizers and pesticides applied are listed on pages 6 to 12. 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, and data were recorded 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 2020 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 66. 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 2020 harvest in this report. Data are given for these characteristics from the 2019 harvest and are found in tables 67-80.

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

- Plumps: 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.

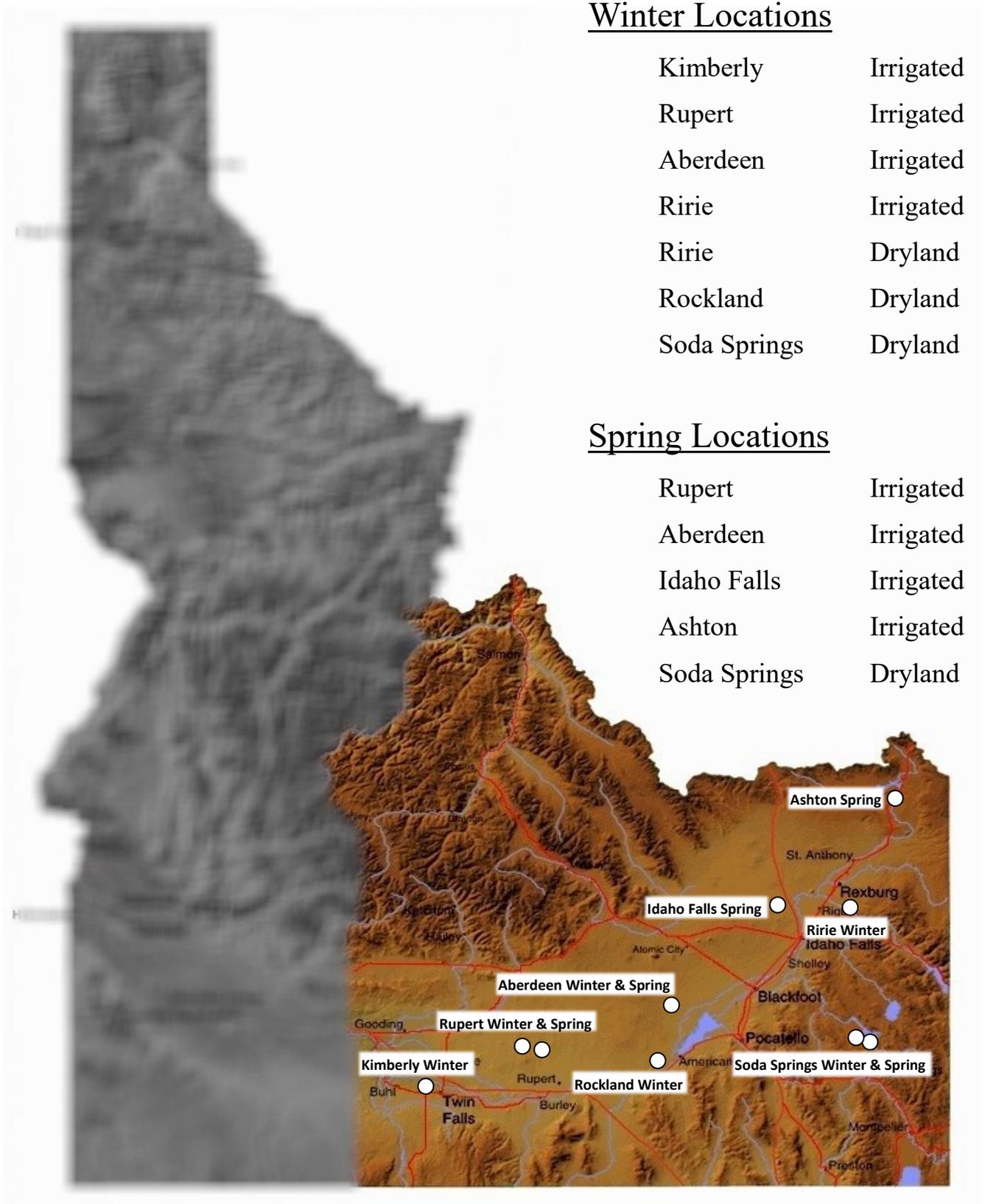
Varieties Tested

A list of released varieties tested in 2019-2020 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 2010-2019.

Southcentral & Southeast Idaho Cereal Variety Trial Locations



Location Descriptions

Kimberly Winter Irrigated:

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

Coordinates: 42°33'4.86"N 114°20'31.40"W
Elevation: 3897 ft.
Soil Type: #10 Bahem silt loam, 1-4% slopes
Previous Crop: Spring Barley
Planting Date: October 8, 2019
Harvest Date: August 6, 2020
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")	1.3	8.0	11.5	268	268	32 ppm	287ppm	39ppm
Fertilizer applied (lbs/A)	-	-	-	215	125	110#		52# SO ₄
Total	1.3	8.0	11.5	483	393	-	-	52# SO ₄

Rupert Winter Irrigated:

**Cooperator: Luke Adams
Located at 900 N. 150 W. Rupert, Idaho**

Coordinates: 42°44'59.98"N 113°41'54.76"W
Elevation: 4269 ft.
Soil Type: #24 Portneuf silt loam, 1-4% slopes
Previous Crop: Spring Barley
Planting Date: September 24, 2019
Harvest Dates: August 20 & 21, 2020
Chemicals applied: Huskie 15oz./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	12.3	122	122	21 ppm	294 ppm	26 ppm
Fertilizer applied (lbs/A)	-	-	-	302	262	75#	8#	89#
Total	1.2	7.7	12.3	424	384	75#	8#	89#

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: October 2, 2019
Harvest Dates: August 12 & 13, 2020
Chemicals applied: Huskie 15 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")	1.06	8.4	8.2	168	168	18 ppm	342 ppm	35 ppm
Fertilizer applied (lbs/A)	-	-	-	240	200	-	20#	100#elemental Sulfur
Total	1.06	8.4	8.2	408	368	-	20#	100# Elem. S

Ririe Winter Irrigated:

**Cooperator: Clark Hamilton
Located at HWY 26 and 175 E, ¼ mile south of highway.**

Coordinates: 43°36'46.48"N, 111°41'25.70"W
Elevation: 5030 ft.
Soil Type: #7 Bock Loam Soil
Previous Crop: Peas
Planting Date: September 26, 2019
Harvest Date: August 14 & 17, 2020
Chemicals applied: MCPA .7 pts, Affinity Broadspec .8 oz, 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")	1.7	7.9	2.6	118	118	18 ppm	333 ppm	48 ppm
Fertilizer applied (lbs/A)	-	-	-	214	174	30#	-	-
Total	1.7	7.9	2.6	332	292	30#	-	-

Location Descriptions

Ririe Winter Dryland:

Cooperator: Trevor Davey

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

Coordinates: 43°33'32.63"N 111°43'04.10"W
Elevation: 5537 ft.
Soil Type: #42 Ririe silt loam, 4-12% slopes
Previous Crop: Fallow
Planting Date: October 3, 2019
Harvest Date: August 17, 2020
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")	1.5	6.4	<1.0	116#	116#	38 ppm	400 ppm	15 ppm
Fertilizer applied (lbs/A)	-	-	-	40	40	30 #	-	-
Total	1.5	6.4	<1.0	156	156	30#	-	-

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 18, 2019
Harvest Date: August 3, 2020
Chemicals applied: GoldSky 16oz/A, LV6 8oz/A

Fertility:

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

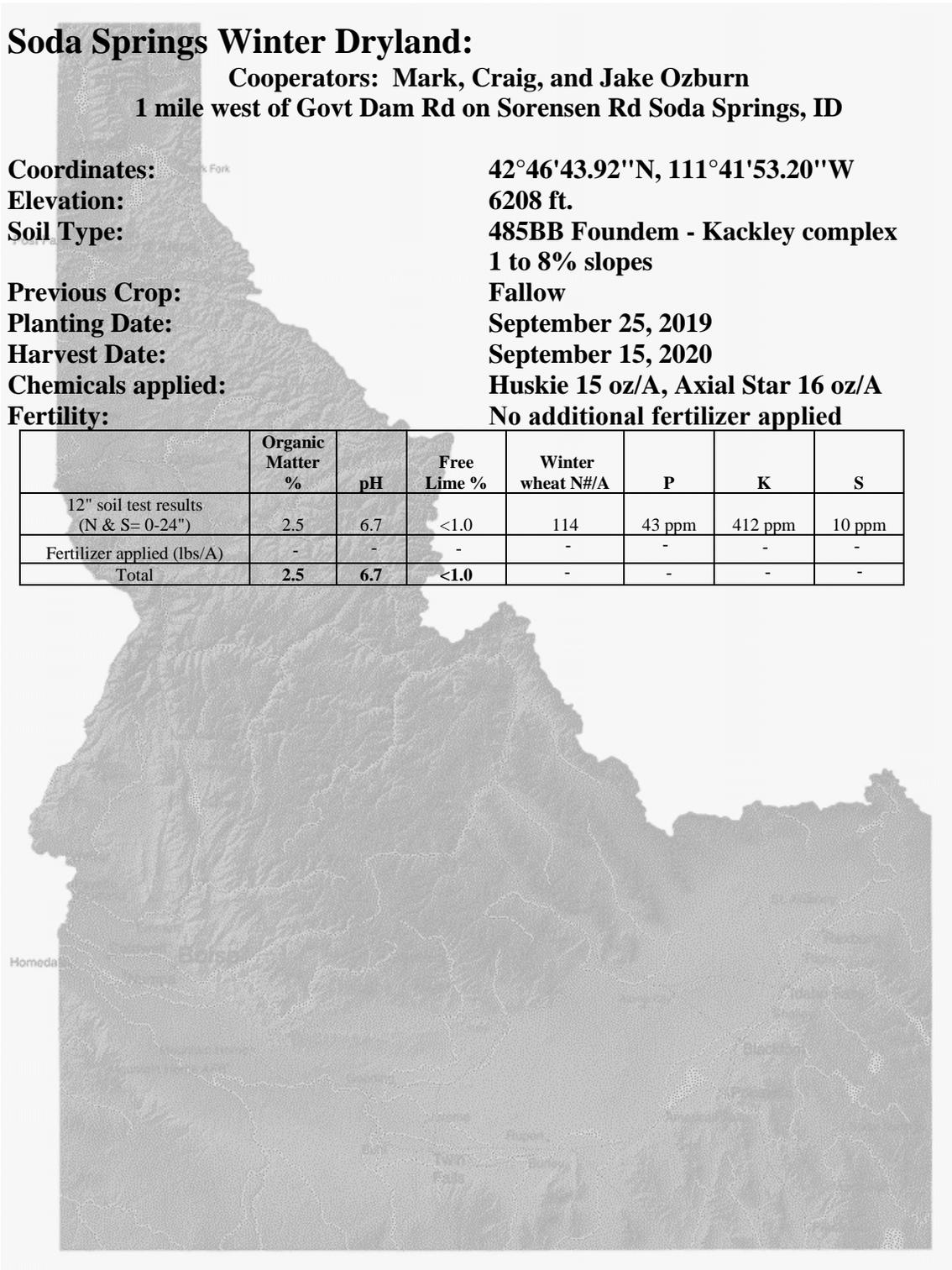
Location Descriptions

Soda Springs Winter Dryland:

Cooperators: Mark, Craig, and Jake Ozburn
1 mile 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: September 25, 2019
Harvest Date: September 15, 2020
Chemicals applied: Huskie 15 oz/A, Axial Star 16 oz/A
Fertility: No additional fertilizer applied

	Organic Matter %	pH	Free Lime %	Winter wheat N#/A	P	K	S
12" soil test results (N & S= 0-24")	2.5	6.7	<1.0	114	43 ppm	412 ppm	10 ppm
Fertilizer applied (lbs/A)	-	-	-	-	-	-	-
Total	2.5	6.7	<1.0	-	-	-	-



Location Descriptions

Rupert Spring Irrigated:

**Cooperator: Grant 4-D Farms
Approximately 500 E. 700N., Rupert, ID**

Coordinates: 42°43'18.50"N, 113°34'11.79"W
Elevation: 4202 ft.
Soil Type: #23 Portneuf silt loam, 0-1% slopes
Previous Crop: Sugar Beets
Planting Date: March 24, 2020
Harvest Dates: August 10&11, 2020
Chemicals applied: Huskie 15oz/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")	1.2	7.9	1.1	183	183	28 ppm	318 ppm	24 ppm
Fertilizer applied (lbs/A)	-	-	-	180	110	-	-	30#
Total	1.2	7.9	1.1	363	293	-	-	30#

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 9, 2020
Harvest Date: August 28 & 31, 2020
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	7.8	7.2	233	233	26 ppm	365 ppm	78 ppm
Fertilizer applied (lbs/A)	-	-	-	90	50	-	-	20# SO ₄
Total	0.9	7.8	7.2	323	283	-	-	20#SO ₄

Location Descriptions

Idaho Falls Spring Irrigated:

Cooperator: Marc Thiel
Approximately 2350 S. on 45th West Idaho Falls, ID

Coordinates: 43°28'43.31"N, 112°7'24.15"W
Elevation: 4684 ft.
Soil Type: #22 Pancheri silt loam, 0-2% slopes
Previous Crop: Potatoes
Planting Date: April 20, 2020
Harvest Date: August 25, 2020
Chemicals applied: Huskie 15 oz/A, Starane Ultra 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")	1.7	8.0	9.7	175	175	39 ppm	291 ppm	24 ppm
Fertilizer applied (lbs/A)	-	-	-	115	50	30#	-	-
Total	1.7	8.0	9.7	290	225	30#	-	-

Ashton Spring Irrigated:

Cooperator: Alan Baum
Approximately 4000 E. 1450 N. Ashton, ID

Coordinates: 44°05'21.86"N, 111°21'21.38"W
Elevation: 5557 ft.
Soil Type: #74 Marystown silt loam 8 – 12% slopes
Previous Crop: Barley
Planting Date: May 5, 2020
Harvest Date: September 3, 2020 – Barley
 September 11, 2020 - Wheat
Chemical applied: Huskie 15 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")	2.5	5.9	<1.0	100	100	45 ppm	317 ppm	17 ppm
Fertilizer applied (lbs/A)	-	-	-	165	80	10#	50#	20#
Total	2.5	5.9	<1.0	265	180	10#	50#	20#

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°48'48.91"N 111°38'41.05"W
Elevation: 6220 ft.
Soil Type: #485BB - Foundem - Kackley complex,
 1 to 8 % slopes
Previous Crop: Spring Barley
Planting Date: May 11, 2020
Harvest Date: September 10, 2020
Chemicals applied: Huskie 12 oz/A, AxialStar 16oz/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	-	-	52	52	13#	-	13#
Total	-	-	-	52	52	13#	-	13#

Temperature and irrigation/precipitation totals for some 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 21 – August 6, 2020	115.3	29.2	15	73	21	24.7
Rupert winter	May 11 - August 21, 2020	108.9	29.3	42	92	18	13.87
Ririe Dryland	May 5 – August 3, 2020	103.8	31.6	13	46	12	4.23
Rockland	May 11 – August 3, 2020	104.2	27.7	28	63	17	3.4
Idaho Falls	May 5 - August 25, 2020	104.1	29.9	23	89	30	15.18
Ashton	May 5 - September 9, 2020	98.6	23.7	12	115	48	10.67

Table 1. Released varieties tested in 2019-2020 with seed size and adjusted seeding rate.

Variety	Exp. No.	1000 Kernel Weight (g)	Seeds per Pound	Adjusted Seeding Rate ¹ (lb/A)	Year Released	Developer(s)/Distributor of variety
Soft White Winter Wheat						
Appleby CL+	OR12161250CL+	40	11,484	87	2019	Oregon AES
Brundage	ID86-14502B	44	10,428	96	1996	Idaho AES
Devote	WA8271	45	10,080	99	2019	Washington AES, USDA
Eltan	WA7431	39	11,631	86	1990	Washington AES, USDA
Jasper	WA 8169	45	10,080	99	2015	Washington AES, USDA
LCS Artdeco	NSA06-2153A	47	9,651	104	2011	Limagrain Cereal Seeds, LLC
LCS Blackjack	LWW15-71945	44	10,309	97	2019	Limagrain Cereal Seeds, LLC
LCS Drive	LWW12-7105	45	10,193	98	2015	Limagrain Cereal Seeds, LLC
LCS Ghost	LWW14-74143	41	11,200	89	2018	Limagrain Cereal Seeds, LLC
LCS Hulk	LWW14-73163	48	9,549	105	2017	Limagrain Cereal Seeds, LLC
LCS Shark	LWW14-71195	50	9,072	110	2017	Limagrain Cereal Seeds, LLC
LCS Shine	LCS72916	40	11,340	88	2018	Limagrain Cereal Seeds, LLC
LCS Sonic	LWW14-73161	46	9,969	100	2017	Limagrain Cereal Seeds, LLC
M-Idas	11PN050#03	50	9,164	109	2019	McGregor
M-Press		53	8,640	116	2019	McGregor
Nixon	OR2121086	38	12,096	83	2019	Oregon State AES
Norwest Duet	LOR-092	44	10,428	96	2015	OSU /Limagrain Cereal Seeds, LLC
Norwest Tandem	LOR-334	42	10,800	93	2016	OSU /Limagrain Cereal Seeds, LLC
OR2X2CL+	ORI2150031CI+	40	11,340	88	2019	Oregon State AES
Otto	WA008092	43	10,673	94	2011	Washington AES, USDA
Purl	WA8234	45	10,193	98	2018	Washington AES, USDA
Rosalyn	OR2071071	35	12,960	77	2013	Oregon AES
Stephens	OR65-116	44	10,309	97	1977	Oregon AES
Stingray CL+	WA8275CL+	46	9,861	101	2019	Washington AES, USDA
SY Assure	04PN096-2	43	10,549	95	2016	AgriPro /Syngenta Cereals
SY Ovation	03PN108#21	47	9,651	104	2011	AgriPro /Syngenta Cereals
SY Raptor	04PN046#16	54	8,400	119	2017	AgriPro /Syngenta Cereals
UI Castle CL+	IDN 09-DH10	40	11,484	87	2015	Idaho AES / Limagrain Cereal Seeds
UI Magic CL+	IDN 09-DH11	41	11,200	89	2015	Idaho AES / Limagrain Cereal Seeds
UI Sparrow	IDO1108DH	35	13,148	76	2016	Idaho AES
VI Bulldog	UIL 07-28017B	38	11,937	84	2019	Idaho AES / Limagrain Cereal Seeds, LLC
VI Presto CL+	UIL17-6451CL+	44	10,309	97	2020	Idaho AES / Limagrain Cereal Seeds, LLC
VI Shock	UIL15-72223	36	12,777	78	2020	Idaho AES / Limagrain Cereal Seeds, LLC
VI Voodoo CL+	UIL17-6268CL+	46	9,861	101	2020	Idaho AES / Limagrain Cereal Seeds, LLC
WB 456	BU6W99-456	42	10,800	93	2009	Bayer Crop Science / WestBred
WB1376CLP	BZ6WM09-1030CLP	37	12,427	80	2014	Bayer Crop Science / WestBred
WB1529	BZ6W07-436	41	11,063	90	2013	Bayer Crop Science / WestBred
WB1783	BZ6W09-471	45	10,193	98	2016	Bayer Crop Science / WestBred
YSC-201		43	10,673	94	2020	Yield Star Cereals
YSC-215		37	12,259	82	2020	Yield Star Cereals
Hard Red and White (W) Winter Wheat						
AP Iliad	11PN044#84	53	8,640	116	2020	AgriPro /Syngenta Cereals
AP Nugrain (W)	W96-530-053W	40	11,484	87	2006	AgriPro /Syngenta Cereals
AP Redeye	05PN044-20	42	10,800	93	2019	AgriPro /Syngenta Cereals
Flathead		41	11,063	90	2019	Montana AES
FourOSix	MT1462	37	12,427	80	2018	Montana AES
Golden Spike (W)	UT1944-158	36	12,777	78	1999	Utah AES, USDA
Irv (W)	OR2110679	36	12,777	78	2018	Oregon AES
Juniper	IDO 575	39	11,631	86	2005	Idaho AES, USDA
Kairos		44	10,309	97	2020	Highland Specialty Grains
Keldin	ACS55017	54	8,400	119	2011	Bayer Crop Science / WestBred
LCS Jet	NSA 7208	47	9,651	104	2015	Limagrain Cereal Seeds, LLC
LCS Rocket	NSA10-2196	50	9,164	109	2018	Limagrain Cereal Seeds, LLC
LCS Yeti (W)	LCI13DH-2222	47	9,651	104	2018	Limagrain Cereal Seeds, LLC
LCS Zoom	LWH14-73915	42	10,800	93	2019	Limagrain Cereal Seeds, LLC
Millie (W)	OR2130118H	36	12,777	78	2021	Oregon State AES
Promontory	UT1567-51	37	12,259	82	1990	Utah AES, USDA
Sequoia	WA8180	40	11,340	88	2015	Washington AES, USDA
Scorpio	WA8268	39	11,782	85	2019	Washington AES, USDA
UI Bronze Jade (W)	IDO1706	38	11,937	84	2019	Idaho AES
UI Silver (W)	IDO658B	36	12,600	79	2011	Idaho AES, USDA
UI SRG	IDO656	43	10,673	94	2012	Idaho AES, USDA
Utah 100	UT1650-150	42	10,800	93	1997	Utah AES, USDA
WB4311	XA4104	38	11,937	84	2017	Bayer Crop Science / WestBred
WB4401		38	11,937	84	2019	Bayer Crop Science / WestBred
WB4623CLP	BZ9WM09-1663	35	13,148	76	2014	Bayer Crop Science / WestBred
WB4792	XB4711	38	11,937	84	2018	Bayer Crop Science / WestBred
Yellowstone	MT00159	42	10,800	93	2005	Montana AES

¹Adjusted 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 2019-2020 with seed size and adjusted seeding rate.

Variety	Exp. No.	1000 Kernel Weight (g)	Seeds per Pound	Adjusted Seeding Rate ¹ (lb/A)	Released	Developer(s)/Distributor of variety
Soft White Spring Wheat						
Alturas	IDO526	29	15,916	63	2002	Idaho AES, USDA
AP Coachman	08PN2001-07	47	9,651	104	2020	AgriPro / Syngenta Cereals
Louise	WA7921	35	13,148	76	2004	Washington AES, USDA
Melba (club wheat)	WA8193	41	11,200	89	2016	Washington AES, USDA
Ryan	WA8214	36	12,600	79	2016	Washington AES, USDA
Seahawk	WA8162	38	11,937	84	2015	Washington AES, USDA
Tekoa	WA8189	36	12,777	78	2016	Washington AES, USDA
UI Cookie	IDO1405S	34	13,540	74	2019	Idaho AES, USDA
UI Pettit	IDO632	35	13,148	76	2006	Idaho AES, USDA
UI Stone	IDO599	27	17,117	58	2012	Idaho AES / Limagrain Cereal Seeds
WB-1035CL+		44	10,428	96	2011	Bayer Crop Science / WestBred
WB6430	BZ608-125	26	17,788	56	2013	Bayer Crop Science / WestBred
Hard Red Spring Wheat						
Alum	WA8166	31	14,632	68	2015	Washington AES, USDA
AP Octane	USW112000024-1-4	45	10,193	98	2019	AgriPro / Syngenta Cereals
AP Renegade	06PN3017-9	45	10,080	99	2018	AgriPro / Syngenta Cereals
AP Venom	USW112000083-1-3	40	11,484	87	2019	AgriPro / Syngenta Cereals
Choteau	MT9920	32	14,400	69	2003	Montana AES
CP3066	CPX3619	37	12,259	82	2020	Winfield United
Dagmar	MT1621	42	10,930	91	2019	Montana AES
Duclair	MT0832	31	14,872	67	2011	Montana AES
Expresso	DA984-034SRR	36	12,600	79	2006	Bayer Crop Science / WestBred
Glee	WA8074	37	12,259	82	2012	Washington AES, USDA
Jefferson	IDO462	33	13,957	72	1998	Idaho AES, USDA
Lanning	MT1316	39	11,782	85	2016	Montana AES
Net CL+	WA8280 CL+	39	11,782	85	2019	Washington AES, USDA
SY Gunsight	06PN3015-08	43	10,673	94	2017	AgriPro / Syngenta Cereals
WB9303	XC9302	45	10,080	99	2019	Bayer Crop Science / WestBred
WB9590	F9N12-0151	38	12,096	83	2016	Bayer Crop Science / WestBred
WB9668	BZ908-552	37	12,259	82	2013	Bayer Crop Science / WestBred
WB9707	XC9304	54	8,479	118	2019	Bayer Crop Science / WestBred
WB9879CLP	IMICHT79	36	12,777	78	2011	Montana AES / Bayer Crop Science / WestBred
Hard White Spring Wheat						
Dayn	WA8123	39	11,631	86	2012	Washington AES / AgriPro / Syngenta Cereals
Klasic	NK77S1817	31	14,872	67	1982	Northrup-King Co., Minneapolis, MN
SY Teton	SY10136	58	7,889	127	2015	AgriPro / Syngenta Cereals
UI Platinum	IDO694C	33	13,745	73	2014	Idaho AES, Anderson Group
WB7202CLP	XA7320	39	11,631	86	2017	Bayer Crop Science / WestBred
WB7328	BZ9S09-0133W	44	10,428	96	2014	Bayer Crop Science / WestBred
WB7589	BZ9S09-0735W	49	9,353	107	2014	Bayer Crop Science / WestBred
WB7696	XB9512	39	11,782	85	2018	Bayer Crop Science / WestBred
Winter Barley - malt						
Charles	94Ab1274	52	8,723	92	2005	USDA-ARS, Aberdeen
Desiree	FR124/12	51	8,894	90		Pflanzenzucht Oberlímpurg
Endeavor	95Ab2299	45	10,080	79	2008	Idaho AES, USDA
KWS Donau		52	8,723	92		KWS Cereals
KWS Faro		47	9,755	82		KWS Cereals
KWS Scala	GW2895	51	8,894	90	2012	KWS Cereals
KWS Sommerset	GW3479	59	7,688	104	2017	KWS Cereals
LCS Calypso		56	8,100	99	2017	Limagrain Cereal Seeds, LLC
Lightning	DH130910	47	9,755	82	2020	Oregon AES, USDA
Thunder	10.0777	31	14,872	54	2016	Oregon AES, USDA
Wintmalt		52	8,808	91	2014	KWS Lochow
Winter Barley - feed and food						
Buck ²	09-OR-86	40	11,340	71	2014	Oregon AES, USDA
Eight-Twelve	79Ab812	41	11,063	72	1988	Idaho AES, USDA
Sunstar Pride	SDM204-B	46	9,969	80	1995	Sunderman Breeding, Twin Falls, ID
Upspring ²	05ARS748-270	39	11,631	69	2018	Idaho AES, USDA

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

² Hullless

Table 1 (cont'd). Released varieties tested in 2020 with seed size and adjusted seeding rate.

Usage:	Variety	Exp. No.	1000 Kernel Weight (g)	Seeds per Pound	Adjusted Seeding Rate ¹ (lb/A)	Year Released	Developer(s)/Distributor of variety
Two-Row Spring Barley							
Feed	Altorado	BZ509-601	45	10,080	79	2016	Highland Specialty Grains
Feed	Champion	YU501-385	42	10,930	73	2007	Highland Specialty Grains
Feed	Charger	BZ512-319	40	11,340	71	2020	Highland Specialty Grains
Feed	Claymore	BZ509-216	41	11,063	72	2015	Highland Specialty Grains
Feed	FeedMor	Moravian 169	45	10,193	78	pending	Molson Coors Beverage Company
Feed	Idagold II	C32	44	10,428	77	2002	Molson Coors Beverage Company
Feed	Lenetah	01Ab11107	43	10,549	76	2008	Idaho AES, USDA
Feed	Oreana	BZ509-448	44	10,428	77	2015	Highland Specialty Grains
Feed	Xena	BZ594-19	42	10,930	73	2000	Highland Specialty Grains
Food	Goldenhart ²	2Ab09-X06F058HL-31	43	10,673	75	2018	Idaho AES, USDA
Food	Julie ²	03AH6561-94	40	11,484	70	2010	Idaho AES, USDA
Food	Kardia	2Ab09-X06F084-51	44	10,309	78	2016	Idaho AES, USDA
Food	Transit ²	03AH3054-51	45	10,080	79	2010	Idaho AES, USDA
Malt/Feed	Moravian 180	Pop10-022-030	46	9,969	80	pending	Molson Coors Beverage Company
Malt/Feed	Bill Coors 100	Moravian 150	51	8,894	90	2015	Molson Coors Beverage Company
Malt	Moravian 164	Pop09-051-007	46	9,969	80	2019	Molson Coors Beverage Company
Malt	AAC Connect	TR04282	43	10,673	75	2016	Agriculture Canada / Canterra Seeds
Malt	AAC Synergy	TR09208	42	10,800	74	2015	Agriculture Canada / Syngenta
Malt	ABI Eagle	2B11-4949	39	11,631	69	2018	Busch Agricultural Resources, LLC, Ft. Collins, CO
Malt	ABI Voyager	B3719	44	10,428	77	2011	Busch Agricultural Resources, LLC, Ft. Collins, CO
Malt	AC Metcalfe	TR232	44	10,428	77	1994	Agriculture Canada
Malt	Accordine		54	8,400	95		Nordsaat Saatzzucht GmbH
Malt	BC Ellinor		50	9,072	88		Limagrain Cereal Seeds, LLC
Malt	BC Leandra		54	8,400	95		Limagrain Cereal Seeds, LLC
Malt	Brunilda		57	7,958	101		Limagrain Cereal Seeds, LLC
Malt	CDC Copeland	TR150	36	12,600	63	1999	CDC University of Saskatchewan/ SeCan
Malt	Conrad	B5057	40	11,340	71	2004	Busch Agricultural Resources, LLC, Ft. Collins, CO
Malt	Esma		49	9,257	86		Ackermann Saatzzucht GmbH & Co. KG
Malt	Explorer		43	10,673	75		Secobra Recherches
Malt	GemCraft	2Ab08-X05M010-65	43	10,549	76	2018	USDA ARS, Idaho AES
Malt	KWS Amadora		50	9,164	87	2015	KWS Lochow
Malt	KWS Chrissie		52	8,808	91	2019	KWS Lochow
Malt	KWS Fantex		45	10,193	78		KWS Lochow
Malt	KWS Jessie		52	8,808	91	2019	KWS Lochow
Malt	LG Diablo		50	9,072	88		Limagrain Cereal Seeds, LLC
Malt	LCS Odyssey	NSL08-4556-A	43	10,673	75	2015	Limagrain Cereal Seeds, LLC
Malt	LCS Opera		46	9,861	81		Limagrain Cereal Seeds, LLC
Malt	Merit 57	2B99-2657	37	12,259	65	2009	Busch Agricultural Resources, LLC, Ft. Collins, CO
Malt	Moravian 69	C69	38	11,937	67	2005	Molson Coors Beverage Company
Malt	Moravian 179	C10-116-201	46	9,969	80	2019	Molson Coors Beverage Company

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 2019 provided good conditions for early to mid-season planting of winter grain at irrigated locations but soil moisture at the dryland locations varied and at Soda Springs the trial was planted into dry ground. Cold temperatures into the low teens in Aberdeen in late October halted fall growth and in some fields, late-planted winter wheat did not emerge until the spring. At Aberdeen, September precipitation was much greater than average (see Chart 1), followed by a very dry October and winter months.

Spring planting conditions were good for stand establishment, and moisture was average to very good.

Weather Conditions

Two April freeze events (April 2-3 and April 13) damaged winter grain, especially in upper elevation areas where dry soil conditions exacerbated the cold damage. Additional freezing temperatures occurred in May and June in several areas, causing floret sterility and reducing seed. Cool spring conditions resulted in seasonal deficits in growing degree days, which delayed crop maturity, with heading dates delayed up to 4 days from average (Table 3). Temperatures during the spring and early summer were moderate. A surprising amount of June precipitation resulted in fewer growing degree days, excellent conditions for grain filling and delayed crop maturity. Natural precipitation was below the 10-year and 105-year averages in October, November, February and August, and above average in

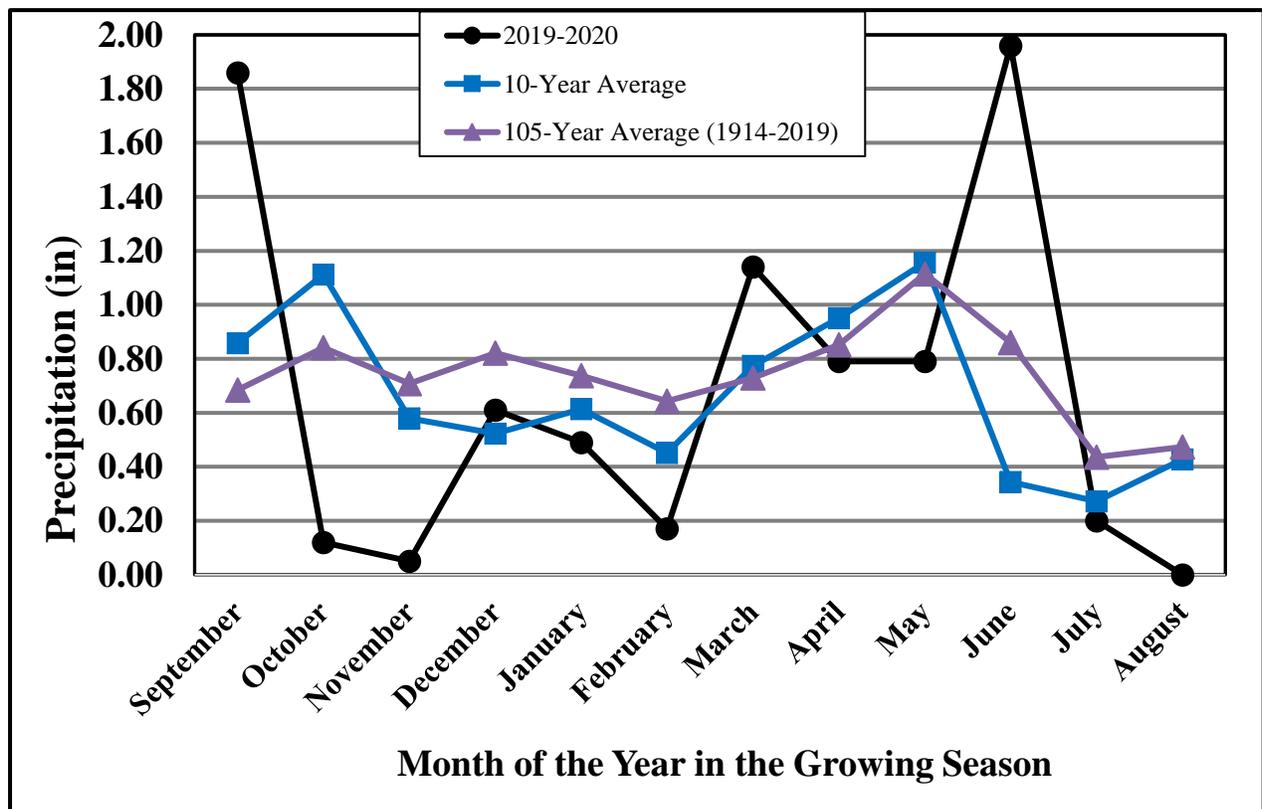


Chart 1. 2019-2020 growing year precipitation recorded at Aberdeen, ID, versus 10-year and 105-year averages. Source: NWS & Agrimet data.

September and June (Chart 1). Seedlings of spring planted crops showed cold banding indicating multiple freezing events early in the season.

The precipitation in July through August was average or below average, and there was enough late summer heat to dry the crop for harvest.

Over all locations, heading dates for winter wheat nurseries were at the 10-year average of the previous ten years (Table 3). Spring wheat heading dates were one to two days later than previous ten-year average, and spring barley was two days later. Plant heights were less than average for winter and average for spring barley but significantly taller for spring wheat. Lodging was low for all crops, with good to excellent test weight. Trial yields for winter and spring wheat were above average, and below average for spring 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, late-season stripe rust and Xanthomonas black chaff / bacterial leaf streak. Physiological leaf spot (PLS) was not a problem in 2020.

There were not significant snow accumulations and very little winter wheat was damaged by snow mold. As Xanthomonas bacteria are fairly ubiquitous throughout our grain production areas, bacterial leaf streak and black chaff did develop but was not problematic in most of the crop. Overall, foliar diseases were low as compared to 2019 when black chaff and bacterial streak were widespread. 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 is supposed to 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, but damage was not as severe as in previous years. 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, seedling 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 (*Puccinia striiformis* f.sp. *tritici*)

Stripe rust did not infect susceptible varieties of fall-planted wheat, preventing disease carryover to the spring. Nor did stripe rust overwinter near the Oregon – Idaho border, but it was found in Brundage soft white winter wheat and in susceptible spring wheat and barley varieties very late in the season. Susceptible spring wheat became moderately infected late in the season, resulting in 33% leaf area infected on the susceptible check, but with no significant 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 no barley stripe rust was found in 2020.

Barley scald (*Rhynchosporium secalis*) did not reach the damaging levels and was seen at low to intermediate levels in Ashton. 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 not significantly affected in 2020, as in 2019 when stands were 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. aciformis*) is a stem-based disease usually found in winter wheat and barley, but in some years can be found in spring grains. Strawbreaker, also called eyespot, occurred throughout the production region in 2019 and 2020, and was as prevalent as take-all in winter and spring grain. 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*) occurs frequently in grain following grain. Fusarium occurs where deficit moisture conditions early to mid-season which predisposes crops to infection and occurs where irrigation was not increased to compensate for moisture deficits. Due to the

moist conditions in the spring of 2020, there were very few incidences of Fusarium crown and foot rot. However, there were several spring wheat fields with 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 but less so in 2020. 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 2020 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. 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. In 2020, there were very few reported cases of FHB or DON being problematic in spring wheat or spring barley. 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 2020 data of spring wheat reaction to FHB infection, and Addendum 6a-6c & 7a-7c 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, reducing 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 2017 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 occurred in 2010) of 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 and 2020 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 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, 2019 and 2020, 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.

2020 Report: Discussion of Location Conditions and Results

NASS within the USDA reports Idaho 2020 wheat yields at 97 bu/A over all categories (irrigated and dryland, winter and spring). Out of 1.24 million acres planted, 1.164 acres were harvested. For spring wheat, 495,000 acres were harvested of the 510,000 acres planted resulting in an average of 91 bu/A. For winter wheat, 660,000 acres were harvested of the 720,000 acres planted with an average yield of 101 bu/A. Overall, quality was reported as good to excellent.

For barley, 500,000 of 520,000 acres planted in 2020 were harvested (NASS) for a total harvest of 55 million bushels. The average yield in the state was reported as 110 bu/A.

https://www.nass.usda.gov/Statistics_by_State/Idaho/index.php

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, winter barley under irrigation in Aberdeen (Table 31), 13ARS537-25 (QC) yield was 168 bu/A, and 13ARS537-25 was 164 bu/A, a difference of 4 bu/A. While that may seem significant, the LSD for the trial is 22 bu/A, indicating that differences of less than 22 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 4, Keldin +11-52-0 was 2 bu/A greater than Keldin without the starter fertilizer which is not considered statistically significant (LSD = 6 bu/A at $\alpha = .05$). Table 4 included three years of data

over multiple irrigated sites. Other agronomic traits were very similar indicating no effect of starter fertilizer. Under dryland conditions (Table 5), Keldin + 11-52-0 was 3 bu/A greater than Keldin, but with the site LSD of 4 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 Scorpio, UI Bronze Jade (hard white winter), LCS Jet, Yellowstone, Millie and Keldin at the top with 159, 159, 158, 157, 155 and 153 bu/A, respectively. Test weights were very good, averaging 61.5 lbs/bu. Protein targets for hard red winter wheat is 12.5%, and these trials resulted in lower than needed average protein. Lower yielding varieties had enough soil and applied nitrogen to meet protein goals, but higher yielding varieties required additional protein to hit desired targets. **Averaged over all 2020 irrigated locations**, the highest yielding **hard winter wheat** varieties (Table 6) were Scorpio (161 bu/A) and WB4311 (156 bu/A), both with excellent test weight. Scorpio headed five days later than WB4311, was two inches taller and had 1% higher protein. UI Bronze Jade was the highest yielding hard white winter variety, more than 15 bu/A greater than AP Nugrain 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 45 bu/A, where the top yielding varieties included UI SRG (50 bu/A), Keldin (with 11-52-0 at 49 bu/A), Sequoia (49 bu/A), Yellowstone (48 bu/A), LCS Jet (48 bu/A) and Utah 100 (47 bu/A). Protein average for these trials was still below 12.5%, but test weight averages were very good, with most varieties above 60 lbs/bu. **2020 combined dryland yields for hard red and white**

winter wheat (Table 7) averaged 45 bu/A, with the highest yielding varieties at 53 bu/A (Utah 100), 52 bu/A (LCS Zoom), 52 bu/A (Sequoia), 51 bu/A (UI Silver and FourOsix), 48 bu/A (WB4792 and Keldin).

The top yielding **soft white winter varieties over the last three years** over all irrigated locations (Table 16) are LCS Ghost (160 bu/A) and VI Shock (159 bu/A), LCS Hulk and WB1783 (both at 157 bu/A). The top yielding group were all very similar in yield, including SY Ovation, Jasper, UI Sparrow, UI Castle CL+. Test weights were low for several of the top-yielding varieties including LCS Ghost, UI Sparrow and Rosalyn. Proteins for the trials were within the soft white winter protein targets between 9–12%. **Averaged over all 2020 irrigated locations**, the highest yielding **soft white winter wheat** named varieties (Table 18) were VI Shock (162 bu/A) and LCS Hulk (160 bu/A). Heading date averaged June 1, and average test weights hovered right at 60 lbs/bu.

Average 3-year dryland yields for soft white winter (Ririe, Rockland and Soda Springs, Table 17) were 50 bu/A, where the top yielding varieties included UI Sparrow (59 bu/A), Devote (55 bu/A), Eltan (54 bu/A) and Nixon (53 bu/A). Norwest Tandem, Jasper, Otto, and WB1783 all yielded 50 bu/A. All had test weight less than 60 lbs/bu except Devote and WB1783 (60.5 and 60.1 lbs/bu, respectively) and protein less than 12% except Devote, Otto and WB1783. **One-year combined dryland locations for 2020 (Table 19)** averaged 48 bu/A, with the highest yielding varieties at 60 bu/A (Otto), 58 bu/A (UI Sparrow), 57 bu/A (AP Iliad) and 56 bu/A (Eltan with in-furrow 11-52-0). Statistically within the top yielding group were SY Raptor, Devote, LCS Sonic, Jasper, M-Press, LCS Shine, Stingray CL+, Purl, LCS Hulk, Norwest Tandem and Nixon. Test weights overall were below 60, averaging 59.2 lbs/bu.

Winter Barley 3-Year Averaged Data

Three-year, multiple location averages for winter barley are presented in Table 28. Top yielding released varieties include Sunstar Pride (175 bu/A), KWS Somerset (172 bu/A), LCS Calypso (172 bu/A), Desiree (171 bu/A), KWS Scala (166 bu/A) and Thunder (166 bu/A). There were malt, feed (Sunstar Pride, Eight-Twelve) and food lines in this trial, with Buck and Upspring being hullless food lines with very high test weight (comparable to winter wheat) but having reduced spring stands. Proteins were in the target range for malt specs except for the food lines Upspring and Buck, which averaged 15.5% and 13.9% grain protein, respectively. Plumps of Charles and Endeavor were low and lodging was high compared to the other winter malt varieties. For a high yielding variety, LCS Calypso had very low lodging. For the one-year **irrigated averages in 2020** (Table 29), the top yielding varieties are the malt lines KWS Donau (150 bu/A), KWS Somerset (150 bu/A) and Wintmalt (142 bu/A). Test weights averaged above 48 lbs/bu and grain proteins below 12%, except for the hullless food barleys Upspring and Buck (15.8% and 14.9% protein) with test weights close to 60 lb/bu.

Spring Wheat 3-Year Averaged Data

Note: (W) indicates a hard white wheat.

Over **three years over all locations**, averaging over twelve site-years, the highest yielding hard spring varieties under irrigation (Table 33) were Dayn (hard white spring wheat at 124 bu/A), AP Renegade (118 bu/A) and SY Teton (hard white at 117 bu/A). The hard reds with the best combinations of test weight and high protein include Alum, WB9590 and WB9668. The average 3-year test weight was 61.9 lbs/bu, and the average grain protein was 13.9%. High protein lines were WB9668 (15.4%),

Alum (14.4%), WB9590 (14.9%) and the hard white WB7328 (14.6%). The **2020 combined irrigated average** (four locations) for hard spring wheat (Table 35) was 110 bu/A, six bushels higher than 2019. Alum averaged 127 bu/A, Dagmar 119 bu/A, AP Venom 120 bu/A, and Dayn 115 bu/A, all with protein less than 14%. High protein red spring wheat lines were WB9303 (15.6%), Lanning (15.2%), Dagmar (14.9%), WB9668 (14.8%) and WB9590 (14.5%).

There is only one **dry land location** for hard spring wheat (Soda Springs), and the three-year average data are in Table 34. Highest yielding hard spring varieties include Dayn (W) at 67 bu/A, SY Teton (W) at 64 bu/A, Jefferson at 62 bu/A, and WB7202CL+ (W) at 62 bu/A. Grain protein averages were below target, indicating higher fertilization is required to bring the hard spring wheat up to preferred levels of grain protein.

Three-year averages for soft white spring wheat over all locations (Table 42) put WB6430 at the highest yield (124 bu/A), followed by UI Stone and UI Cookie (119 bu/A), and Alturas, Melba, Seahawk and Tekoa (all at 117 bu/A). The **2020 combined irrigated average** for soft white spring wheat (Table 44) was 122 bu/A. WB6430 yielded 131 bu/A, UI Stone yielded 127 bu/A, UI Pettit 126 bu/A, and UI Cookie 125 bu/A. Test weight was 61.3 lbs/bu for the average, and grain protein 9.0%.

As with hard spring wheats, there was only one **dry land location** for soft white spring wheat (Soda Springs), and three-year average data is summarized in Table 43. Tekoa was the highest yielding variety at 71 bu/A, followed by Melba club wheat at 70 bu/A, Louise, Ryan and UI Stone at 66 bu/A and Seahawk at 65 bu/A. Test weight average was right at 60 lbs/bu, and protein was 10.3%.

Spring Barley 3-Year Averaged Data

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

Three-year averages (12 site-years) for the malt varieties (Table 51) puts LCS Odyssey, Explorer and ABI Voyager at the top (140, 136 and 134 bu/A, respectively), all with excellent test weight and protein. Not significantly different from those top three were ABI Eagle, GemCraft and AAC Synergy. Taking a look at **combined irrigated averages** for 2020 (Table 52), KWS Chrissie, KWS Fantex, LG Diablo and KWS Jesse yielded 166, 166, 162 and 162 bu/A respectively, all with excellent test weight, protein and plumps. Within the top yielding group (not significantly different than KWS Chrissie) were KWS Amadora, BC Leandra, LCS Opera, LCS Odyssey, BC Ellinor, Esma and Brunilda.

For the feed and food varieties, over three years (12 site-years), Altorado, Oreana, Champion, Claymore and Xena were the highest yielding feed varieties (Table 59) at 139, 135, 130, 130 and 130 bu/A, respectively. Kardina (hulled) was the highest yielding food barley, followed by Julie, Transit and Goldenhart (all are hullless, as reflected in the very high test weights). In the **combined 2020 irrigated trials** (Table 60), the top yielding named varieties were Charger (147 bu/A), Altorado (143 bu/A) and Xena (141 bu/A). Kardina was the highest yielding food barley (137 bu/A).

Kimberly Research and Extension Center, Winter Grain

Winter wheat nurseries were planted following spring barley on October 6, 2019 – and were planted into drier than optimal conditions. Irrigation provided 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 was not

damaging. Plots were harvested August 6th. Soft white winter wheat yields averaged 20 bu/A less than 2019, and 30 bu/A greater than 2018, with the highest yielding variety at 182 bu/A (Table 20), reflecting excellent irrigation practices. Hard winter wheat yields were similar to 2019 yields and about 53 bu/A greater than 2018.

Note: (W) indicates a hard white wheat.

The hard winter wheat group (Table 8) yield ranged from 131 to 196 bu/A. High yielding WB4401 hard red winter hit 196 bu/A, 7 bu/A higher than LCS Jet at 189 bu/A. UI Bronze Jade (W), Keldin, Utah 100, LCS Rocket, Scorpio, and WB4792 were the next highest yielding varieties, yielding 187, 187, 185, 184, 183 and 183 bu/A, respectively. Site average for yield of the hard winter group was 172 bu/A, similar to 2019, 60 bushels more than 2018 and 42 greater 2017. Test weight average was 62.3 lbs/bu, excellent for winter wheat, and grain protein average for the location was 11.4%. The very high yields resulted in low average protein, as the plots were fertilized for expected yield that was lower than the highest yielding varieties. Total N available was 483 lbs N/acre. Optimal grain protein for hard red winter wheat should be 12.5% or greater. The ratio of applied N to (172 average) bu/A yield was 2.8, below the 3.0 to 3.5 ratio needed for optimal protein in hard winter wheat.

Keldin was entered in the trials twice, the second entry listed of Keldin had 20 lbs/A of 11-52-0 placed in-furrow with the seed. Under irrigation, Keldin with starter fertilizer yielded 3 bushels per acre more than Keldin without starter fertilizer, statistically the same as the plots without as the LSD (0.05) is 13 bu/A. Over time, especially under dryland situations, there is a yield advantage to utilizing starter fertilizer (see Table 7).

In the soft white winter group (Table 20), 2020 irrigated yield varied from 103 to 182 bu/A with lower CV's for the location than in 2018, but higher than 2019. Norwest Duet (182 bu/A), AP Iliad (180 bu/A) and LCS Blackjack (177 bu/A) were the highest yielding varieties, not statistically different from the highest yielding group in bold (Table 20). Test weight averaged 60.6 lbs/bu, and grain protein average for the location was 9.0%. With a total of 393 lbs available N in the soil (residual plus applied N fertilizer - see site description on page 6) and average yield for soft white winter wheat nursery at 159 bu/A, the lbs of N to yield calculates to 2.5 lbs of nitrogen per bushel of yield.

Rupert, Luke Adams, Winter Grain

Plots were planted Sept 24th in silt-loam soil following spring barley into good soil moisture and seedbed conditions. Spring stands of the winter wheat nurseries were good, without the damage that occurred in 2017 from excessive snow, ponding water and freeze-thaw cycles, but there were some winter-tender varieties that resulted in low yields. There were no visual symptoms of BYD occurring at this site. Plots were planted within a winter barley field, which was abandoned and replanted in the spring because of severe winter kill. Winter barley plots were harvested August 21st and averaged only 98 bu/A due to winter kill of some varieties (Table 30). In 2019 the average yield was 124 bu/A and in 2018 plots averaged 147 bu/A. Yields ranged from 57 (Buck with only a 28% spring stand) to 157 bu/A (KWS Somerset). KWS Donau yield was 21 bu/A less at 136 bu/A, followed by Wintmalt (130 bu/A), and KWS Scala (126 bu/A). Despite significant winter kill of winter barley at this location, yields of some were surprisingly high, many of which are European malt lines. The ratio of available and applied N (385 lbs N/A) to average bushel yield (98) was 3.9 lbs N/bu. Proteins were not high considering the

average was slanted up by three high protein food barley lines.

Winter wheat plots were harvested August 20th. Average yield for the hard winter wheat trial (Table 9) was 129 bu/A, 17 bu/A less than 2019 and 23 bushels less than 2018. Yield ranged from 92 (WA8289) to 151 bu/A for MT1642. Test weight averaged 60.3 lbs/bu, and protein averaged 11.3%. The ratio of average yield to total N was $424 / 129 = 3.3$, at the 3.0-3.5 recommended to obtain high protein (12.5% or greater) hard red winter wheat. However, the proteins were lower than optimal with the trial average at 11.3%. Yellowstone, Utah 100, WB4792, Flathead, Keldin and FourSix were the highest yielding named lines at 150, 147, 146, 143, 140 and 140 bu/A, respectively. Stripe rust did not impact yield, and there was no lodging.

The entry of Keldin with 11-52-0 in-furrow yielded 6 bu/A more than the plots without starter fertilizer but was still less than the 13 bu/A required to be considered statistically significant. The CV for this trial is very good (7.1%).

The soft white winter group (Table 21) ranged in yield from 109 to 158 bu/A. The highest yielding varieties were VI Shock (158 bu/A), Norwest Duet (151 bu/A), SY Ovation (147 bu/A), and M-Press (146 bu/A). Test weights averaged 59.0 lbs/bu. The ratio of available and applied N (384 lbs N/A) to average bushel yield (134) was 2.9 N/bu. Unexpectedly, the proteins were low given the high rate of N with the trial average at 9.8%. There was no lodging in the soft winter wheat nursery, especially of some varieties that would be better suited for dryland conditions.

Aberdeen Research and Extension Center, Winter Grain

The winter trials in Aberdeen were planted October 2nd in a Declo loam soil into good

seedbed conditions and soil moisture, and harvested August 12th and 13th. Neither BYD nor stripe rust was observed in the winter grain. The preceding crop was green manure oats.

The winter barley at Aberdeen had extensive winter damage in 2017, but survived well in 2018 and 2019, with 2019 average spring stands at 95-100%. In 2020, like in Rupert, there was some winter kill in 2020 that reduced stands of several varieties, including Buck and Upspring, two hulless winter food barleys. Winter barley yields were as high as 184 bu/A with an overall average of 155 bu/A (Table 31), 30 bu/A less than in 2018 and 23 bu/A less than in 2019. High yielding named varieties included Eight-Twelve (winter feed), Sunstar Pride (winter feed), Charles (165 bu/A), KWS Donau (164 bu/A), and KWS Somerset (163 bu/A). Charles and Endeavor, two older winter malt varieties, yielded 165 and 144 bu/A, respectively, with spring stands at 98 and 93%. If winter kill is a problem, these two varieties often are the most susceptible and are the first to show damage, however, the greatest winter kill in 2020 was in the hulless food barleys. Test weight averaged 52.5 lbs/bu, with no lodging, and grain protein averaging 11.7%. The ratio of applied N to average bushel yield was 2.4 lbs N/bu (368 lbs N/155 bu/A). Despite the relatively high N, grain protein in malt lines remained low when compared to the hulless food barleys.

For an internal “Quality Control” (QC) 13ARS537-25 was included twice, once as 13ARS537-25 (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 (8.7%). The two separate entries yielded at 168 and 164 bu/A, a difference of 4 bu/A. The LSD at 22 bu/A indicates that yield differences have to be greater than 22 bu/A to be considered statistically

significantly different, which the duplicate entries were not.

The hard winter wheat survival (Table 10) averaged 95-100%, which was better than the winter barley varieties. Overall yields were less than 2019 by 19 bushels and less than 2018 by 25 bu/A. Lodging was very low and averaged 1%. Stripe rust was not present in the winter wheat and did not impact yield. The highest yielding line was Yellowstone (161 bu/A), Sequoia (151 bu/A), Scorpio (150 bu/A), WB4792 (147 bu/A), Flathead (147 bu/A), and Millie (145 bu/A). The CV of 8.3% for yield was very good. Heading date for this group at Aberdeen was three days earlier than last year and still five days later than the ten-year averages. Test weights were very good at 61.5 lbs/bu for the overall average. There was relatively low lodging for such a high yielding trial, with only one variety (AP Redeye) showing high lodging at 23%. Grain protein averaged 12.2%. The ratio of applied N to average bushel yield was 3.1 lbs N/bu (408 lbs N/138 bu/A). Additional N is recommended for the upper yielding varieties to meet requirements for yield and target protein of 12.5%. The hard red winter wheat Flathead had excellent protein, test weight and yield. The entry of Keldin with 11-52-0 in-furrow yielded 1 bu/A more than the plots without starter fertilizer and was less than the 16 bu/A required to be considered statistically significant.

The overall yield average in the Aberdeen soft white winter trial (Table 22) was 150 bu/A, 15 bu/A less than 2019, 23 bu/A less than 2018, ranging from the low of 129 bu/A (WA8397) to a high of 178 bu/A. The highest yielding named varieties were YSC-215 (178 bu/A), VI Voodoo CL+ (177 bu/A) VI Bulldog (174 bu/A) and WB1529 (169 bu/A) and LCS Hulk (169 bu/A). Heading date for this group at Aberdeen was three days later than last year. The test weights averaged at 59.8 lbs/bu and the overall grain

protein was at 10.7%. The ratio of applied N (368 lbs N) to average bushel yield (150 bu/A) was 2.5 lbs N/bu, which is reflected in the higher protein. There was no lodging for such a high yielding trial.

Ririe Irrigated, Clark Hamilton, Winter Wheat

Located near Ririe, this irrigated location was added in 2019 on the Hamilton Farm about 600 feet lower in elevation than the dryland plots on the LDS church farm. The plots were planted September 26th, into loam soil following spring seeded peas, and harvested August 14th and 17th.

Spring stand of the hard winter wheat trial was excellent (Table 11), and the average yield was 135 bu/A, varying from 117 (WB4311) to 155 bu/A (MT1642). Yield was likely reduced due to severe cold temperatures during jointing in early May. Test weight averaged 62.7 lbs/bu, with two hard white varieties achieving 65 lb test weight (IDO1806 and AP Nugrain). Grain proteins were low, averaging 9.6, with 2.5 lbs N per bushel (332 total N available /135 bu average yield), indicating less than optimum levels of N to meet yield and protein.

For the soft white winter wheat trial (Table 23), the yield varied from 126 bu/A to 164 bu/A (LCS Blackjack and VI Shock). Test weights were very good, averaging 61.5 lbs/bu, with WB456 and WB1376CLP having 63.6 and 64.3 lbs/bu, respectively. Grain protein averaged 9.5%. The ratio of lbs N to bushel yield was 2.0 (292 total N available /145 bu average yield), indicating less than optimum levels of N to meet yield and protein. The high-yielding varieties included LCS Blackjack, VI Shock (both at 164 bu/A), UI Sparrow (162 bu/A) LCS Hulk (158 bu/A) and YSC-215 (158 bu/A). Nixon (154 bu/A), LCS Ghost (154 bu/A), and LCS Artdeco (152 bu/A) were also in the high yield group.

Ririe Dryland, 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 dry to two feet, therefore grain was planted relatively late October 3rd following chemical fallow. After abundant late September rains, grain was planted into heavy stubble that had been disked to form an excellent seed bed. Fall growth was limited and the spring stand was heavily damaged by high winds (up to 80 mph) and blowing sand. Only two reps of both winter wheat trials were able to be harvested (Tables 12 and 24). Despite the environmental damage, yield was relatively good, averaging 39 bu/A for the soft white winter and 35 bu/A for the hard winter wheat group. The trials were harvested August 17th.

The hard winter wheat group (Table 12) had average yields of 35 bu/A, 14 bu/A more than 2019, but 15 bu less than 2018. Previous yields were 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 2020 yield range went from a low of 25 bu/A (WB4623CLP) to a high of 47 bu/A (Sequoia). Overall site conditions were stressful, and the CV for yield was a little high (12.8%). Sequoia, UI Silver, Keldin with 11-52-0, Promontory, Irv, Millie (W), Yellowstone, Scorpio, Utah 100, UI SRG and FourOsix were in the top yielding group. Average grain protein was very high at 15.1%, reflecting excess nitrogen levels to meet yield and protein. The ratio of available N to bu yield (156 lbs N/ 35) is excessive at 4.5. Test weights were low, averaging 57.8 lbs/bu. There was no lodging. The comparison of Keldin at 33 bu/A with Keldin with in-furrow fertilizer of 11-52-0 at 41 bu/A was not significantly different in this trial as statistics with only two reps is not valid.

The soft white winter wheat (Table 24) averaged 39 bu/A at this location, ranging from 32 bu/A (M-Idas) to 48 bu/A (UI Sparrow). Yields were 16 bu/A greater than 2019, and 6 bu/A more than 2018. Overall site conditions were poor, as indicated above, but even with the relatively low yield CV (8.2 %), statistical analyses based on two reps is not valid. The stands of the first two reps were essentially less than 10%, but the remaining two reps had very good stand. The ratio of available N to average bushel yield (156 lbs N/ 35) is excessive at 4. Average proteins were very high for this soft white wheat group at 14.8%, test weights were very low and averaged 55.8 lbs/bu. The top-yielding varieties were UI Sparrow, Devote, Eltan with 11-52-0, Otto, OR2X2CL+, SY Raptor (48, 47, 47, 46, 43 and 43 bu/A, respectively). Average heading date was 6/22, three days earlier than 2019 (6/25), and eight days later than 2018 (6/14), and average plant height was 23 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 September 18th and harvested August 3rd, similar to harvest in 2019. Snow mold diseases were not a significant problem, and spring stands were good for hard winter wheat (94% in Table 13) and soft winter wheat (94% in Table 25). Dwarf bunt (*Tilletia controversa* Kuhn or TCK smut) 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 infection.

The hard winter wheat yield average was 40 bu/A, 7 bu/A greater than 2019, 2 bu/A greater than the 2018 average of 38 bu/A and 2 bu/A less than the 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 2020 yield ranged from 32 to 51 bu/A with a reasonable yield CV at 11.2%. The top yielding varieties this year were UI Silver (51 bu/A), Keldin with 11-52-0 (47 bu/A), and Sequoia (46 bu/A). The Keldin 11-52-0 included an in-furrow application of monoammonium phosphate at 20 lbs phosphate per acre and yields of 47 bu/A were statistically greater than Keldin without the in-furrow fertilizer (39 bu/A). Heading date was three days earlier than 2019 (6/9) and one day later than in 2018. Grain proteins were low (11.1%), indicating a deficit in available nitrogen to make protein for hard winter wheat.

For an internal "Quality Control" (QC) Juniper was included twice, once as Juniper (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 a little higher than optimum (11.2%). The two separate entries yielded at 40 and 38 bu/A, a difference of 2 bu/A. The LSD at 6 bu/A indicates that yield differences have to be greater than 6 bu/A to be considered statistically significantly different, which the duplicate entries were not.

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 as long as protein is adequate. The soft white winter varieties Otto, Devote, Eltan, Jasper, UI Sparrow and Norwest Duet averaged 55, 51, 51, 50, 49, and 49, respectively (Table 25). The test weights were good, averaging 60.9 lbs/bu. Grain protein averaged 10.6%, optimum for soft white winter. Heading date was three days earlier than 2019 (6/9) and four days days later than in 2018. There was no lodging. Eltan planted with an application of monoammonium phosphate at 20 lbs phosphate per acre 11-52-0 in furrow did not

yield differently than without the preplant fertilizer.

Soda Springs, Jake, Mark and Craig Ozburn, Dryland Winter Wheat

The two small dryland winter wheat trials of hard and soft winter wheat were increased to full nurseries at Soda Springs in 2018 at the request of area growers. The 2020 trial was planted September 25th and harvested September 15th, similar to 2019. Despite the dry planting conditions, the stands were good and uniform, with better-than-expected winter survival (Table 14 for hard winter and Table 26 for soft white winter). The relatively cool spring resulted in later than expected heading dates, with the hard winter group still heading 7 days earlier than 2019, and 4 days later than 2018. The soft white group also headed late (6/28) – still 7 days earlier than 2019 and 7 days later than 2018.

In the hard winter trial, forty-six varieties of hard red and hard white wheat were planted, including one check with in-furrow phosphorus fertilizer and “QC” planting of Juniper (Table 14). The Keldin 11-52-0 included an in-furrow application of monoammonium phosphate at 20 lbs phosphate per acre but yields (55 bu/A) were not statistically different than Keldin without the in-furrow fertilizer (48 bu/A). With an LSD of 14 bu/A, the yield of Keldin with 11-52-0 would have to be 14 bu/A greater to be considered significant.

For an internal “Quality Control” (QC) Juniper was included twice, once as Juniper (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 higher than optimum (17.2%). The two separate entries yielded at 48 and 49 bu/A, a difference of 1 bu/A. The LSD at 14 bu/A indicates that yield differences have to be greater than 14 bu/A to be considered statistically significantly different, which the duplicate entries were not.

The highest yielding varieties of the hard variety trial at Soda Springs included WB4792 (75 bu/A), Utah 100 (69 bu/A), LCS Zoom (67 bu/A), UI Bronze Jade (66 bu/A), FourOsix (65 bu/A), Sequoia (64 bu/A), and LCS Jet (62 bu/A). There was no stripe rust pressure at this location, and the spring stands were very good. Heading dates were behind at this location compared to 2018, with the average heading date 5 days behind 2018 (6/21) and six days ahead of 2019 (7/2). Test weight was good, averaging 60.2 lbs/bu. There was no lodging. The ratio of available and applied N (114 lbs N/A) to average bushel yield (55) was 2.1 N/bu. As a result, the proteins were low with the trial average of 11.6%.

Forty-five soft white winter wheat varieties were included in a separate nursery (Table 26). Winter conditions were not severe, resulting in an average 94-100% spring stand. Average heading dates (6/28) were behind this location in comparison to 2018, with the average heading date 7 days behind 2018 (6/21), but ahead of 2019 (7/3). A relatively dry summer resulted in yields about 15 bu/A less than in 2018 but 6 bu/A greater than in 2019. Yield CV's were high at 17.8 %. Average yields for the soft nursery were 58 bu/A. The yield ranged from 46 bu/A (WB1376CLP) to 77 bu/A (AP Iliad). The highest yielding named varieties included AP Iliad (77 bu/A), UI Sparrow (76 bu/A), SY Raptor (73 bu/A), Otto (71 bu/A), Eltan with 11-52-0 in furrow (68 bu/A), LCS Sonic (65 bu/A), LCS Shine (64 bu/A), Purl (64 bu/A), Jasper (64 bu/A), M-Press (62 bu/A), LCS Hulk (62 bu/A) and Stingray CL+ (62 bu/A). There was no lodging, proteins were at 10.3% average and test weights were a little low (58 lbs/bu).

The Eltan 11-52-0 included an in-furrow application of monoammonium phosphate at 20 lbs phosphate per acre but yields (68 bu/A) were not statistically different than

Eltan without the in-furrow fertilizer (59 bu/A). With a LSD of 16 bu/A, the yield of Eltan with 11-52-0 would have to be 75 bu/A to be considered significantly greater.

The ratio of available and applied N (114 lbs N/A) to average bushel yield (58) was 2.0 N/bu. As a result, the proteins were good with the trial average of 10.3%. No lines were above protein optimum levels, but some were a little low.

If considering 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.

Spring Grain Locations

Rupert, Duane Grant 4-D Farms and Taylor Grant, Spring Grain

The variety trials in Rupert were planted March 24th in silt loam soils with good soil moisture and harvested August 10th and 11th. The preceding crop was sugar beets. There were no major weather-related problems.

There was some lodging for the **hard spring wheat** nursery (Table 36). Average yield was 114 bu/A, compared to 131 bu/A in 2019, 120 bu/A in 2018, 110 bu/A in 2017, 125 bu/A in 2016, and 105 bu/A in 2015. Test weight average was 61.5 lbs/bu, and average protein was at 13.5%. The top yielding named varieties were Dayn hard white (126 bu/A and 12.5% protein), SY Gunsight (125 bu/A and 13.0% protein), WB9707 (121 bu/A and 13.8% protein), AP Renegade (120 bu/A and 12.9% protein), and SY Teton hard white (120 bu/A and 13.3% protein). The top two varieties, statistically higher than other entries, were advanced lines IDO1804 hard white at 140 bu/A and IDO2004 at 129 bu/A. The ratio of available and applied N (363 lbs N/A) to

average bushel yield (114 bu/A) was 3.2 lbs N/bu. The average grain protein for this trial was good at 13.5% but was not optimal for the protein target of 14.5%. 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.

In this Rupert hard spring wheat trial were three entries of AP Renegade - one with our standard seed treatment (Vibrance Extreme), one with an undisclosed “base seed treatment” applied by McGregor, and a third with an undisclosed “additional McGregor seed treatment”. There were no differences in the treatments for yield, test weight, plant height or date of heading.

The **soft white spring wheat** yield (Table 45) average in Rupert was 117 bu/A, compared to 140 bu/A in 2019. In 2018 in this area, it was 123 bu/A, in 2017 it was 119 bu/A, in 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. The 2020 results had low CV's of 6.8% for yield, indicating the variability in this trial was low. Even so there were not large differences in yield for the soft white spring group. UI Pettit yielded 127 bu/A, UI Stone at 122 bu/A, UI Cookie at 121 bu/A, and WB6430 yielded 121 bu/A. Average grain protein was low at this site at 9.0%. The ratio of available and applied N (293 lbs N/A) to average bushel yield (117) was 2.5 lbs N/bu.

The **spring malt barley** trial at Rupert (Table 53) had average yields of 154 bu/A, 10 bushels greater than 2019, and about 6 bushels more than 2018, with a yield range from 114 to 180 bu/A. The ratio of available and applied N (293 lbs N/A) to average bushel yield (154) was 1.9 lbs N/bu. There was no lodging. LG Diablo was the top yielding malt barley (180 bu/A), followed by LCS Opera (178 bu/A), KSW Jessie (173

bu/A), KWS Leandra (172 bu/A), KWS Amadora (170 bu/A), LCS Odyssey (168 bu/A), and KWS Chrissie (167 bu/A). Test weights averaged 53.0 lbs/bu, and percent plumps were 97%. Heading date for this trial was 6/6, 8 days earlier than in 2019 (6/14), and 9 days earlier than 2018 (6/15).

The average yield for two-rowed feed barley in Rupert for 2020 (Table 61) was 157 bu/A, 18 bu more than 2019 (139) bu/A, and 6 bu/A more than 2018. The high yielding two-rowed feed varieties were Claymore (170 bu/A), Charger (166 bu/A), Oreana (161 bu/A), and Xena (159 bu/A). Average test weight for this trial was 52.9 lbs/bu for the feed barleys, and 57.8 lbs/bu for hullless and hulled (Kardia) food barleys. The hullless, high beta-glucan food barleys Julie, Goldenhart, and Transit yielded 125, 119, and 115 bu/A but also had very high test weights (60.9, 59.8, and 57.5, respectively). For this trial, the ratio of available and applied N (293 lbs N/A) to average bushel yield (157 for feed) was 1.9 lbs N/bu with an average site grain protein of 10.6% for the hulled, and 13.3% for the hullless.

Aberdeen Research and Extension Center, Spring Grain

Spring variety trials were planted April 9th in Declo loam soils with good soil moisture and plots were harvested August 28th and 31st two weeks later than in 2018. The preceding crop was green manure oats. The yields were close to the ten-year average for spring barley, but higher for spring wheat (see Table 3). Stripe rust of wheat was present very late in the season but there were no yield impacts in the susceptible wheat varieties.

The CV's for the Aberdeen spring trials were much higher than usual at this location due to planting into a bad location with very poor calcareous soil (previously scraped with underlying calcareous soil exposed). The CV for the hard spring wheat nursery was 13.1% for yield (Table 37). Hard spring

wheat yield varied from 63 bu/A (Klasic) to 102 bu/A (Dayn). The top four named varieties for yield in the hard red and white trial were the hard white springs Dayn (102 bu/A with 14.0% protein), AP Renegade (101 bu/A and 13.7% protein), AP Venom (98 bu/A and 12% protein) and Alum (95 bu/A and 14.0% protein). Test weights for the hard spring wheats averaged 62.0 lbs/bu. There was no lodging and the grain protein average was 13.7%. (All hard spring wheat trials are top-dressed at flowering with 40 pounds of N to promote higher protein hard spring wheat.) The high named protein wheats included WB9303 (15.5%), WB7328 (15.3 %), Espresso (14.8%), WB9668 and CP3066 (14.3%), Alum (14.0 %). The ratio of available and applied N (323 lbs N/A) to average bushel yield (87) was 3.7 lbs N/bu with an average site grain protein of 13.7%.

Three entries of AP Renegade - one with our standard seed treatment (Vibrance Extreme), one with an undisclosed base seed treatment applied by McGregor, and a third with an additional undisclosed McGregor seed treatment. There were no differences in the treatments for yield, test weight, plant height or date of heading except the AP Renegade + base was significantly less yielding than the AP Renegade with "base+root" treatment. There was no significant difference between AP Renegade with "base+root" and the one with our standard fungicide seed treatment.

The soft white spring wheat yields at Aberdeen (Table 46) averaged 83 bu/A with a range from 71 (UI Stone) to 95 bu/A. The CV's for the Aberdeen spring trials were much higher than usual at this location due to planting in very poor calcareous soil (previously scraped with underlying calcareous soil exposed). The CV for the soft white spring wheat nursery was higher than desired at 15.1% for yield (Table 46). The LSD (0.05) was 18 bu/A, resulting in few significant differences in yield amongst

entries. Highest yields of named varieties were obtained from Louise (95 bu/A), Seahawk (91 bu/A), UI Pettit (71 bu/A), UI Melba (club wheat, 86 bu/A), and Alturas (85 bu/A). The average heading date of 6/16 was 6 days earlier than 2019 (6/22) and was two days later than in 2018. There was no lodging and test weights averaged 60.9 lbs/bu. The ratio of available and applied N (283 lbs N/A) to average bushel yield (83 bu) was 3.4 lbs N/bu with an average site grain protein of 8.3%. Similar to the hard spring wheat trials, poor soil conditions damaged overall trial results.

Two-rowed malt barley lines yield average was higher than in 2019 by 31 bushels due to untimely frost during heading in 2019. Yields were 7 bu/A higher than 2018 (Table 54). Yield ranged from 118 bu/A (10ARS191-3) to 170 bu/A (AAC Synergy). The top yielding lines were AAC Synergy (170 bu/A), Lightning (a facultative winter barley at 167 bu/A), Brunilda (166 bu/A) CDC Copeland (164 bu/A), Conrad (162 bu/A), AAC Connect (160 bu/A), ABI Eagle (159 bu/A), Esma (156 bu/A), Explorer (56 bu/A), and Accordine (153 bu/A). The average heading date (6/20) was seven days earlier than 2019, and 3 days later than 2018 (6/17). Lodging was very low, with the only significant lodging in AC Metcalfe at 18%. The ratio of available and applied N (283 lbs N/A) to average bushel yield (145 bu/A) was 2.0 lbs N/bu with an average site grain protein of 10.8%.

The average yield for two-rowed feed barley in Aberdeen for 2020 (Table 62) was 104 bu/A, significantly less than 2019 (at average 121 bu/A) and 2018 (146 bu/A). The high yielding two-rowed feed varieties were Bill Coors 100 (122 bu/A), Champion (120 bu/A), Oreana (118 bu/A), Claymore (115 bu/A), Lenetah (114 bu/A), Charger (113 bu/A), Xena (112 bu/A) and Altorado (111 bu/A). Average test weight for this trial was 52.9 lbs/bu). The hulless, high beta-

glucan food barleys Transit, Goldenhart Julie and yielded 115, 112 and 108 bu/A and also had high test weights (57.7, 60.7 and 61.2 lbs/bu, respectively). Kardia is hulled with lower test weight than the hulless lines. The heading date for this trial was 6/20, seven days earlier than 2019 (6/27) and two days later than in 2018. Lodging was very low and averaged about 1%. For this trial, the ratio of available and applied N (283 lbs N/A) to average bushel yield (104 bu/A) was 2.7 lbs N/bu with an average site grain protein of 10.6% for feed barley.

Idaho Falls, Marc Thiel, Spring Grain

The Idaho Falls location following potatoes, was planted on April 20th in silt-loam soils with good soil moisture and harvested August 25th. The surrounding field was in barley.

Average grain yield for the hard spring wheat (Table 38) was 115 bu/A, which was 1 bushel less than 2019, 4 bushels less than 2018 and 11 bushels less than the average in 2017. The yield CV was good for an off-station location at 8.9%. Hard spring wheat yield ranged from 100 (IDO1701S) to 143 bu/A (Dayn). Average grain protein was 14.1%, and test weight was at 62.8 lbs/bu. The two highest yielding named varieties were the hard white wheat, Dayn (143 bu/A and 13.8% protein) and the hard red wheat, Alum hard red (129 bu/A and 14.6% protein). Below that top group were AP Venom (128 bu/A and 12.8% protein) and AP Renegade (124 bu/A and 13.3% protein). Lodging was minimal and average grain protein was good at 14.1%.

The high protein lines include WB9303 at 16.5%, Lanning at 15.9%, WB9707 at 15.8%, Dagmar at 15.6%, WB9668 at 15.5%, WB9879CLP at 15.3%, WB9590 at 15.0%, and Alum at 14.6%, all of which had excellent test weight. The ratio of available and applied N (290 lbs N/A) to average bushel yield (115) was low, 2.5 lbs N/bu.

Three entries of AP Renegade - one with our standard seed treatment (Vibrance Extreme) yielded 124 bu/A, one with an undisclosed base seed treatment applied by McGregor yielded 118 bu/A, and a third with an additional undisclosed McGregor seed treatment yielded 114 bu/A. There were no statistical differences in the treatments for yield, test weight, plant height or date of heading except the AP Renegade + base was significantly earlier than the other treatments. Grain protein of AP Renegade was 13.3%, while the AP Renegade + base + root was 12.7%.

WB6430, UI Stone, Seahawk, UI Cookie, UI Pettit and Alturas topped the yield chart (Table 47) for the soft white spring wheat varieties at Idaho Falls at 141, 137, 133, 132, 129 and 128 bu/A, respectively, with an overall trial average of 125 bu/A, 5 bu/a greater than 2019, and 7 bu/A less than 2018. The 2020 yield CV was very good for an off-station location at 7.4%. Yields ranged from 114 bu/A (AP Coachman) to 141 bu/A (WB6430). Test weight averages were good at 61.8 lbs/bu, and grain proteins were at 9.5%. The ratio of available and applied N (225 lbs N/A) to average bushel yield (125) was 1.8 lbs N/bu. Additional nitrogen would have benefited yield and protein, but the field was in a field of spring barley and managed for optimum spring barley yield.

The two-rowed malt barley yields in Idaho Falls (Table 55) averaged 143 bu/A, 34 bushels/A greater than 2019, and 7 bu/A more than 2018. The yield ranged from 103 (Lightning) to the highest yielding variety KWS Jessie which hit 172 bu/A. The yield CV was very good for an off-station location at 7.5%. Other top yielding named varieties included KWS Chrissie, LCS Opera, BC Leandra, KWS Amadora, KWS Fantex, and BC Elinor. Moravian 179 yielded 150 bu/A with excellent test weight, plumps and

protein, a little higher yielding but similar agronomically to ABI Voyager (141 bu/A) and ABI Eagle (137 bu/A). Test weight average was 52.8 lbs/bu, plumps were high (93.3%) and lodging was low at 5%. The ratio of available and applied N (225 lbs N/A) to average bushel yield (143) was 1.6 lbs N/bu with an average site grain protein of 10.8%.

The two-rowed feed and food barley trial (Table 63) averaged 152 bu/A, with the top yielding line averaging 182 bu/A (HO516-429), significantly higher than every other entry, and with 54.3 lb test weight. Altorado yielded 163 bu/A, Claymore yielded 159 bu/A, Charger 156 bu/A, and Bill Coors 100 at 156 bu/A. The yield CV was very good for an off-station location at 8.4%. The test weight average for the feed lines was 54.0 lbs/bu and protein average was 10.8%.

The hullless food barleys in the trial have very high test weight averages, so they were averaged separately. Test weight of the hullless lines averaged 60.8 bu/A (even including the hulled Kardia, the average was 59.1 lbs/bu) and the protein was at 13.1%.

Ashton, Alan Baum, Spring Grain

The Ashton location was planted May 5th in silt-loam soil into good soil moisture following barley. Barley plots were harvested September 3rd, and wheat plots were harvested September 11th.

There are two soil-based factors that are important in plant health and reducing yield potential in this area. Soil pH can be low, sometimes below 6.0 which can contribute to high micro-nutrient accumulations (magnesium, manganese, iron and boron). This location had soil pH at 5.9 and leaf necrosis (browning) can occur when the pH varies from 4.5 to 6.0 in fields. 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 the 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 the 2016 Small Grains Report available online <http://www.uidaho.edu/extension/cereals/scs/uidaho/sgr>.

The average yield for the hard spring wheat (Table 39) was 128 bu/A, compared to 74 bu/A in 2019, 100 bu/A in 2018, 83 bu/A in 2017, 88 bu/A 2016, 94 bu/A in 2015, and 100 bu/A in 2014. The yield CV's were good at 7.6%. Heading dates were three days later than 2019 and delayed eleven days from 2018. The range in yield varied from 108 bu/A (WB7328) to 154 bu/A (hard white Dayn). Test weights were above average at 61.7 lbs/A, and protein averaged 13.6%. The high yielding varieties were Dayn (154 bu/A) and advanced hard white line IDO1804S (150 bu/A). Other high yielding lines include WB9707 (138 bu/A, 62.9 lb test weight and 14.5% protein) CP3066 (137 bu/A, 61.8 lb test weight and 13.6% grain protein. The highest proteins were seen in WB9303 (at 15.7%), Lanning (15.5%), Dagmar (at 15.3%), WB9879CLP (14.5%) and WB9668 (at 14.5%). The ratio of available and applied N (265 lbs N/A) to average bushel yield (128) was 2.1 lbs N/bu. The average grain protein levels for hard spring wheat were 13.6%. Protein averages are relatively low at the higher yields as there was not enough N to meet yield and protein goals.

In the soft spring wheat trial (Table 48), the high yielding named varieties were WB6430 (147 bu/A), AP Coachman (138 bu/A) and Melba club wheat (138 bu/A). The average

yield for the soft white spring trial was 129 bu/A, higher than 2019 by 50 bu/A, and higher than 2018 by 30 bu/A, and ranged from a low of 114 bu/A (Ryan) to a high of 147 bu/A (WB6430). Heading dates averaged two days later than 2019, and 11 days later than in 2018. The test weight average was a 61.6 lbs/A, with no lodging. With the low ratio of 1.4 lbs N/bu (180 lbs N/ 129 bu/A), grain protein averaged 9.3% - lower than optimal levels for yield and protein, not surprising given the excellent yield associated with this year at this location.

Two-rowed malt barley yields (Table 56) ranged from 110 bu/A (Lightning) to 179 bu/A. The average was 140 bu/A, 44 bu/A greater than 2019, 39 bu/A greater than 2018, and 33 bu/A greater than in 2017. The highest yielding named lines were KWS Fantex (179 bu/A) and KWS Chrissie (165 bu/A). Other high yielding lines include BC Ellinor (161 bu/A), LG Diablo (158 bu/A), BC Leandra (157 bu/A), LCS Odyssey (155 bu/A) and ABI Eagle (148 bu/A). Lodging averaged less than 1%. Overall test weight was 52.7 lbs/bu, protein averages were 10.7% and plumps were 96%. The 180N: 140 bu ratio calculates as 1.3 lbs N/bu, very low for the average yield - lower than optimal levels for yield and protein, again not surprising given the excellent yield associated with this year at this location. Also of note is the relatively low yield for ABI Voyager, which at 132 bu/A is below the trial average. ABI Voyager is susceptible to cereal cyst nematode and likely suffered yield loss due to high populations of CCN which are widespread in the Ashton area.

The barley feed lines averaged 125 bu/A with advanced line HO516-429 (157 bu/A) and Charger (146 bu/A) yielding significantly higher than other entries. Other high yielding lines include Xena (137 bu/A) and Altorado (134 bu/A) (Table 64). The barley CV for yield was good at 9.6%. The

feed barley average test weight was 53.1 lbs/bu, and the food barley test weight averaged 57.8 lbs/bu as most of them are naked or hulless barleys. Kardia is a hulled, high beta-glucan food line with lower test weight than the other hulless food lines. Proteins of the feed lines averaged 10.6% and the food barley proteins averaged 14.5% with a total N:bu ratio of 1.3 lbs N/bu. The hulless barleys also had significantly reduced stands when compared to the hulled lines. Hulless barleys are more susceptible to environmental stress and handling damage.

Soda Springs, Kyle Wangemann and Scott Brown, Spring Grain

The only spring dryland extension trials were in Soda Springs. The nursery was planted May 11th and harvested September 10th. The previous crop was spring barley.

Yield averages for the hard red and hard white spring nursery (Table 40) were 54 bu/A, 13 bu/A less than 2019, 8 bu/A better than 2018. While there was good moisture early in the season, late season precipitation was lacking. The range in yield was 40 to 62 bu/A. The five highest yielding named varieties were the hard red Jefferson (62 bu/A), AP Renegade (with a separate undisclosed seed treatment “base+root at 62 bu/A), WB7202CLP (62 bu/A), Alum (61 bu/A), and hard white SY Teton (60 bu/A). Also in the high yield group was the hard white (W) WB7589, Glee, Dagmar, UI Platinum, WB7696 (W), Net CL+, Espresso and CP3066. The average heading date (7/11) at this location was similar to 2019 and 11 days later than in 2018. Test weights averaged 62.0 lbs/bu, stands were good but grain proteins were very low, averaging 9.8%, with the highest proteins in Dagmar (11.3%) and Espresso (11.2%). The total

N:bu ratio of 1.0 (52 N/54 bu) was too low for optimal yield and protein targets.

For the soft white spring wheat (Table 49), the nursery averaged 62 bu/A, 21 bu/A less than 2019, 4 bu/A greater than 2018, and 34 bu/A greater than 2017. The yield ranged from 52 (WA8327) to 77 bu/A (WB-1035CL+). Following WB1035CL+ were Melba club wheat (70 bu/A), Ryan (69 bu/A) and AP Coachman (67 bu/A). Test weight average was 60.5 lbs/bu, and proteins were low at 8.6%. The total N:bu ratio of 0.8 (52 N/62 bu) was too low for optimal yield and protein targets.

Replicated dryland barley trials were added to Soda Springs trials. Two-rowed malt barley yields (Table 57) ranged from 27 bu/A (Lightning) to 55 bu/A (10ARS191-3). The trial average was 45 bu/A, 63 bu/A less than 2019, and 20 bu/A less than 2018. The highest yielding named lines were LCS Opera (53 bu/A), KWS Fantex (52 bu/A), LCS Odyssey (52 bu/A), BC Leandra (51 bu/A), Moravian 69 (51 bu/A), KWS Chrissie (50 bu/A), Accordine (49 bu/A) and Brunilda (49 bu/A). There was no lodging, overall test weight was 51.8 lbs/bu and plumps were 95%. Protein averages were an acceptable 10.6%. The total N:bu ratio of 1.2 (52 N/45 bu) was too low for optimal yield and protein targets.

The feed lines averaged 52 bu/A with Claymore (61 bu/A) and Oreana (55 bu/A) as the statistically highest yielding named varieties (Table 65). The food barleys yielded an average of 40 bu/A. Kardia is a hulled, high beta-glucan food line with lower test weight than the hulled lines Julie, Transit and Goldenheart, which have a test weight close to 60 lbs (59.4 lbs/bu). Proteins of the feed lines averaged 13.7%.

Table 2. Variety Descriptions

SPRING BARLEY - Malt

AAC Connect (TR04282) – released in 2016 by Agriculture and AgriFood in Manitoba, Canada, AAC Connect is marketed in the U.S. by Meridian Seeds. AAC Connect has been in the trials for three years (Table 51). AAC Connect has malt quality similar to AC Metcalfe with higher extract and lower beta glucan. It is a mid-maturity, two-rowed variety with moderate resistance 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, and had high test weight and percent plumps. AAC Connect has higher protein in the trials but below 11.5%, and was at or a little lower than average for yield. Lodging was high in the irrigated trials. In 2020, average yields were at 90% of all location averages (Table 58), but at 110% of average at Aberdeen.

AAC Synergy – released in 2015 by Agriculture and AgriFood Canada, AAC Synergy is a two-rowed malt barley in the sixth year of testing in these trials. AAC Synergy is marketed by AgriPro in the PNW. AAC Synergy has high percent plump, average percent protein, and low beta-glucan levels. Overall yield was slightly below average (Table 51), similar to AC Metcalfe, with average or better test weight and plumps. Height of Synergy is four inches less than Copeland and two inches shorter than Metcalfe with similar tendencies for high lodging under irrigation. In Fusarium head blight (FHB) screening trials, AAC Synergy was moderately resistant for FHB (disease indices) and was average for levels of DON on the seed. AAC

Synergy also expressed high levels of resistance to foliar pathogens.

ABI Eagle (2B11-4949) – a newer release by Busch Agricultural Resources (2018), Eagle has been tested in the variety trials for four 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, three to four inches shorter, with lower plumps. Lodging was a little less than Voyager, but protein was higher (Table 51). FHB reaction initially has been similar to ABI Voyager. In 2020, ABI Eagle performed well in Aberdeen, Ashton and Soda Springs (Table 58).

ABI Voyager (B3719) – a 2011 release from Busch Agricultural Resources, Voyager consistently out yields many other two-rowed malt varieties in the barley production area. Three-year average yields (Table 51) were below LCS Odyssey and similar to Moravian 69, with higher test weight and plumps, with similar percent lodging. ABI 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), is susceptible to FHB and shows average DON accumulation.

AC Metcalfe (TR232) – two-rowed malting barley released in 1994 by Agriculture and Agri-Food Canada with excellent quality, lower yield potential than average (90% of trial average, Table 58), and 2” 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.

Accordine – a two-rowed European malt variety under testing in Idaho with Ackermann Saatzucht GmbH & Co. KG. Accordine is a successful malt variety in Germany with outstanding malt quality for German type all-malt brewing. Accordine yields were 107% of trial averages in Aberdeen and Soda Springs locations in 2020 (Table 58) and was not tested at other locations. Accordine performed as a mid-maturity, shorter variety with medium protein levels and plumps. Accordine is marketed through Nutrien AG Seeds, and first tested in Idaho in 2020.

BC Ellinor – an older two-rowed spring malt and feed variety under testing in Idaho with Limagrain Cereal Seeds. Ellinor was developed in Germany by Breun Craft, targeted for the German all-malt style beers. Ellinor averaged 108% of trial average for yield (Table 58) across all locations in 2020 trials but was 1.8 lbs lower than average for test weight. Ellinor was later maturing than average with average proteins and plumps.

BC Leandra – a two-rowed European malt variety under testing in Idaho with Limagrain Cereal Seeds. Like Ellinor, BC Leandra was developed in Germany by Breun Craft, targeted for the German all-malt style beers. BC Leandra averaged 110% of trial average for yield across all locations in 2020 trials (Table 58). Yield, test weight, protein and plumps were good (Table 52). Yields were 23 bu/A greater than ABI Voyager, with later maturity (3 days) and 7 inches shorter than Voyager.

Brunilda – a two-rowed malt submitted by Ackermann for testing in Idaho in 2020. Brunilda was high yielding (in the top group for yield in Table 52), early maturing and four inches shorter than average. Brunilda has good grain quality, average protein and good plumps.

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 52). Copeland was 3-5 inches taller than average with greater lodging, and was average for grain protein and plumps, with good test weight. In 2019 FHB screening trials, CDC moderately susceptible for FHB infection and had low-to-average DON levels in the grain.

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 3-4 inches shorter than ABI Voyager, is average for lodging and protein. Conrad has yielded well in the dry land upper elevation areas. Conrad has low disease measures for FHB (moderately resistant) and medium seed-levels of DON.

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 eastern Idaho in 2020, Esma had 107 percent of average yield in Idaho Falls and Aberdeen, very good test weight, average to later than average heading date, and was 3 - 4 inches shorter with very low for lodging. Esma has good malt quality with low beta-glucan, high extract, and good FAN potential. Esma is susceptible to FHB. Like many of the European malt types, Esma is suited for the craft beer market.

Explorer – a newer introduction from Secobra Recherches, Explorer is a two-rowed malting barley in the fourth year in these trials. In the 3-year summary, Explorer was greater than average in grain yield

(Table 51), similar to LCS Odyssey with higher test weight. Heading date, protein, plumps and test weight were at trial averages. Explorer is shorter than average (4-5 inches) and lower than average for lodging. Explorer has good resistance to leaf diseases and is widely adapted but is susceptible to FHB. 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.

GemCraft (2Ab08-X05M010-65) – released by the USDA-ARS and Idaho AES in 2018, GemCraft is a PVP 2-row malt barley released for the craft industry and favored by the Brewers Association due to its good taste profile. Yield over the previous three years were average, similar to ABI Eagle, Test weight was below trial averages. Height, heading date and grain protein were similar to Conrad, with lower plumps. Lodging tends to be greater under irrigated production systems.

KWS Amadora – German two-rowed malt line registered in 2015 bred by KWS Lochow, introduced into the US through KWS in Illinois and entered into the trials in 2020. Irrigated average yield, plant height and grain protein of KWS Amadora was similar to LCS Odyssey with even better test weight (Table 52). Heading date was similar to trial average and three days earlier than LCS Odyssey. Yield of KWS Amadora averaged 107 percent of trial average (Table 58), doing particularly well in eastern Idaho. KWS Amadora was resistant to PNW races of barley stripe rust in WSU trials.

KWS Chrissie – a two-rowed malt line registered in France in 2019, introduced into the US through KWS in Illinois and entered into the trials in 2020. Irrigated average yield, plant height and grain protein of KWS

Chrissie (166 bu/A) was greater than LCS Odyssey with similar test weight (Table 52). Yield of KWS Chrissie averaged 109 percent of trial average (Table 58). KWS Chrissie has good disease resistance, including to several nematode pests but was susceptible to PNW races of barley stripe rust in WSU trials.

KWS Fantex – German two-rowed malt line bred by KWS and introduced into the US through KWS in Illinois and entered into the trial in 2020. Yield of KWS Fantex averaged 110 percent of trial average (Table 58), doing particularly well in Ashton where it yielded 128% of trial average. Fantex headed 2-3 days later than average and the other KWS varieties. KWS Fantex was resistant to PNW races of barley stripe rust in WSU trials.

KWS Jessie – French malt line released in 2019 through KWS Momont, introduced into the US through KWS in Illinois and entered into the trial in 2020. KWS Jessie is a two-rowed malt with excellent quality, very high yield potential and proteins similar to LCS Odyssey (Table 52). Jessie has very good test weight and is very short with good resistance to lodging. KWS Jessie was moderately susceptible to moderately resistant to PNW races of barley stripe rust.

LG Diablo – LG Diablo is a non-GN producer (glycosidic nitrile) that was released for dual-purpose malting and brewing with excellent yield potential. Barley varieties used for distilling require low to no GN in the grain. LG Diablo is a two-rowed malt marketed in the US through LCS and is in the second year in these trials. Yield has been excellent, similar to the KWS lines and LCS Odyssey, with lower test weight and later maturity (Table 52). Lodging resistance, grain protein and plumps were good. Great Western liked the

variety based on data from the UK. LG Diablo has good disease resistance, excellent malting quality with high hot water extract and low grain nitrogen.

LCS Odyssey (NSL08-4556-A) – LCS Odyssey is a European two-rowed malt barley released and distributed through Limagrain Cereal Seeds. In 2020, LCS Odyssey yields were 107% of trial averages (Table 58). In three years of testing, LCS Odyssey was the highest yielding variety behind Moravian 179, greater than Explorer (Table 51). Test weights were lower than average with average lodging, even as LCS Odyssey is 3-5 inches shorter than the trial average. Heading date is 1-3 days later than average with average proteins and good plumps. LCS Odyssey is more susceptible than current U.S. malt varieties for FHB and had higher levels of DON accumulation. LCS Odyssey has excellent resistance to CCN populations and is resistant to PNW races of barley stripe rust. Odyssey has excellent malt quality for all-malt brewing with dual usage in distilling (a low GN or glycosidic nitrile variety).

LCS Opera – tested in Idaho from 2018 to 2020, LCS Opera is a very high yielding two-rowed, dual purpose barley for malt and feed. In 2020, irrigated average yields of LCS Opera were 110% of trial average (Table 58), consistently at or above trial averages at all locations. While the best zone of adaptation is in eastern / northern Washington, irrigated average yield of LCS Opera was comparable to LCS Odyssey (Table 52) with lower test weight and two days later in maturity. LCS Opera has very good resistance to PNW races of barley stripe rust.

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, lower test weight and higher lodging than average. Merit 57 has good plumps and protein. While in 2020, irrigated average yield of Merit 57 was at 100% (Table 58), over the past three years yield and test weight averages were below trial averages. Merit 57 is moderately susceptible to FHB and DON accumulation is at average (Addendum 6a).

Moravian 69 (C69) - two-rowed spring malt barley released by Molson Coors Beverage 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 over all locations similar to ABI Voyager and higher than Copeland and Conrad (Table 51). 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 Molson Coors adapted to the higher production conditions of southern Idaho. Yields of Moravian 179 were similar to LCS Odyssey averaged over three years at multiple locations; however, Moravian 179 was not included at the Ashton location so the average is slightly skewed (Table 51). Moravian 179 has very high plumps and test weight and lower than average lodging. Proteins were at trial average, with plant height similar to M69 and four inches shorter than trial average. Molson Coors lines are under Title V and PVP.

Moravian 180 – is a newly released two-rowed malt from Molson Coors with lower-than-average yield performance (87% of

trial averages see Table 58). In 2020, yields were similar to CDC Copeland and Conrad with good test weight and very early but earlier in maturity, heading ten days earlier than CDC Copeland. Moravian 180 was five inches below trial average and shorter than Moravian 69 by four inches and 6 days earlier in heading.

SPRING BARLEY – Food

Goldenhart (2Ab09-X06F058HL-31) – Released by the USDA-ARS in Aberdeen in 2018, Goldenhart is a spring two-rowed hulless food barley with beta-glucan content similar to Transit (9-10%) released for significantly increased yield potential, especially under dry land conditions. However, three-year averages for irrigated production conditions put Goldenhart significantly lower in yield than Transit (Table 59, Chart 8). In 2020, yields at Aberdeen were 107% of trial average (Table 66), which includes high-yielding feed lines, but yields were similar to Transit at all other locations. Goldenhart has very high test weight and protein (Table 59) as expected for a hulless line. Goldenhart and the hulless barleys are susceptible to FHB and DON accumulation. Goldenhart was 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. Julie and the hulless barleys are

susceptible to FHB and DON accumulation. Careful handling of all hulless barleys prior to planting reduces germ damage and protects seedling stand establishment.

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 59) of Kardia was greater than Julie, Transit and Goldenhart. The beta-glucan level of Kardia is 7- 8.5% compared to 6.5% in Salute. Kardia is moderately susceptible to FHB (Addendum 7b) and has lower test weight than the hulless food barley lines due to its hulled characteristic. Yields in 2020 in Ashton were excellent in a cool, high-elevation environment.

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 or similar to Julie but the percent beta-glucan is higher than Julie. As a hulless line, test weights are high for barley. Transit and the hulless barleys are susceptible to FHB and DON accumulation.

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 60). Altorado is similar to Champion in disease resistance, test weight, plant height, lodging, and lower in grain protein. Altorado averaged two days

later in heading and in 2020 yields were 108% of trial average.

Bill Coors 100 (C100) – released as a feed line from Molson Coors Beverage Company in Burley, Bill Coors 100 is a short, high test weight feed line with strong straw strength and lower protein (Table 60). Average yields over three years was at trial average. In 2020 yields were 106% of trial average.

Champion (YU501-385) – 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 above trial average, comparable to Xena and slightly more than Lenetah under irrigation with higher test weight and plumps. Champion has slightly greater than average height, less than average protein, and heads 1-3 days earlier than trial average. Champion is moderately susceptible to FHB (Addendum 7b).

Charger (BZ512-319) – newly released feed line from Highland Specialty Grain (2020), Charger is a two-rowed barley with very high yield potential (Table 60), good test weight and earlier than average heading date, similar to Champion. In 2020, yields of Charger were 111% of trial averages (Table 66), yielding very well in the Ashton trials (Table 64).

Claymore (BZ509-216) – two-rowed feed originally developed through WestBred, Claymore is carried by Highland Specialty Grains. In three-year averages, Claymore consistently is in the top yielding group of feed lines, comparable to Altorado and Xena. Claymore is tall and similar in height to Champion (Table 57) with good straw strength, is 2-3 days later in heading, with lower test weight. In 2020, yields of Claymore were 111% of trial averages

(Table 66), yielding very well in the Soda Springs trials (Table 64). Claymore has good FHB tolerance.

FeedMor (Moravian 169) – Molson Coors released FeedMor as a two-rowed feed line in 2020 for its high yield potential and good test weight. FeedMor is very short, similar to Moravian 69 and Bill Coors 100, with greater yield. Heading date and lodging was at trial average, with high percent plumps kernels. In 2020 trials, FeedMor yielded 95% of trial averages (Table 66).

Idagold II (C32) – a two-rowed spring feed and malt line developed by Molson Coors Beverage 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. Idagold II is susceptible to FHB and DON accumulation (Addendum 7b).

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 produces 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 (Table 60). Lenetah yields and lodging are similar Champion and is slightly more susceptible than Champion for FHB.

Moravian 164 – a two-rowed feed barley line originally released by Molson Coors for production in dry land environments, Moravian 164 yields (3-yr data summary, Table 60) were slightly below average under

irrigation. Test weight was very good (below trial average as the trial included hullless barley lines), heading date was four days after Champion, and M164 was seven inches shorter than Champion, similar to FeedMor.

Oreana (BZ509-448) – a short, two-rowed feed barley originally developed through WestBred, Oreana is carried by Highland Specialty Grains. In three-year data averages (Table 60), Oreana had good test weight, excellent yields similar to Altorado and Claymore, and was 4-5 inches shorter than average, an unusual combination of yield and plant height. Oreana showed moderate susceptibility to PNW races of stripe rust, susceptible reaction to FHB (Addendum 7b) and showed higher levels of DON accumulated in the seed. Oreana yields in 2020 were 108% of trial average, performing well in Aberdeen and Soda Springs.

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 2010-2020, similar to or greater than Champion. Xena is of average height and straw strength, similar to Champion. Test weight tends to be slightly higher than average, but less than Champion. Xena yields in 2020 were 109% of trial average, doing well in Ashton (Table 66). Xena has shown low FHB disease and lower DON levels and classified as moderately susceptible (Addendum 7b).

WINTER BARLEY – Malt, Feed, Food

Buck (09-OR-86) – Oregon State University hullless, 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 (56-60 lbs/bu) due to the hullless seed trait. In 2017-18, Buck yields (132 bu/A) were comparable to Charles, but 2020 yields were low due to poor winter survival (Table 30, 31). 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' average yields and test weights are lower than the winter variety average (Table 28), but in 2020 yield of Charles was similar to Sunstar Pride (Table 31, Aberdeen and Chart 4). 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 as in 2020 near Rupert (Table 30). Both Charles and Endeavor can suffer significant stand losses under cold, dry winter conditions. For improved winter survival, Charles and Endeavor do best when protected from cold dry winter winds and with good soil moisture prior to entering winter conditions.

Desiree (FR124/12) – a two-rowed winter malt variety introduced from Germany by Pflanzenzucht Oberlimpurg through Nutrien Ag. In the second year of testing, winter survival was poor in Rupert. Yield in 2019 reached 192 bu/A in Aberdeen but was significantly less in 2020 (149 bu/A). Test weight is lower than trial average due to poor conditions but was over 48 lbs/bu in Aberdeen (Table 31). Desiree had average height and protein, and headed two days earlier than trial average, similar to Charles.

Eight-Twelve – a six-rowed winter feed barley released by the USDA-ARS and the Idaho AES in 1991. Eight-Twelve yields averaged 145 bu/A under irrigation in 2018-2020 (Table 28), 163 bu/A in two locations in 2020, . Eight-Twelve has good winter survival but may 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 test weight, 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). For improved winter survival, Endeavor and Charles do best when protected from cold dry winter winds and with good soil moisture prior to entering winter conditions.

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 and in 2020 (Table 29 and Chart 4). In Aberdeen in 2019, yields hit 199 bu/A. Lodging was below average in 2019 trials even though it was the yield leader. Winter survival of the KWS lines was better than the trial averages (Table 30). Maturity was earlier than average, and proteins were at 11.4%, compared to the trial averages of 11.7% (Table 29). For end use quality, extract content for Donau is at the level of 81.4% with a low level of proteolytic and cytolytic modification, which is preferred in the craft brewing industry.

KWS Faro – a 2-rowed winter malting variety from KWS Lochow, marketed in the U.S. through KWS Cereals. In the first year in the trials, yield of Faro was at trial average but had reduced stand due to winter conditions in Rupert. Winter survival of the KWS lines was better than the trial averages, although Faro spring stand was lower than Donau and Somerset (Table 30). Test weights were lower than average (but still better than the 48 lb/bu required for No. 1 barley). KWS Faro had a seven day earlier-than-average heading date, good protein and high plumps.

KWS Scala (GW2895) – 2-rowed winter malting variety from KWS Lochow, marketed in the U.S. through KWS Cereals. KWS Scala yielded above 3-year trial averages (Table 28) similar to Thunder 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 (average 51.5 lbs/bu), with good protein and plumps. In 2019 in Aberdeen, yields hit 200 bu/A. Winter survival of the KWS lines was better than the trial averages, although Scala spring stand was lower than Donau and Somerset. Scala was 1-2 days 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 3-year summary of testing in southern Idaho, Somerset yields were comparable to feed variety Sunstar Pride with good test weight, winter survival and plumps. Heading dates, plant height and grain protein were at trial averages. Under stressful conditions in the 2020 Rupert trials, Somerset had the highest percent winter survival and the highest yield (Table 30).

LCS Calypso – a two-rowed winter malt barley brought in by Limagrain Cereal Seeds in 2016-17 from Europe, and currently handled through Scoular Grain. Calypso is in the fifth year of testing in southeastern Idaho, and has shown excellent yield potential in southern Idaho, similar or greater to the winter feed line Sunstar Pride, with 172 bu/A and 52.5 lb/bu test weight over the three years of testing (Table 28, Chart 4). In Aberdeen in 2018, Calypso yielded 212 bu/A with little to no lodging. In 2019, yields in Aberdeen were 196 bu/A, however 2020 conditions were not favorable for high yield of Calypso, which yielded 89% of trial averages (Table 32). Calypso was earlier in heading (3-4 days) and 2-4 inches taller than average with excellent percent plumps and low lodging

Lightning (DH130910) – Lightning is a true facultative winter malt barley developed through the doubled haploid program at Oregon State University under Pat Hayes. Lightning was in both the winter and spring trials in 2020, but in some locations did poorly in the spring trials. Winter conditions in Rupert were poor, resulting in low spring stands, and yields were below trial average. Test weight and plumps were good, protein was a little high (11.9%) and heading date was two days earlier than trial average (Table 29.)

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 (Table 28). Test weight, protein, lodging and plant height is below 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 166 bu/A over the three-year summary (Table 28) with good test weight and spring stand. In 2020, poor winter conditions reduced significantly spring stand (Table 30). Heading date is three to five days earlier than the trial average and plant height was one to five inches less. Plumps were above average and lodging was a little greater than trial averages, better than Endeavor and Charles. Thunder yields were comparable to KWS Scala 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 two-rowed 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 plumps seed and had 2% higher grain protein (Table 28). Seed germination may be low under dry land conditions, and winter survival was poor in 2020 in both locations.

Wintmalt – a shorter, two-rowed winter malt developed by KWS Lochow (Germany) and imported from Europe. Wintmalt is being produced in the PNW, has good foliar disease resistance, and is an AMBA approved malt variety. In the third-year summary (Table 28), Wintmalt's plant height, lodging, protein and yields were at trial average. Wintmalt test weight was below average (which included the hulless lines, but at 51.4 lbs/bu is very good), heading was 1 day later than average, and 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 dry land conditions, is average in yield (Table 42, 43), with average test weight, heading date and height. Alturas is susceptible to the current races of stripe rust and to FHB (Addendum 4).

AP Coachman (08PN2001-07) - dry land soft white spring from AgriPro / Syngenta Cereals with released in 2020. AP Coachman was tested in 2019 in one dry land location (Soda Springs, Table 47) and yielded very well (90 bu/A) competing with Tekoa and Seahawk. In 2020, irrigated yields were below average (Table 49). It was three inches taller than average, with later maturity, average protein and low test weight. AP Coachman has resistance to current races of stripe rust, Hessian fly, and susceptible to FHB (Addendum 3c).

Louise (WA7921) – soft white spring wheat released in 2004 from Washington State University’s spring wheat breeding program and used as a long-term quality 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 irrigated conditions in Aberdeen (Table 46, 50). Louise is susceptible to stripe rust and very susceptible to FHB.

Melba (WA8193) – Melba is a 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 42), performing particularly well in 2020 (Chart 6). Melba is average in height, five days later in heading than UI Stone, with low protein. Melba is resistant to stripe rust and very susceptible to FHB.

Ryan (WA8214) – Ryan is a partial waxy soft white spring wheat released from Washington State University, AES and USDA in 2016. Over three years, Ryan yields were at trial average, similar to Tekoa over four irrigated locations (Table 42). Under dry land conditions, yield was similar to UI Stone and Seahawk (Table 43). 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 lodged a little under higher input.

Seahawk (WA8162) – a soft white spring wheat released from Washington State University’s spring wheat breeding program in 2014 adapted to dry land and irrigated production areas. Seahawk has resistance to Hessian fly, is very resistant to stripe rust, and susceptible 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 Alturas (Table 42). Plant height is a little above average and heading 4-5 days later than UI Stone. Seahawk may have a tendency to lodge under high production practices.

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 42). Tekoa did not yield as well in areas where irrigation was restricted at the end of the growing

season. In 3-year summaries, Tekoa yields were at trial average. Tekoa is adapted to low pH soils where aluminum toxicity can occur. Tekoa has very good test weight, is 5 days later in maturity (heading date) than UI Stone and average for plant height. Tekoa is resistant to stripe rust, Hessian fly, and susceptible 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 42) show UI Cookie above trial average for yield, lower for test weight and higher for grain protein and agronomically very similar to UI Stone. Performance under dry land conditions is below average (Table 43). 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 under irrigation (Table 42) and average under dry land conditions. 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 42). UI Stone was selected for good end use quality and reduced FHB susceptibility (carries the Fhb1 resistance gene). In 2020, UI Stone yielded similar to UI Cookie and about 4 bu/A below WB6340 (Table 44). 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+ – a 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 very susceptible to stripe rust, but WB3035CL+ yielded very well in Soda Springs in 2020. WB-1035CL+ has very good test weight (Table 42), is shorter and has earlier heading date than average, with relatively high protein.

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 consistently 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 and Red

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 SY Gunsight for yield and test weight, but higher in protein (Table 33). Alum heads about four days later than, is four to five inches taller than average, 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 dry land conditions in 2020 (Table 40).

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 had high yield but conditions in 2020 resulted in lower-than-average yields (Chart 5). AP Octane had below average protein. AP Octane was 2-4 inches shorter than trial average and has early maturity, heading three days later than Klasic. 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 high yields (Table 33) under irrigation, 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 average protein. Additional N should be applied at heading to meet protein goals. AP Renegade has resistance to Hessian fly, with good HTAP stripe rust and FHB tolerance.

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 and 2020 yielded equally as well as AP Octane in the average of the irrigated trials (Table 35). Venom has looked very strong in fall planted systems with good straw strength. AP Venom is at trial averages for plant height, and 4-6 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.

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 WB9590 under dry land conditions in Soda Springs (Table 40). 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.

CP3066 (CPX3616) – tested in 2019 under the experimental number CPX3616, CP3066 is a hard red spring supported by Winfield United. Yields were at trial average across irrigated locations (Table 35) with good test weight and protein (14%). CP3066 headed 4

days earlier than average and 6 days earlier than Jefferson. CP3066 is five inches shorter than Jefferson.

Dagmar (MTS1588) – the dry land hard red spring wheat Dagmar is a 2019 release from Montana State University and in the first year of testing in 2019 UI trials was the top yielding variety in Soda Springs. In 2020, Dagmar was included in the irrigated trials and yielded well in Ashton and Soda Springs. Dagmar had very good test weight, high protein, medium maturity and was seven inches taller than the irrigated trial average (Table 35). 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. Dayn is 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, yielding 116% of trial averages in 2020 (Table 41). 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 1-3 days earlier and about 1-3 inches taller, depending on the year. Yield of Duclair in Soda Springs was very good in

2019 and 2020, comparable to Klasic (Table 40), with average test weight and protein. Duclair is PVP protected.

Espresso (DA984-034SRR) – a hard red spring wheat bred and released in 2006 by WestBred (Bayer CropScience) with good resistance to stripe rust. Espresso was included due to its susceptibility to low falling number (FN). Yield performance was similar to Klasic (Table 35), with lower test weight and later maturity, heading 11 days after Klasic. Espresso has high grain protein and medium plant height.

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 dry land and irrigated trials and similar to WB9668 (Table 33). Glee has good test weight, is taller than average (5 inches taller than WB9668) and is average for percent seed protein.

Jefferson (IDO462) – hard red spring wheat released by Idaho AES and USDA-ARS in 1998. Jefferson is primarily intended as a dry land variety due to it being taller than average (about four inches taller under irrigation) and susceptible to lodging. Irrigated and dry land yields have been at or above nursery averages (Table 33, 34). 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 and hard white spring wheat in general.

Lanning – a hard red spring wheat released by Montana Ag experiment Station for dry land production. Lanning has high grain protein and strong gluten characteristics, improving that of Vida. In the first year of testing, Lanning yielded 89% of trial averages (Table 41). Lanning had good test weight, was mid-maturity and an inch shorter than Jefferson.

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 dry land production. Under irrigation, yields were slightly below average, it was 6 days later in maturity, was 4 inches taller (Table 33) and may tend to lodge under higher production conditions. Proteins were average under irrigation. At the dry land Soda Springs trial site, Net CL+ did well for yield, like UI Platinum, but was six days later in maturity (heading date).

SY Gunsight (06PN3015-08) – Syngenta released this hard red spring in 2016. Average three-year yields were similar to SY Teton and Alum (Table 33). Test weight and grain protein of SY Gunsight are average, with similar heading dates to Jefferson. It is moderately ‘resistant’ to FHB

and stripe rust, and susceptible to Hessian fly.

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 33). SY Teton was 7 bu/A less than Dayn for yield, with lower test weight and three inches shorter. Heading date is average, and grain protein is less than average. Reaction to head blight was like 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 Jefferson and WB202CLP, and less than Dayn (W) and SY Teton (W) (Table 33). In some environments, UI Platinum shows 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 hard white spring wheat released by Westbred (a unit of Bayer Crop Science) in 2017. In the three-year summary, the irrigated yield average of WB7202CLP was similar to WB7589, UI Platinum and Jefferson and was at 103% of trial average (Table 41). Test weight was similar to both varieties and slightly higher than the average, heading date was 2 days earlier than trial average, and it was 2-3 inches taller than Klasic. In 2020, yields were above average at 103% (Table 41).

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 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 33).

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 33). Under heavy pressure, WB7589 was moderately resistant to stripe rust in 2016. Like all hard white spring wheat, WB7589 is susceptible to FHB.

WB7696 (XB9512) – 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. In 2020, yields were 8 bu/A greater than WB7589. WB7679 yielded two bu/A less than Dayn under dry land conditions but had greater test weight and lower protein.

WB9303 (XC9302)– new in the trials this year is WB9303, a hard red spring wheat released by Westbred / Bayer Crop Science in 2020. Initial results put WB9303 at 86% of trial average, similar to WB7328. WB9303 has excellent test weight and protein, with irrigated trial average at 62.4 lbs/bu and 15.6% grain protein. WB9303 is early to mid-maturity, heading seven days earlier than WB9668 in 2020 irrigated trials (Table 35) and is about 4 inches taller than WB9668. WB9303 is resistant to stripe (yellow) rust.

WB9590 (F9N12-0151)– a hard red spring released by Westbred / Bayer Crop Science in 2018 developed out of the North Dakota program, 3-year yields were similar to Jefferson and Alum in irrigated trials (Table 33), with average test weight and high protein. WB9590 was 5-6 inches shorter than Jefferson with greater grain protein content, averaging 14.9% over the irrigated locations. Heading date was at average and similar to Jefferson. Under dry land production, WB9590 was similar to WB9668 for average yield. 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, has 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).

WB9707 (XC9304) – new in the trials this year is WB9707, a hard red spring wheat released by Westbred / Bayer Crop Science in 2020. Initial results put WB9707 at 102% of trial average, similar to SY Gunsight (Table 41) and better than WB9668. WB9707 has excellent test weight (63 lbs/bu) and protein (14.4%) in 2020 irrigated trials (Table 35). Heading was 7 days earlier than Alum and 4 days earlier than WB9590, close to trial average. Under dry land conditions, yield was greater than WB9668. WB9707 has resistance to stripe rust.

WB9879CLP (IMICHT79) – 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 irrigated conditions, yields were above average and comparable to WB9590 with slightly lower test weight and protein, with 5-6 inches taller in plant height. WB9870CLP headed 8 days later than WB9668 in 2020. Under dry land, yields were similar to Choteau (Table 40), but was 10 inches taller and six days later in heading.

WINTER WHEAT – Soft White Winter

AP Iliad (11PN044#84) – soft white winter released in 2020 by Agripro Syngenta adapted to intermediate to high-moisture rainfall and irrigated conditions. AP Iliad has resistance to stripe rust, strawbreaker foot rot, physiological leaf spot (PLS), soil-borne mosaic virus (SBMV). In 2020 trials, AP Iliad averaged 103% of trial averages, doing particularly well at the Kimberly site at 180 bu/A (Table 20) and in Soda Springs (Table 26). At 5 inches taller and later flowering than SY Assure, AP Iliad also had lower test weight (59.3 lbs/bu).

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 a similar heading date as UI Magic CL+, 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 WB456 and WB1376CL+ (Table 18). Appleby CL+ was an inch taller than UI Magic CL+ and had good straw strength and low lodging. Appleby CL+ has moderate resistance to stripe rust, acceptable to good end use quality, and is one of the earliest maturing Clearfield varieties.

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 test weight and end use quality. Yields in the last three years have been about 95% 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 2020, (Table 17) Brundage yielded 96% of trial average and 95% of SY Ovation. Stripe rust present very late in the season but wasn't severe.

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. In Washington, yields exceed Otto and has stripe rust resistance, good eyespot resistance, Fusarium crown rot resistance (FCR or dry land foot rot) resistance and has cold and snow mold tolerance. In Idaho, Devote agronomically performs similar to Eltan and has excellent emergence when deep planted, yielding 112% of trial average (Table 27) in 2020. Heading date was a little earlier than Eltan and Otto. Test weight was very good and plant height was about an inch less than Eltan. Devote has good FCR, strawbreaker (eyespot), snow mold and stripe rust resistance. End use quality is better than Eltan.

Eltan (WA7163) – soft white winter wheat released in 1990 by the Washington AES. Eltan has wide adaptability in the dry land production areas with good snow mold tolerance. Yields are still consistently good in dry land trials (Table 17). 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, so difenoconazole seed treatment is recommended.

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 (2-4 days earlier than Eltan and Otto) with good cold tolerance, stripe rust resistance, eyespot foot rot resistance (strawbreaker), and very good end use quality. It is broadly adapted with high yield potential, with yields in Southeastern Idaho comparable to Eltan and WB1783 under irrigation but with lower test weight (Table 17). Jasper seems to adapt very well to high rainfall and irrigation and does very well when water becomes limited later in the season. Under irrigation yields were comparable to LCS Hulk and UI Castle (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 16), LCS Artdeco yields were 98% of trial average (Table 27) similar to WB1529 and WB456 but with low test weight and very low protein. Plant height was 3-6 inches shorter than average with 3 days earlier heading. LCS Artdeco is moderately resistant to stripe rust, and very susceptible to dwarf bunt. LCS Artdeco is early maturing, daylength insensitive and can be a little winter tender.

LCS Blackjack (LWW15-71945) – Blackjack is a 2019 release from the Limagrain Cereal Seeds program; it is an awnless soft white winter derived from a Bobtail/Rosalyn cross with excellent yields in the 2019 trials, similar to WB1783. In 2020 yields were 106% of trial averages (Table 27) and similar to Norwest Duet (Table 18). Blackjack was 2 inches shorter than Brundage with similar heading date but

with lower test weight. Straw strength was good, and LCS Blackjack is resistant to stripe rust, has good stress resistance and good disease resistance to stem based diseases.

LCS Drive (LWW12-7105) – LCS Drive is a LCS ArtDeco derivative, released in 2015 from Limagrain Cereal Seeds. LCS Drive is a low protein, soft white winter wheat with irrigated yields similar to Stephens and WB 456 averaged over years and locations (Table 16). In 2020, yields were below average, comparable to UI Magic CL+ and WB 456. LCS Drive has low test weight, runs 4-6 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, awnless 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 LCS Ghost has excellent yield potential and in 2019 was at the top of the yield chart at 188 bu/A in the irrigated averages, and 196 bu/A at Aberdeen. In 3-year averages, LCS Ghost yields were similar to UI Magic CL+ with low test weight, heading date was the same as WB1783 and was 1 inch taller than WB1783. LCS Ghost wasn't tested under dry land conditions. LCS Ghost had good resistance to stripe rust in 2019. LCS Ghost is very winter tender.

LCS Hulk (LWW14-73163) – a soft white winter with released in 2018 by Limagrain Cereal Seeds for its wide adaptation in the PNW. Three-year average yields were at trial average with low test weight (Table 16). In 2020, average yield of LCS Hulk was 106% of trial average (Table 27), 8 bu/A greater than UI Sparrow (Table 18) with better test weight. Under dry land conditions, LCS Hulk yielded similarly to Rosalyn, Nixon, Purl and Stingray CL+ (Table 19). LCS Hulk has high adaptability, excellent standing power, good resistance to stem based diseases. Height is average under irrigated and dry land 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 in the Snake River Plain. LCS Shark is derived from LCS Artdeco and has resistance to stripe rust and wheat soil-borne mosaic virus (WSBMV), endemic in some areas of the Palouse but not currently a problem in southern Idaho. Three-year performance of LCS Shark was similar to UI Sparrow and LCS Drive (Table 16), with very good yield, average heading date, plant height and grain protein. Test weight is low. LCS Shark is susceptible to dwarf bunt and is resistant to stripe rust.

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 dry land trials in 2019 where yields were comparable to UI Sparrow, and

in 2020 dry land yields were also high, similar to Jasper and Eltan (Table 19). 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 dry land fit for the eastern Washington growing area, and while tall may be suitable for irrigated production in southern Idaho having good straw strength. LCS Sonic was tested in 2019 and 2020 in dry land trials. Yield of LCS Sonic in 2020 was 106% of trial average (Table 27), similar in yield and test weight to Eltan, and heading three days earlier and 1 inch shorter than average.

M-idas (11PN050#03) – a soft white winter wheat marketed through McGregor and in its first year in southern Idaho trials, M-idas yields were similar to Brundage, yielding 94% of location averages, doing best in warmer areas of Kimberly and Aberdeen. Relative yield performance of M-idas was better under irrigated conditions, where yield was less than average. Under dry land conditions, yield 83% of average. M-idas is average in test weight, winter survival (spring stand), and 2-3 days earlier in heading than trial average. M-idas was 5 inches shorter than Brundage.

M-PRESS – a soft white winter wheat marketed through McGregor and in its first year in southern Idaho trials, M-PRESS yields were comparable to UI Sparrow and Norwest Duet at irrigated locations (Table 18). Test weight was greater than UI Sparrow with similar heading date and four inches shorter. M-PRESS is resistant to stripe rust.

Nixon (OR2121086) – Soft white winter released from OSU in 2019, was 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 rainfall areas, good test weight and excellent end use quality. Irrigated average yield over the past three years (Table 16) was 150 bu/A, comparable to UI Magic CL+ and VI Bulldog with average test weight. Nixon yielded well under dry land conditions (Table 17), with 3-year dry land average of 50 bu/A was similar to Norwest Duet and Norwest Tandem. Nixon has average test weight, heading date and grain protein and was two inches taller than average.

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 dry land locations performed at average for yield and test weight. Should not be used under high production irrigated conditions. In 2019 irrigated trials, yield was comparable to WB1783, but with lower test weight, but was not included in 2020 irrigated trials. Heading date was average in dry land trials (Table 17), and grain protein was at average. Norwest Duet is moderately susceptible to dwarf bunt and is resistant to stripe rust. Norwest Duet has desirable end use quality, better than Norwest Tandem.

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 2018-2020 combined irrigated data, similar to Brundage and WB1529 (Table 16). Tandem

has earlier maturity, stiff straw, is good under irrigation. Tandem had average test weight and is 2 days earlier in heading date than average with strong straw strength. Dry land yields were at trial averages (Table 17) and similar to Norwest Duet. Norwest Tandem has acceptable end use quality, 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+ soft white winter has an intermediate to late heading date, (a day or two after UI Magic CL+, (see Table 16, 17), average test weight. good straw strength and stripe rust resistance. OR2X2 CL+ has acceptable end use quality, similar to Madsen.

Otto (WA008092) – a dry land (<12” rainfall production zone) soft white winter released September 2011 by Washington AES, Otto is similar agronomically to Eltan and both are 2-5 days later in heading than trial average (Table 17). Otto has similar yield potential to UI Sparrow, often better than Eltan, with test weight similar to Eltan. Otto has good emergence from deep plantings in the dry land areas with good cold tolerance and straw strength. Otto has resistance to eyespot foot rot and will have similar snow mold tolerance as Eltan, better stripe rust resistance and also is moderately resistant to dwarf bunt. End use quality was better than Eltan.

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 in higher rainfall / irrigated production areas with very good test weight and cold tolerance, resistance to stripe rust, eyespot (strawbreaker) foot rot, cereal cyst nematodes, and low pH soils (aluminum tolerance). Purl has shown good falling number data (higher FN results above 300 seconds). Tested in 2019 in the dry land trials, Purl performed similar to Bruneau for yield, test weight (at trial average), winter survival, while heading 5 days earlier. In 2020 trials, Purl yields were average under irrigated and dry land conditions (lower than Eltan in dry land trials see Table 19 and Table 27). End use quality is not excellent but would be good used for blending.

Rosalyn (OR2071071) – an awnless soft white winter, 2013 release from Oregon State University and the USDA-ARS, Rosalyn irrigated yields are above average and similar to UI Magic CL+ (Table 16), and test weight and grain protein were less than average. Rosalyn is moderately resistant to dwarf bunt and stripe rust, and carries Pch1 resistance, is intermediate for heading date and slightly taller than average.

Stephens (OR65-116) – a 1977 soft white winter release from Oregon AES, Stephens is kept for long-term check in Idaho EVT's. Yield and test weight under irrigation are below average (Table 16, and Table 17). 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 soft white winter 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 (strawbreaker) resistance, and very good end use quality. Stingray CL+ has higher falling number values and good test weight. In 2019 irrigated locations, Stingray CL+ yields were similar to LCS Hulk and Norwest Duet, and in 2020 yields were similar to UI Magic CL+, below irrigated averages. Under dry land conditions, Stingray yields were similar to Eltan, with earlier heading, lower test weight and higher grain protein (Table 19). Overall, Stingray CL+ yields were at 100% of all location averages. Later than Magic CLP.

SY Assure (SY96-2) – a soft white winter wheat released in 2016 by Syngenta Cereals, yield in 2018-2020 irrigated trials was comparable to Stephens and greater than WB 456 and LCS Drive (Table 16) with very good test weight. SY Assure is broadly adapted with earlier heading than the trial average by 3-4 days and is 1-3 inches shorter than average. SY Assure is moderately resistant to moderately susceptible to dwarf bunt, and resistant to stripe rust.

SY Ovation (03PN108#21) – a soft white winter wheat released by Syngenta Cereals in 2011 for higher rainfall and irrigated production. SY Ovation has had excellent yields over the past seven years with excellent test weight. Heading date, height, test weight and grain protein were average (see Table 16). 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. Agronomically similar to SY Ovation with

similar yield potential and better stripe rust resistance. 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 SY Ovation, at trial average (Table 18). SY Raptor is a widely adapted medium maturity variety with good threshability and test weight slightly below average. SY Raptor may have lower FN in some years.

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 16), the irrigated yields were above trial average, similar to UI Sparrow. Overall, UI Castle CL+ yields were 94% over trial average in 2020. Like Sparrow, 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 above average, and dry land yields were a lower than trial average (Table 17). 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 2018-2020 were above trial average (Table 16) and similar to UI Castle CL+. Test weight is slightly above average, heading date is at

trial averages, and it is 1-2 inches shorter than average and SY Ovation. UI Magic CL+ is widely adapted, susceptible to dwarf bunt and has become susceptible to stripe rust.

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 dry land 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 low test weight (58.5 lbs/bu) and a later heading date than average under irrigation (Table 16). Under dry land conditions, UI Sparrow was a top yielding variety over the past three years (Table 17). 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, a low disease pressure year.

VI Bulldog (UIL07-28017B) – VI (Varsity Idaho) Bulldog soft white winter was released through the UI/LCS joint venture in 2019, was developed from advanced experimental lines, has good test weight 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 16), VI Bulldog is medium maturity, has average yield similar to UI Magic CL+ and average test weight under irrigation. In 2020, VI Bulldog overall yields were 101% of trial averages. VI Bulldog is resistant to stripe rust.

VI Presto CL+ (UIL17-6451CL+) – newly released through the UI/LCS joint venture in

2020, VI Presto CL+ is a soft white winter Clearfield line tested under dry land conditions, targeted for low to intermediate rainfall areas. VI Presto CL+ has better emergence properties than Norwest Duet, and in 2020 yielded 89% of dry land trials average (Table 27). Yield was similar to Stephens with better test weight, slightly earlier heading and 5 inches shorter plant height. VI Presto CL+ has resistance to stripe rust, tolerance to *Cephalosporium* stripe and is photoperiod insensitive.

VI Shock (UIL15-72223DH) – a soft white winter wheat released for irrigation through the UI/LCS joint venture in 2020, VI Shock yields were 105% of irrigated averages (Table 27). Three-year average yields were excellent, similar to LCS Ghost and WB1783. 2020 average yield was 162 bu/A, 16 bu/A greater than SY Ovation (Table 18). VI Shock has medium maturity, average protein and test weight (Table 16).

VI Voodoo CL+ (UIL17-6268CL+) – A soft white winter newly released through the UI/LCS joint venture in 2020, VI Voodoo CL+ is a two-gene Clearfield line that performed at 99% of trial average for yield in 2020 (Table 27). Test weight, heading date and protein were about at trial averages (Table 18), and Voodoo was 3 inches shorter than SY Ovation. VI Voodoo CL+ is agronomically similar to UI Magic CL+ with stripe rust resistance and higher yield potential.

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 16) and has excellent test weight. 2020 yields were below average, about 94% of trial entries (Table 27). 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 imi-tolerant containing two genes for tolerance to BASF’s grass herbicide Beyond®. Irrigated yields were below average at 87% of average (Table 27) but with excellent test weights (Table 16). Dry land yields were below the trial averages, similar to Bruneau (Table 17). 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 Brundage over three years 2018-2020 (Table 16), with much higher test weight and good straw strength. Grain protein was at nursery averages. Dry land yields of WB1529 were similar to WB1783 (Table 17). In comparison to WB1783, WB1529 is 2 days earlier in heading date and 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 of WB1783 averaged as high as SY Ovation and LCS Hulk (Table 16), with very good test weight and good straw strength. Multiple year and location dry land yields were also good, comparable to Otto (Table 17). Irrigated yield in 2020 was very good (Table 18 and Chart 4), higher than SY

Ovation and UI Sparrow. Dry land 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.

YSC-201 – a soft white winter wheat variety carried by Wagner Seed, YSC-201 was included at two irrigated locations, Aberdeen (Table 22) and Ririe (Table 23). Yields in both locations were below average, below LCS Shark in Ririe, and with lower test weight. Protein and plant height were close to site average, with a two-day later heading than average.

YSC-215 – A Yield Star soft white winter wheat variety included at two irrigated locations, Aberdeen and Ririe. YSC-215 had good test weight and high protein, average heading date, and was three inches taller than WB 456. Yield and test weight in both locations was very good, similar to LCS Hulk (Table 23). YSC-215 is available through Wagner Seed.

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 at 93% across locations. AP NuGrain was 2 days earlier than average had good grain protein and excellent test weight. In 2019, a year of low stripe rust pressure, AP NuGrain was susceptible.

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 dry land conditions, Golden Spike's test weight is below average, with yield at 95% of average (Table 15) and average grain protein. Plant height was 4 inches less than Juniper (Table 5). Golden Spike is very resistant to dwarf bunt but is susceptible to stripe rust.

Irv (OR2110679) – a hard white winter wheat released from Oregon State University in 2018 for moderate rainfall production conditions, Irv had low yield average under irrigated and dry land conditions (Table 5, 6) in southeastern Idaho. In 2020, Irv yields were 103% of trial averages, doing particularly well under dry land trials in Ririe and Rockland. Irv had average spring stand, heading date and plant height, and was below average for protein and test weight. Irv has good end use quality and is moderately resistant to stripe rust.

LCS Yeti (LCI13DH-2222) – LCS Yeti is a hard white winter wheat released in 2018 by Limagrain Cereal Seeds. LCS Yeti yields under dry land production in the past three years (Table 7) were below trial average, with very good test weight. LCS Yeti yields were 86% of dry land trial averages in 2020. LCS Yeti had very good protein, 2% higher than UI Bronze Jade. LCS Yeti headed 4 days earlier than average and was 1 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 2020, named 'Millie' after Millie Rouch, wife of Chris Rouch, a dry land wheat farm family in eastern Oregon who have been long time

supporters of the OSU wheat breeding program. Millie has good straw strength even under irrigation, good stripe rust resistance, excellent yield potential across rainfall zones from dry land to irrigated. Yields of Millie were excellent under irrigation (Table 4) similar to Yellowstone with very high test weight, and 4 inches shorter. Millie has acceptable to good quality which depends on hitting protein targets.

UI Bronze Jade (W) (IDO1706) – this hard white winter wheat released by IAES in 2019 has been in the trials for 3 years, and has demonstrated good yield, but very low test weight, overall poor quality and should be grown only with a specific contract market in mind. This dry land variety will lodge under irrigation and is 2 inches taller than average. Under dry land 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.

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 good 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. Yield in 2020 was 101% of trial average (Table 15). Protein was a little low, but additional nitrogen would need to be applied to meet N requirements for yield and protein. AP Redeye was resistant to local races of stripe rust and has acceptable end use quality.

Flathead – A hard red winter wheat released through Montana State University (MAES) in 2018, Flathead has a Yellowstone background with enhanced stripe rust resistance (two genes for resistance), shorter stature and early maturity. 2020 yield of Flathead was 96% of trial average but it did very well in Aberdeen (107%) and Rupert (110% of trial average – Table 15). Test weight and grain protein of Flathead is excellent.

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 2020 trials, FourOsix had comparable yield and grain protein to Keldin, with high test weight, was 4 inches shorter and had less lodging than Yellowstone. FourOsix has better resistance to stripe rust than Yellowstone.

Juniper (IDO 575) – hard red winter wheat released in 2005 by the Idaho AES for dry land production areas. Juniper has moderate yield potential under dry land production

(Table 5, 7), about 100% of dry land average, is extremely tall and will lodge under irrigation. Juniper has good test weight and high protein. Juniper performs similar to Golden Spike and LCS Yeti, is very resistant to dwarf bunt and moderately resistant to stripe rust.

Kairos – a hard red winter first in these trials in 2020, Kairos is handled by McKay Seed in Moses Lake, WA. In the first year of testing, Kairos yielded 94% of irrigated averages, similarly to Keldin (Table 6). Kairos had very good test weight, headed early, was 4 inches shorter than average and had low protein.

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. Yields are at trial averages under irrigated and dry land conditions (Table 4, 5). 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 4 (3-year irrigated averages), Keldin and Keldin +11-52-0 were within 2 bushels of each other (LSD = 6 bu/A), indicating no effect of starter fertilizer on yield, stand or other agronomic traits. Under dry land conditions, Keldin + 11-52-0 was 3 bu/A greater than Keldin, but with the LSD of 4 bu/A, there is no statistically significant difference between the two for yield. In

2020, dry land yield was improved by 6 bu/A with the addition of starter fertilizer (Table 7), resulting in yield at 108% of trial average, as compared to Keldin without starter fertilizer which yielded 98% of trial average (Table 15).

LCS Jet (NSA 7208) – a hard red winter with released in 2015 by Limagrain Cereal Seeds. LCS Jet has excellent yield potential (Table 4 irrigated, 15 dry land) and has been a top yielding hard red winter for the previous six years of irrigated testing. In 2020, LCS Jet yielded 102% of irrigated mean (Table 15 and Chart 2). 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 bunt. In 2019, LCS Jet showed an increase stripe rust susceptibility with a susceptible infection type. 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. Three-year irrigated average yield was below trial average, with low test weight and grain protein. Yields in 2020 under irrigation were 95% of trial average (Table 15). 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 Utah 100 for yield in 2020 dry land trials (Table 7), was 3 days earlier in heading and 7 inches shorter. LCS Zoom had excellent stripe rust resistance.

Promontory (UT1567-51) – a hard red winter wheat released by Utah AES in 1990. Promontory is a dry land variety with excellent test weight. Yield under irrigation has been above average, but it will lodge and was not included in the irrigated trials. Promontory has short coleoptiles and may have trouble emerging when planted deep in dry soils. Over the past three years of testing (Table 5), Promontory yields were below average. Promontory is resistant to dwarf bunt and moderately susceptible to stripe rust.

Scorpio (WA8268) – a broadly adapted hard red winter wheat released in 2019 by WSU, Scorpio is mid-maturity with short stiff straw. Scorpio has high yield potential similar to LCS Jet and better than Keldin, and 3-year averages yields were 159 bu/A (Table 4) with lower (no) lodging than LCS Jet and Yellowstone. Test weight and grain protein was less than average. Scorpio should be well-adapted to no-till situations with low pH soils and has Al tolerance. In 2020 dry land trials, Scorpio yields were above average, similar to UI Bronze Jade with slightly better test weight. Scorpio had moderately susceptible reaction to stripe rust in 2019 and has tolerance to Hessian fly. Scorpio has good end use quality.

Sequoia (WA8180) – a hard red winter wheat developed and released in 2015 by WSU. Sequoia has very good (desirable) end use quality and emerges quickly in deep-planted situations. Under irrigation, Sequoia yields were comparable to Keldin over three years (Table 6) but also tended to higher lodging. Test late was lower than average and heading was 6 days later than Keldin. In 2020 yields were 105% of trial average yields. Sequoia has cold tolerance, adult plant resistance to stripe rust, and good straw strength.

UI SRG (IDO656B) – a hard red winter wheat released in 2012 by the Idaho AES for the dry land 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 consistently been well above dry land average, comparable to Yellowstone with similar test weight (Table 5). UI SRG is very resistant to dwarf bunt and resistant to stripe rust and is a good choice for dry land production in southern Idaho.

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 dry land (Table 5) conditions for yield. As a dry land variety, Utah 100 may lodge under irrigated conditions where yields are at trial average. Utah 100 is very resistant to dwarf bunt and is susceptible to current races of stripe rust.

WB4311 (XA4104) – 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 average to below average yield in irrigated and dry land areas (Table 4, 6 and Chart 2), comparable to Irv. WB4311 had excellent test weight, was 2-3 days earlier in heading, and had higher grain protein than average. In 2020, WB4311 yields were 87% of trial average (Table 15). WB4311 has good stripe rust resistance and winter hardiness.

WB4401 – a hard red winter wheat developed by WestBred (Bayer Crop Science) for the central and southern plains, WB4401 can be used for forage and grain yield. Tested only in Kimberly and Aberdeen, 2020 yields were 110% of trial average. Yields were comparable to FourOsix and LCS Jet with very good test weight. WB4401 was 3 inches shorter than

average and 3 days earlier in heading than average. WB4401 is moderately resistant to stripe rust.

WB4623CLP (BZ9WM09-1663) – a hard red winter wheat released by WestBred, WB4623CLP is a two-gene Clearfield wheat. WB4623CLP had below average yields under irrigation but with excellent test weight and protein (Table 4). In the dry land trials yields were at trial average, similar to Promontory (Table 5). Heading date was at average, and plant height was one inch taller than average under irrigation and 3 inches less in dry land. WB4623CLP is susceptible to dwarf bunt and resistant to stripe rust.

WB4792 (XB4711) – a hard red winter wheat released in 2018 by WestBred/Bayer Crop Science, WB4792 is in the second year of testing in these trials. Initial results show very high yield potential with excellent test weights (Table 6). Yields were similar to WB4311 and greater than Keldin. 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. Under dry land conditions, yields were similar to Yellowstone. WB4792 showed susceptibility to 2019 races of stripe rust.

Yellowstone (MT00159) – a hard red winter wheat with excellent yield potential in both irrigated (Table 4, Chart 2) and dry land conditions (Table 5) of southeast Idaho. 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.

Table 3. Ten year averages of selected agronomic data, 2010-2019 compared to 2020.

NOTE: "Average" values are for years 2010 to 2019

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
2012	5	102	2010	5	60.3	2010	5	34	2019	6	6/12	164	2016	6	11
2020	7	102	2011	5	60.2	2019	6	33	2020	7	6/8	160	Avg.	---	9
2014	4	101	2020	7	60.2	2018	7	33	Avg.	---	6/7	160	2011	5	9
2019	6	99	2019	6	60.0	2011	5	32	2017	6	6/7	159	2013	5	8
Avg.	---	95	2012	5	59.7	Avg.	---	32	2013	5	6/6	158	2012	5	5
2010	5	95	Avg.	---	59.5	2014	5	32	2014	5	6/5	157	2015	6	4
2016	6	94	2016	6	59.4	2013	5	31	2018	7	6/5	157	2019	6	3
2017	6	91	2013	5	59.4	2020	7	30	2012	5	6/4	156	2018	7	1
2011	5	86	2015	6	58.1	2012	5	30	2016	6	5/31	152	2020	7	0.4
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
2018	5	106	2020	5	61.6	2019	5	34	2011	5	7/10	192	2010	5	5
2020	5	101	2017	5	61.6	2020	5	34	2019	4	6/28	180	2019	5	4
2019	5	100	2013	5	61.4	2010	5	33	Avg.	---	6/26	178	Avg.	---	4
2017	5	98	2012	5	61.4	2011	5	32	2020	5	6/25	177	2011	5	3
2015	5	97	2015	5	61.0	2018	5	31	2012	5	6/25	177	2016	5	3
Avg.	---	96	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.	---	60.6	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	2020	5	0.2

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	2020	5	53.5	2014	4	36	2010	4	7/5	187	2013	4	33
2017	4	128	2010	4	51.7	2019	5	35	2019	4	6/30	182	2019	5	31
2014	4	127	2013	4	51.6	2018	5	34	2020	5	6/28	180	2011	5	26
2015	4	124	2011	5	51.6	2020	5	33	Avg.	---	6/26	178	2015	4	24
2013	4	122	Avg.	---	51.6	2011	5	33	2012	4	6/25	177	2010	4	24
Avg.	---	121	2019	5	51.5	Avg.	---	33	2017	4	6/24	176	Avg.	---	23
2020	5	119	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	2016	5	11
2011	5	112	2018	5	51.4	2017	4	31	2013	4	6/21	173	2018	5	10
2019	5	111	2015	4	50.6	2016	5	31	2016	5	6/20	172	2020	5	1
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 (2018-2020; 10 site-years).

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Scorpio	159	60.2	98	6/1	35	0	11.0
UI Bronze Jade (W)	159	59.6	99	5/31	39	6	11.3
LCS Jet	158	60.5	99	5/30	34	1	10.7
Yellowstone	157	62.1	98	6/2	40	8	11.2
Millie (W)	155	63.1	99	5/31	36	2	11.3
Keldin + 11-52-0	153	62.6	98	5/31	37	11	11.0
Utah 100	152	61.2	98	6/3	44	0	11.6
Keldin	151	62.8	99	5/31	37	7	11.2
LCS Rocket	148	59.8	98	5/30	35	1	10.6
Irv (W)	146	60.6	98	6/1	38	0	11.5
WB4311	144	63.3	99	5/29	35	1	12.3
IDO1607	142	60.3	98	6/4	37	8	11.8
WB4623CLP	136	63.3	98	6/1	38	6	12.8
Average	151	61.5	98	6/1	37	4	11.4
LSD ($\alpha = .05$)	6	0.7	1	1	1	5	0.8
CV (%)	10.0	2.3	2.8	1.3	5.7	280	7.7
Pr > F	<0.0001	<0.0001	0.4796	<0.0001	<0.0001	<0.0001	<0.0001

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = White

Table 5. Hard Winter Wheat Dryland Nurseries 3-Year Averages (2018-2020; 9 site-years).

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
UI SRG	50	61.3	95	6/18	30	0	12.1
Keldin + 11-52-0	49	61.4	97	6/15	27	0	11.2
Sequoia	49	61.1	94	6/20	34	0	11.9
Yellowstone	48	61.0	95	6/17	28	0	11.7
LCS Jet	48	58.4	95	6/16	24	0	10.8
Utah 100	47	60.1	95	6/17	32	0	12.1
UI Silver (W)	46	61.2	96	6/16	31	0	11.4
Keldin	46	61.2	96	6/16	27	0	11.5
Millie (W)	45	62.0	94	6/17	25	0	12.1
UI Bronze Jade (W)	45	59.5	92	6/17	27	0	10.8
WB4311	44	61.8	95	6/14	24	0	11.9
WB4623CLP	44	61.2	93	6/17	25	0	12.3
Promontory	43	62.0	96	6/15	29	0	12.0
IDO1607	42	57.7	94	6/18	24	0	11.6**
Irv (W)	42	59.6	94	6/17	25	0	12.0
Golden Spike (W)	42	60.4	95	6/18	30	0	11.7
Juniper	42	61.1	95	6/17	34	0	13.0
LCS Yeti (W)	40	61.6	95	6/13	26	0	12.8**
Average	45	61	95	6/17	28	0	11.9
LSD ($\alpha = .05$)	4	0.5	3	1	1	0	1.1
CV (%)	19	1.6	6	1	9.5	.	9.9
Pr > F	<0.0001	<0.0001	0.2417	<0.0001	<0.0001	.	0.0096

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Data from 6 site-locations.

(W) = White

Table 6. Irrigated Hard Winter Wheat Data Combined from Aberdeen, Kimberly, Rupert and Ririe, 2020.

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Scorpio	161	61.3	99	6/2	33	0	11.9
WB4311	156	63.1	100	5/28	31	0	10.7
UI Bronze Jade (W)	155	61.7	99	5/31	36	0	11.4
WB4792	154	63.6	99	5/30	35	0	10.5
WB4623CLP	153	63.4	99	6/1	35	1	12.7
Keldin	151	63.2	99	5/31	35	0	10.9
FourOsix	151	62.5	98	6/1	34	0	11.0
Sequoia	151	60.7	98	6/5	46	22	11.2
MT1642	150	62.1	98	6/3	37	0	11.5
Kairos	149	61.6	99	5/27	29	0	10.9
Keldin + 11-52-0	148	63.0	98	5/30	35	0	10.8
Flathead	145	63.3	100	5/28	35	4	11.2
LCS Rocket	145	59.7	98	5/29	33	0	10.5
OR2150168H (W)	144	59.5	99	5/31	36	0	10.7
IDO1806 (W)	144	60.0	99	5/31	32	0	11.9
AP Redeye	142	62.3	99	5/30	34	6	10.7
LCS Jet	142	60.1	100	5/30	32	0	10.6
IDO1906 (W)	141	60.9	96	5/28	31	0	11.1
OR2150169R	141	61.7	97	6/2	32	0	11.8
WA8289	141	58.6	93	6/1	31	0	10.9
AP Nugrain (W)	140	64.3	98	5/30	31	0	12.0
Millie (W)	137	63.2	99	5/31	33	0	10.8
Irv (W)	135	61.5	97	6/1	35	0	11.3
WA8309	133	63.1	96	6/1	29	0	12.1
Utah 100	133	59.7	99	6/2	41	0	10.8
IDO1607	132	63.5	99	6/3	33	0	11.5
OR2160065H (W)	124	60.2	98	5/31	35	2	11.0
Yellowstone	118	62.3	99	6/1	38	4	10.8
Average	143	61.8	98	5/31	34	1	11.2
LSD ($\alpha = .05$)	5	0.9	4	2	2	6	0.7
CV (%)	4.6	2.1	5.1	2.1	7.4	667.0	4.1
Pr >F	<0.0001	<0.0001	0.1527	<0.0001	<0.0001	<0.0001	<0.0001

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = White

Table 7. Dryland Hard Winter Wheat Data Combined from Ririe, Soda Springs, and Rockland, 2020.

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Utah 100	53	60.8	96	6/17	30	0	13.1
LCS Zoom	52	59.1	93	6/14	23	0	11.7
Sequoia	52	60.9	90	6/21	31	0	12.3
UI Silver	51	62.3	92	6/18	27	0	12.1
FourOsix	51	60.9	94	6/16	25	0	12.8
WA8309	50	58.8	94	6/18	21	0	12.1
WB4792	48	62.9	95	6/14	25	0	11.1
Keldin + 11-52-0	48	62.1	97	6/15	24	0	12.5
UI Bronze Jade (W)	47	59.8	94	6/17	26	0	12.0
Scorpio	47	60.2	93	6/18	23	0	12.4
Yellowstone	47	61.1	94	6/19	26	0	12.4
LCS Jet	47	58.7	96	6/15	22	0	11.5
Irv (W)	46	60.6	95	6/18	24	0	12.7
MT1642	46	61.0	97	6/20	26	0	13.2
IDO1608	45	58.0	93	6/19	24	0	12.8
OR2150168H (W)	45	59.6	91	6/15	25	0	12.4
IDO1607	45	58.3	89	6/18	23	0	12.7
Golden Spike (W)	45	61.3	92	6/19	30	0	12.5
UI SRG	45	60.9	97	6/15	29	0	13.1
IDO1806 (W)	44	62.3	95	6/17	22	0	12.2
Millie (W)	43	61.8	95	6/18	23	0	13.1
WA8289	43	59.0	90	6/17	25	0	10.7
Juniper	42	61.5	92	6/17	29	0	13.7
Keldin	42	61.2	97	6/16	25	0	13.1
LCS Rocket	42	57.5	91	6/17	23	0	11.5
OR2160065H (W)	41	60.4	97	6/17	24	0	13.8
Juniper	41	62.2	95	6/13	24	0	12.2
WB4623CLP	41	61.7	90	6/18	24	0	13.6
IDO1906 (W)	40	59.2	93	6/13	23	0	13.2
Promontory	40	61.3	96	6/17	30	0	13.5
LCS Yeti (W)	40	61.7	94	6/13	24	0	14.3
OR2150169R	40	57.0	92	6/19	23	0	11.4
Flathead	39	61.5	96	6/12	25	0	12.7
OR2150100R	38	59.7	92	6/14	23	0	13.3
WB4311	36	62.0	98	6/14	23	0	12.8
Average	45	60.5	94	6/16	25	0	12.6
LSD ($\alpha = .05$)	7	1.6	7	2	2	.	1.1
CV (%)	17.1	2.8	8.4	1.2	9.9	.	5.4
Pr >F	<0.0001	<0.0001	0.6072	<0.0001	<0.0001	.	<0.0001

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = White

Table 8. Agronomic Data for Hard Winter Wheat at Kimberly, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
WB4401	---	---	196	63.5	100	5/21	38	1	10.2
LCS Jet	129	185	189	61.4	100	5/26	35	0	10.8
MT1642	---	---	188	62.7	100	5/31	41	0	12.0
UI Bronze Jade (W)	142	190	187	61.2	100	5/27	39	0	11.7
Keldin + 11-52-0	110	187	187	63.4	100	5/26	39	0	10.9
Utah 100	134	188	185	61.6	99	5/31	45	0	12.1
LCS Rocket	122	188	184	60.8	99	5/24	37	0	10.5
Keldin	123	187	184	63.6	100	5/27	39	0	11.1
Scorpio	133	182	183	61.4	99	5/29	35	0	11.4
WB4792	---	193	183	64.2	100	5/26	38	0	10.9
AP Redeye	---	187	178	62.9	100	5/26	36	0	11.1
Irv (W)	125	171	176	62.3	100	5/27	38	0	11.6
Yellowstone	121	185	174	62.6	100	5/29	42	15	10.8
FourOsix	---	172	173	63.2	99	5/28	38	0	11.4
WB4311	110	184	171	63.5	100	6/3	35	0	12.6
Millie (W)	129	182	171	63.6	99	5/28	35	0	10.9
OR2150168H (W)	---	---	170	61.9	100	5/27	39	0	11.1
OR2150169R	---	---	170	59.5	100	5/28	33	0	10.4
WA8309	---	---	169	59.7	100	5/28	30	0	11.1
Kairos	---	---	169	61.7	100	5/21	33	0	11.1
OR2160065H (W)	---	---	168	62.2	100	5/27	39	0	11.9
IDO1607	111	171	167	64.6	100	6/1	37	0	11.2
Flathead	---	---	165	63.9	99	5/23	39	18	11.7
AP Nugrain (W)	---	168	164	64.9	100	5/27	34	0	11.8
WA8289	---	190	162	61.2	99	5/27	33	0	11.0
IDO1806 (W)	---	163	160	59.9	100	5/28	36	0	11.5
WB4623CLP	107	155	153	63.2	100	5/28	40	5	13.3
Sequoia	---	---	133	60.5	100	6/1	49	84	12.8
IDO1906 (W)	---	---	131	61.3	100	5/22	33	0	12.6
AVERAGE	119	178	172	62.3	99.6	5/27	37	4	11.4
LSD (0.05)	23	13	13	0.6	1	2	2	9	
CV (%)	14.0	5.3	5.4	0.6	0.8	0.89	3.7	153.6	
P>F	0.0	<0.0001	<0.0001	<0.0001	0.2478	<0.0001	<0.0001	<0.0001	

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = White

Table 9. Agronomic Data for Hard Winter Wheat at Rupert, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
MT1642	---	---	151	61.0	98	6/1	36	0	11.4
Yellowstone	170	155	150	61.75	99	5/31	36	0	10.9
Utah 100	150	139	147	61.4	98	5/29	39	0	11.0
WB4792	---	154	146	62.375	100	5/28	34	0	10.7
Flathead	---	---	143	62.3	100	5/27	33	0	10.6
Keldin + 11-52-0	175	143	140	62.5	96	5/28	34	0	10.7
FourOsix	---	145	140	60.8	99	5/29	32	0	11.3
OR2150168H (W)	---	---	136	60.1	100	5/28	34	0	11.3
Juniper	---	---	135	61.9	99	5/25	31	0	10.0
UI Bronze Jade (W)	176	148	135	59.275	97	5/29	36	0	11.2
WB4623CLP	136	125	134	63.15	96	5/29	33	0	12.5
Keldin	167	134	134	62.5	100	5/29	31	0	10.9
AP Redeye	---	165	134	61.1	98	5/28	33	0	11.0
Millie (W)	157	158	131	62.6	99	5/29	31	0	10.9
Irv (W)	151	136	130	60.4	96	5/30	35	0	11.4
IDO1607	144	142	129	58.8	100	5/31	31	0	11.7
Scorpio	155	164	128	58.0	100	5/31	32	0	10.8
Sequoia	---	---	126	61.8	98	6/2	44	0	11.8
Kairos	---	---	125	60.8	100	5/26	28	0	10.8
OR2160065H (W)	---	---	124	60.6	98	5/30	34	0	11.9
WA8309	---	---	124	56.3	86	6/1	28	0	11.5
OR2150169R	---	---	123	55.625	88	6/1	30	0	11.0
AP Nugrain (W)	---	140	121	63.3	96	5/27	27	0	12.1
WB4311	143	155	118	62.025	100	5/27	29	0	11.7
IDO1806 (W)	---	131	118	61.1	100	5/28	29	0	12.4
LCS Rocket	150	150	116	57.5	100	5/28	31	0	10.9
LCS Jet	169	167	114	57.3	100	5/28	29	0	11.4
IDO1906 (W)	---	---	101	57.7	84	5/28	29	0	12.9
WA8289	---	168	92	55.975	73	6/1	30	0	10.9
Average	152	146	129	60.3	96	5/29	32	0	11.3
LSD ($\alpha=.05$)	13	20	13	1.0	12	2	2	0	
CV (%)	6.3	9.7	7.1	1.1	8.6	0.9	4	.	
Pr > F	<0.0001	<0.0001	<0.0001	<0.0001	0.0024	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = White

Table 10. Agronomic Data for Hard Winter Wheat at Aberdeen, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
Yellowstone	177	156	161	62.3	98	6/2	37	0	12.0
Sequoia	132	116	151	60.7	95	6/7	43	3	12.4
Scorpio	176	176	150	60.1	100	6/2	34	0	12.2
WB4792	---	---	147	64.2	99	5/30	35	0	11.4
Flathead	---	---	147	63.3	100	5/29	34	0	13.2
WB4401	---	---	145	62.7	97	5/29	32	0	11.2
Millie (W)	181	174	145	63.0	97	6/1	35	0	12.4
FourOsix	---	169	143	63.0	96	6/2	35	0	11.2
Utah 100	177	126	143	61.8	100	6/3	40	0	12.7
LCS Jet	175	182	143	60.1	99	5/31	34	0	11.6
Keldin + 11-52-0	163	158	142	62.4	98	6/1	35	0	12.7
Keldin	177	147	141	62.8	97	6/1	36	0	12.6
OR2150169R	---	---	140	57.6	100	6/3	35	0	11.0
IDO1607	141	145	140	60.6	100	6/3	33	0	12.3
UI Bronze Jade (W)	173	169	140	61.1	100	5/31	38	0	12.2
OR2150168H (W)	---	---	140	60.6	97	5/31	36	0	11.8
WA8289	---	175	138	60.1	100	6/1	34	0	11.3
AP Redeye	---	---	137	62.0	100	6/1	37	23	11.1
MT1642	---	---	137	61.2	96	6/4	35	0	12.6
WB4623CLP	156	144	136	63.1	98	6/2	34	0	14.3
Irv (W)	168	161	132	61.1	98	6/2	36	0	12.2
WA8309	---	---	129	58.5	98	6/1	32	0	11.9
LCS Rocket	161	171	128	59.3	95	5/30	33	0	11.4
WB4311	168	164	127	62.9	98	5/30	31	0	13.7
AP Nugrain (W)	---	138	125	64.2	96	5/30	32	0	13.4
IDO1806 (W)	---	155	123	63.4	98	5/31	34	0	12.3
IDO1906 (W)	---	---	120	60.4	100	5/29	33	0	12.8
Kairos	---	---	120	60.9	99	5/29	28	0	12.3
OR2160065H (W)	---	---	118	61.6	96	5/31	35	6	12.7
Average	163	157	138	61.5	98	6/1	35	1	12.2
LSD ($\alpha=.05$)	16	17	16	0.9	5	2	5	12	
CV %	6.8	7.7	8.3	1	3.5	0.85	9.8	825.8	
Pr > F	<0.0001	<0.0001	<0.0001	<0.0001	0.5974	<0.0001	0.0018	0.5231	

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = White

Table 11. Agronomic Data for Hard Winter Wheat at Ririe, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
MT1642	---	---	155	63.4	100	6/7	34	0	10.1
Juniper	---	---	149	63.5	100	6/1	32	0	8.6
FourOsix	---	---	148	63.2	100	6/6	32	0	9.9
LCS Jet	---	---	145	61.7	100	6/4	30	0	8.7
OR2150169R	---	---	144	59.2	100	6/6	31	0	9.3
Utah 100	---	---	144	61.9	100	6/7	40	0	9.9
Scorpio	---	---	142	61.3	100	6/7	31	0	9.7
WA8309	---	---	142	59.9	100	6/6	26	0	9.0
LCS Rocket	---	---	141	61.1	100	6/5	30	0	9.2
UI Bronze Jade (W)	---	---	139	61.1	100	6/6	33	0	9.7
WA8289	---	---	138	61.4	100	6/6	30	0	9.9
Keldin + 11-52-0	---	---	137	63.8	96	6/4	31	0	8.8
Irv (W)	---	---	136	62.5	96	6/7	33	0	10.1
Keldin	---	---	136	63.9	100	6/4	33	0	9.1
WB4792	---	---	136	63.7	96	6/4	34	0	9.0
Yellowstone	---	---	133	62.7	100	6/5	37	0	9.2
Millie (W)	---	---	132	63.7	100	6/6	30	0	9.1
OR2160065H (W)	---	---	132	62.6	100	6/6	34	0	10.7
OR2150168H (W)	---	---	131	61.8	100	6/5	34	0	10.0
Kairos	---	---	130	62.8	96	6/4	28	0	9.4
AP Redeye	---	---	129	63.3	100	6/5	31	0	9.4
IDO1607	---	---	129	62.7	96	6/8	32	0	9.2
IDO1806 (W)	---	---	128	65.0	100	6/7	30	0	9.8
Flathead	---	---	126	63.8	100	6/2	33	0	9.3
AP Nugrain (W)	---	---	125	65.0	100	6/4	29	0	10.8
IDO1906 (W)	---	---	121	62.0	100	6/3	30	0	9.4
Sequoia	---	---	120	62.5	100	6/9	46	0	10.6
WB4623CLP	---	---	118	64.0	100	6/7	33	0	10.8
WB4311	---	---	117	64.2	100	6/3	30	0	10.4
Average	---	---	135	62.7	99	6/5	32	0	9.6
LSD ($\alpha=.05$)	---	---	13	0.4	4	3	2	0	
CV (%)	---	---	7.1	0.5	3.1	1.2	4.7	.	
Pr > F	---	---	<0.0001	<0.0001	0.6803	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = White

Table 12. Agronomic Data for Hard Winter Wheat at Ririe, Dryland, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
Sequoia	47	23	47	58.1	65	6/23	32	0	14.9
UI Silver	50	25	46	59.5	73	6/23	22	0	14.5
MT1642	---	28	41	57.5	100	6/22	24	0	15.5
Keldin + 11-52-0	50	18	41	---	100	6/23	20	0	15.8
Promontory	48	21	40	59.5	90	6/20	26	0	15.3
Irv (W)	49	22	40	57.6	90	6/23	24	0	15.6
Millie (W)	---	19	40	58.4	89	6/23	23	0	16.3
Yellowstone	54	24	39	58.1	83	6/23	23	0	14.9
IDO1608	---	18	39	54.0	80	6/23	25	0	15.1
Scorpio	---	21	39	57.0	78	6/21	22	0	15.1
Utah 100	52	21	39	58.5	93	6/20	26	0	14.8
UI SRG	56	21	38	57.7	97	6/19	24	0	15.9
FourOsix	---	23	38	58.7	90	6/23	23	0	15.2
IDO1806 (W)	---	26	37	59.7	94	6/22	20	0	15.2
UI Bronze Jade (W)	51	20	37	56.1	88	6/19	26	0	14.8
WB4792	---	21	37	60.6	90	6/19	21	0	13.4
OR2160065H (W)	---	---	36	57.0	98	6/24	21	0	16.8
WA8309	---	---	36	55.4	90	6/22	23	0	14.5
LCS Zoom	---	20	35	55.5	80	6/20	20	0	14.5
IDO1607	52	21	34	55.1	63	6/24	22	0	15.9
IDO1906 (W)	---	---	34	57.3	83	6/20	21	0	15.6
Juniper	51	19	34	60.1	90	6/19	28	0	13.8
Juniper (QC)	---	---	34	59.8	73	6/21	22	0	15.2
OR2150169R	---	---	34	53.3	90	6/23	25	0	14.6
Keldin	53	22	33	58.0	100	6/23	25	0	15.9
LCS Jet	61	23	31	55.4	92	6/23	24	0	14.2
OR2150100R	---	---	31	57.3	73	6/20	24	0	15.6
OR2150168H (W)	---	---	31	56.4	73	6/19	25	0	14.6
WA8289	---	15	31	54.7	73	6/22	32	0	13.7
Flathead	---	---	30	59.7	92	6/21	22	0	15.0
Golden Spike (W)	48	19	29	58.6	75	6/23	20	0	14.8
LCS Yeti (W)	---	18	28	60.2	85	6/21	22	0	15.7
LCS Rocket	---	17	27	53.3	68	6/22	23	0	14.0
WB4311	51	20	26	61.2	98	6/21	26	0	15.4
WB4623CLP	52	21	25	58.6	70	6/24	23	0	15.4
Average	50	21	35	57.8	85	6/21	23	0	15.1
LSD ($\alpha=.05$)	8	5	9	2.3	22	5	6	0	
CV (%)	12.1	16.5	12.8	1.8	12.8	1.3	12	.	
Pr > F	0.0964	0.0012	0.0035	<0.0001	0.0236	0.5371	0.0229	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = White

(QC) = Quality Control

Table 13. Agronomic Data for Hard Winter Wheat at Rockland, Dryland, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
UI Silver	37	27	51	63.9	95	6/5	26	0	10.1
Keldin + 11-52-0	43	38	47	63.1	95	6/2	23	0	10.6
Sequoia	45	30	46	63.1	94	6/8	28	0	9.3
FourOsix	---	38	44	62.6	94	6/3	24	0	11.1
Utah 100	40	32	44	62.1	95	6/5	27	0	11.0
Irv (W)	37	28	44	61.8	94	6/5	24	0	10.9
Promontory	34	25	43	62.8	95	6/7	29	0	11.9
LCS Zoom	---	36	42	60.5	94	6/4	20	0	9.7
WB4792	---	28	42	64.5	94	6/3	24	0	10.1
MT1642	---	---	42	62.6	95	6/7	24	0	12.4
UI Bronze Jade (W)	40	28	41	61.7	95	6/6	24	0	10.5
WA8309	---	---	41	60.8	94	6/5	19	0	10.3
IDO1607	38	22	41	59.5	94	6/5	21	0	10.5
Keldin	37	39	41	62.9	95	6/2	23	0	10.7
Scorpio	---	39	41	62.0	95	6/5	21	0	10.1
OR2150168H (W)	---	---	41	61.5	95	6/2	24	0	11.2
Yellowstone	39	37	40	62.8	95	6/5	23	0	11.7
Juniper	34	35	40	63.6	94	6/6	29	0	11.8
IDO1608	---	39	40	60.3	94	6/5	22	0	10.7
LCS Jet	45	44	40	60.6	94	6/2	20	0	9.9
UI SRG	42	33	40	62.3	95	6/4	27	0	12.0
Golden Spike (W)	33	22	39	62.6	94	6/7	26	0	11.1
LCS Rocket	37	41	39	59.9	93	6/6	21	0	10.6
OR2150100R	---	---	38	61.3	95	6/2	21	0	12.5
WB4623CLP	34	34	38	62.7	93	6/5	20	0	12.6
IDO1806 (W)	---	32	38	63.4	94	6/3	20	0	10.4
Millie (W)	44	38	38	63.4	94	6/5	22	0	11.7
Juniper (QC)	34	35	38	63.0	94	6/4	22	0	12.3
Flathead	---	---	38	62.5	94	5/30	24	0	11.6
OR2160065H (W)	---	---	37	61.7	94	6/5	23	0	12.4
WB4311	41	39	37	62.8	95	6/2	22	0	11.3
IDO1906 (W)	---	---	36	60.5	93	6/1	22	0	11.4
OR2150169R	---	---	35	58.7	90	6/7	21	0	9.8
WA8289	---	29	33	61.4	92	6/6	21	0	9.5
LCS Yeti (W)	24	35	32	63.0	95	5/31	21	0	13.5
Average	38	33	40	62	94	6/4	23	0	11.1
LSD ($\alpha=.05$)	8	5	6	0.5	1	2	2	0	
CV (%)	14.5	10.3	11.2	0.6	1	0.7	5.9	.	
Pr >F	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = White

(QC) = Quality Control

Table 14. Agronomic Data for Hard Winter Wheat at Soda Springs, Dryland, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
WB4792	---	55	75	62.5	99	6/23	29	0	9.8
Utah 100	61	64	69	60.8	100	6/26	34	0	13.6
LCS Zoom	60	70	67	58.6	98	6/23	26	0	10.8
WA8309	---	---	66	58.4	97	6/30	23	0	11.5
UI Bronze Jade (W)	62	54	66	59.7	97	6/28	28	0	10.8
FourOsix	---	44	65	60.3	97	6/25	27	0	12.1
Sequoia	60	71	64	60.1	98	7/3	41	0	12.7
WA8289	---	50	64	58.7	96	6/27	25	0	9.0
LCS Jet	70	51	62	58.5	100	6/25	24	0	10.4
UI SRG	70	70	58	61.2	99	6/25	34	0	11.4
Golden Spike (W)	63	63	58	60.6	99	6/29	36	0	11.6
Scorpio	---	48	58	60.0	100	6/29	25	0	12.0
Yellowstone	79	63	58	61.1	98	6/30	30	0	10.6
IDO1607	56	52	57	58.6	98	6/28	26	0	11.9
IDO1806 (W)	---	51	57	62.5	98	6/28	25	0	11.1
AP Redeye	---	---	56	60.3	97	6/25	25	0	11.0
OR2150168H (W)	---	---	56	59.4	96	6/26	26	0	11.5
Keldin + 11-52-0	79	54	55	61.1	98	6/25	28	0	11.0
UI Silver	66	81	55	62.1	98	6/29	31	0	11.7
WB4623CLP	64	59	55	61.4	96	6/28	27	0	12.7
LCS Yeti (W)	68	50	54	61.1	98	6/22	28	0	13.8
IDO1608	---	51	54	57.6	100	7/2	27	0	12.7
Millie (W)	64	52	53	61.9	98	6/28	25	0	11.4
Irv (W)	62	46	53	60.8	97	6/29	25	0	11.6
LCS Rocket	60	52	52	57.3	100	6/25	24	0	10.0
MT1642	---	---	52	61.1	98	7/2	29	0	11.7
OR2150169R	---	---	50	57.3	97	6/30	24	0	9.9
Juniper	62	47	49	62.0	100	6/25	37	0	11.1
IDO1906 (W)	---	---	48	58.8	99	6/22	24	0	12.6
Juniper (QC)	62	47	48	60.9	99	6/18	24	0	13.7
Keldin	73	59	48	61.1	99	6/28	27	0	12.7
Flathead	---	---	47	61.3	100	6/21	28	0	11.5
OR2160065H (W)	---	---	47	59.9	99	6/26	26	0	12.3
OR2150100R	---	---	40	59.4	99	6/24	24	0	11.7
WB4311	74	61	40	61.7	100	6/22	23	0	11.7
Promontory	70	67	38	60.7	100	6/25	35	0	13.4
Average	65	57	55	60.2	98	6/26	28	0	11.6
LSD ($\alpha=0.05$)	10	17	14	0.8	3	2	3	0	
CV (%)	11.4	21.1	17.2	0.7	1.9	0.8	7.6	.	
Pr > F	<0.0001	0.0005	<0.0001	<0.0001	0.0155	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = Hard White Winter

(QC) = Quality Control

Table 15. Hard Winter Wheat Yield Percentage of Location Averages, 2020.

Variety or Selection	(100% = Average)						Soda	Variety
	Kimberly	Aberdeen	Rupert	Ririe Irrigated	Ririe Dryland	Rockland	Springs	Average
UI Silver	---	---	---	---	130	127	100	119
Utah 100	108	103	114	107	110	110	125	111
WB4792	106	107	113	101	104	104	136	110
WB4401	114	105	---	---	---	---	---	110
LCS Zoom	---	---	---	---	100	105	121	109
FourOsix	100	104	108	110	107	111	118	108
MT1642	109	99	117	115	117	104	94	108
Keldin + 11-52-0	109	103	109	101	116	117	100	108
Yellowstone	101	116	116	99	111	101	105	107
UI Bronze Jade (W)	109	101	104	103	104	103	119	106
Scorpio	106	109	99	105	110	102	105	105
Sequoia	77	109	97	89	133	114	116	105
UI SRG	---	---	---	---	109	99	106	104
WA8309	98	93	96	105	103	103	120	103
Irv (W)	102	96	101	101	113	109	95	103
IDO1608	---	---	---	---	110	99	98	102
LCS Jet	110	103	88	108	89	99	112	101
Millie (W)	99	105	101	98	113	95	96	101
AP Redeye	103	99	103	96	---	---	102	101
Juniper	---	---	105	110	97	100	90	100
IDO1607	97	101	100	95	97	102	103	99
Keldin	107	102	104	101	93	102	86	99
OR2150168H (W)	99	101	105	97	89	101	101	99
OR2150169R	99	102	95	107	96	88	92	97
Promontory	---	---	---	---	114	106	69	97
Flathead	96	107	110	94	84	94	86	96
IDO1806 (W)	93	89	91	95	104	95	103	96
Golden Spike (W)	---	---	---	---	83	97	105	95
LCS Rocket	107	93	90	104	77	96	95	95
Kairos	98	87	97	96	---	---	---	94
OR2160065H (W)	98	85	96	98	103	93	85	94
WA8289	94	100	71	102	89	82	116	94
AP Nugrain (W)	95	91	93	92	---	---	---	93
WB4623CLP	89	98	104	88	70	96	99	92
WB4311	99	92	92	86	73	92	73	87
IDO1906 (W)	76	87	78	90	97	90	87	86
LCS Yeti (W)	---	---	---	---	80	81	98	86
OR2150100R	---	---	---	---	89	96	73	86
Location Average (bu/A)	172	138	129	135	35	40	55	

(W) = Hard White

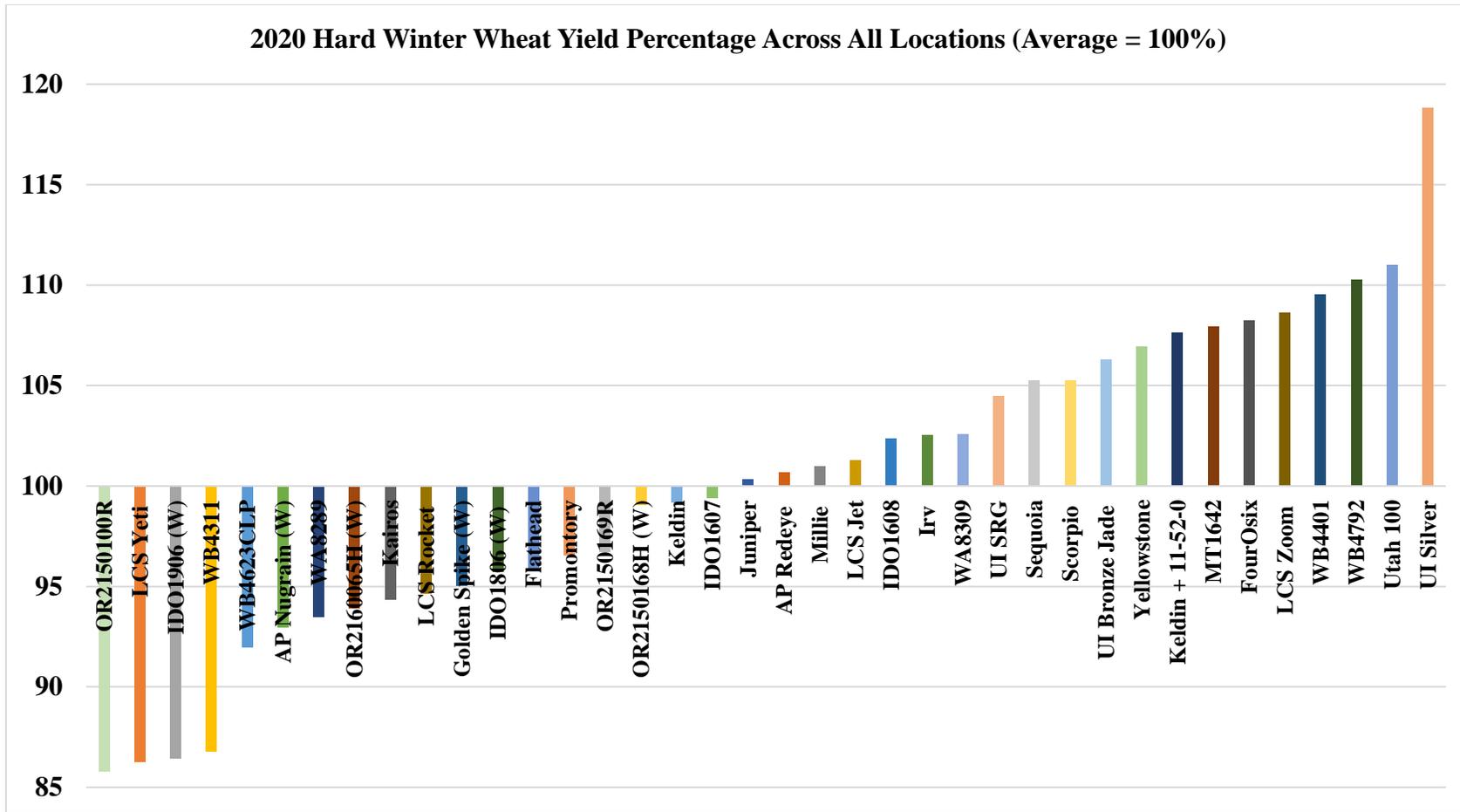


Chart 2. Hard winter wheat yield percentage across all locations.

(W) White

Table 16. Soft White Winter Wheat Irrigated Nurseries, 3 Year Averages (2018 - 2020; 10 site-years).

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
LCS Ghost	160	57.8	97	5/30	38	1	9.1
VI Shock	159	60.5	98	5/31	38	1	9.6
LCS Hulk	157	61.4	96	6/1	37	0	9.4
WB1783	157	61.9	97	6/1	38	0	9.8
IDO1708	156	59.2	99	5/29	37	4	8.8
SY Ovation	155	60.5	99	5/31	38	0	9.7
Jasper	153	59.5	98	6/2	38	0	9.8
UI Sparrow	152	58.5	98	6/3	42	1	9.6
UI Castle CL+	151	60.6	97	6/3	39	4	10.5
VI Bulldog	150	60.4	98	5/30	38	0	9.1
Rosalyn	150	58.9	98	6/1	38	1	9.2
Nixon	150	60.2	98	6/1	39	0	9.5
UI Magic CL+	150	60.9	98	5/30	36	0	9.6
LCS Shark	147	59.2	95	5/30	36	0	9.6
LCS Artdeco	147	59.5	97	5/29	34	0	8.8
Brundage	145	61.2	98	5/29	39	0	9.6
Norwest Tandem	145	60.3	98	5/29	33	0	9.5
WB1529	145	62.2	98	5/30	36	0	9.7
Stephens	144	59.3	97	5/31	38	1	9.6
SY Assure	143	61.3	98	5/28	34	0	9.3
LCS Drive	139	58.9	98	5/28	31	1	9.4
WB 456	138	62.4	98	5/29	37	0	10.2
OR2X2CL+	134	60.2	98	6/1	39	0	10.1
WB1376CLP	130	62.8	98	5/30	38	0	10.5
Average	148	60.3	98	5/31	37	1	9.6
LSD ($\alpha = .05$)	11	0.5	2	2	1	2	0.8
CV (%)	17	1.9	5.9	2.9	8.4	642	9.3
Pr > F	<0.0001	<0.0001	0.7796	<0.0001	<0.0001	<0.0001	0.0005

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 17. Soft White Winter Wheat Dryland Nurseries, 3 Year Averages (2018 - 2020; 6 site-years).

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
UI Sparrow	59	57.9	93	6/26	30	0	10.2
Devote	55	60.5	91	6/26	26	0	12.2
Eltan	54	58.9	96	6/27	29	0	10.9
Nixon	53	58.0	93	6/23	28	0	11.8
Norwest Tandem	50	58.1	93	6/21	24	0	11.1
Jasper	50	56.1	95	6/24	27	0	11.7
Otto	50	58.9	91	6/27	28	0	12.3
WB1783	50	60.1	91	6/23	27	0	12.1
WB1529	49	59.8	96	6/21	24	0	11.8
Rosalyn	49	57.3	86	6/24	27	0	10.8
Norwest Duet	49	57.7	90	6/24	30	0	11.5
IDO1708	49	56.9	94	6/21	27	0	11.1
OR2X2 CL+	48	58.1	86	6/25	27	0	12.9
UI Magic CL+	48	58.8	87	6/22	26	0	12.1
UI Castle CL+	46	58.6	94	6/26	28	0	12.6
WB1376CLP	46	59.7	87	6/21	27	0	13.1
Stephens	43	57.3	90	6/22	27	0	11.6
Average	50	58.4	91	6/24	27	0	11.9
LSD ($\alpha=0.05$)	6	1.0	9	1	1	0	0.9
CV (%)	16.7	2.5	14	0.9	7.0	.	6.5
Pr > F	<0.0001	<0.0001	0.4765	<0.0001	<0.0001	.	<0.0001

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 18. Irrigated Soft White Winter Wheat Data Combined from Aberdeen, Kimberly, Ririe and Rupert, 2020.

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
WA8293	164	60.3	98	6/3	38	0	9.8
VI Shock	162	60.2	98	6/1	36	0	9.6
LCS Hulk	160	61.4	98	6/2	36	0	9.6
LWW16-71088	159	60.0	98	6/1	34	0	8.5
WA8306 CL+	159	59.7	99	6/1	40	3	9.8
IDO1708	158	59.7	98	5/31	34	0	8.8
WA8305 CL+	156	60.3	98	6/2	39	0	9.3
LCS Blackjack	154	59.1	98	6/1	34	0	10.0
Norwest Duet	154	60.5	98	6/2	40	0	10.1
M-Press	153	60.2	98	6/3	36	0	9.4
UI Sparrow	152	59.0	99	6/4	41	0	9.7
SY Ovation	148	60.5	98	6/1	36	0	10.3
Jasper	148	59.0	97	6/3	36	0	10.2
WB1783	148	61.6	95	6/2	35	0	10.7
SY Raptor	147	59.5	98	5/31	34	1	9.5
Norwest Tandem	147	60.4	98	5/30	31	0	9.4
Nixon	147	60.3	98	6/2	37	0	9.6
AP Iliad	146	59.3	100	5/31	35	0	10.9
VI Voodoo CL+	146	60.4	98	6/2	33	0	10.0
Purl	146	60.9	95	6/1	36	0	9.5
Rosalyn	146	58.9	96	6/4	37	0	9.4
LCS Ghost	146	57.6	95	5/31	35	0	9.3
UI Castle CL+	144	61.1	97	6/4	38	0	10.4
WA8307	143	59.7	96	6/3	38	0	10.2
UI Magic CL+	142	61.0	97	5/31	34	0	9.2
Stingray CL+	141	60.7	97	6/2	35	0	9.7
Stephens	141	59.2	96	5/31	35	0	9.8
LCS Artdeco	140	59.2	95	5/31	31	0	9.0
Brundage	140	61.0	95	5/30	36	0	10.0
M-Idas	140	59.8	98	5/29	31	0	9.5
LCS Drive	138	59.2	97	5/29	28	0	9.6
OR2X2CL+	138	60.0	97	6/2	38	0	10.5
LCS Shark	138	59.0	98	5/31	33	0	9.8
VI Bulldog	138	60.8	96	5/31	34	0	9.6
WB1529	137	61.9	97	5/31	33	0	10.0
SY Assure	136	61.1	97	5/29	31	0	9.7
MT1432	135	61.0	97	6/6	43	5	10.5
WB 456	135	62.2	96	5/30	35	0	10.5
M-Idas with SSR	135	60.1	97	5/30	31	0	9.3
Appleby CL+	127	60.9	96	5/31	35	0	10.6
WB1376CLP	122	62.8	97	5/31	35	0	9.8
Average	145	60.2	97	6/1	35	0.2	9.8
LSD ($\alpha = .05$)	11	0.9	3	1	1	2	0.7
CV (%)	10.7	2.2	4.3	1	5	1296	5.1
Pr >F	<0.0001	<0.0001	0.2422	<0.0001	<0.0001	0.0031	<0.0001

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 19. Dryland Soft White Winter Wheat Data Combined from Ririe, Rockland and Soda Springs, 2020.

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Otto	60	59.8	97	6/23	27	0	12.2
UI Sparrow	58	59.0	95	6/21	29	0	11.6
AP Iliad	57	60.3	96	6/19	24	0	10.8
Eltan 11-52-0	56	59.5	96	6/22	26	0	11.6
SY Raptor	54	58.8	97	6/16	23	0	11.8
Devote	53	60.1	97	6/22	25	0	12.6
WA8293	52	59.4	94	6/20	25	0	11.8
LCS Sonic	52	59.5	95	6/17	25	0	12.0
Eltan	51	59.7	95	6/20	26	0	11.9
Jasper	51	58.9	96	6/19	26	0	12.0
M-Press	51	58.8	96	6/18	25	0	11.6
LCS Shine	51	60.0	97	6/13	22	0	10.8
Stingray CL+	51	58.7	96	6/19	24	0	12.4
Purl	49	59.3	96	6/16	24	0	11.8
LCS Hulk	49	59.6	96	6/17	25	0	12.1
Norwest Tandem	49	58.3	96	6/15	23	0	11.8
Nixon	49	59.3	97	6/17	25	0	12.0
Rosalyn	48	59.1	94	6/20	25	0	11.3
Norwest Duet	48	59.1	97	6/18	27	0	11.2
OR2X2CL+	48	58.9	97	6/19	25	0	12.4
SY Ovation	48	59.3	97	6/17	25	0	11.6
IDO1808	48	58.3	96	6/26	25	0	12.7
LWW16-71088	48	58.9	98	6/17	22	0	10.8
UIL17-6834 CL+	47	59.3	97	6/16	23	0	13.0
WA8306 CL+	47	59.2	96	6/19	27	0	11.2
OR2130755	47	60.0	95	6/14	25	0	11.8
Appleby CL+	47	59.3	96	6/16	25	0	12.3
WA8307	46	58.1	97	6/21	26	0	11.6
WB1529	46	60.4	95	6/17	22	0	12.2
WB 456	46	59.0	96	6/16	23	0	12.6
IDO1810	46	59.4	99	6/29	28	0	13.1
Brundage	46	59.0	97	6/15	24	0	11.9
IDO1708	45	58.4	95	6/15	24	0	11.4
VI Voodoo CL+	44	59.1	96	6/19	22	0	12.4
WB1783	44	60.4	96	6/19	24	0	12.7
UI Castle CL+	44	59.2	96	6/22	24	0	13.0
UI Magic CL+	43	59.5	96	6/17	23	0	12.6
SY Assure	43	59.7	93	6/15	21	0	12.0
MT1432	43	59.6	97	6/22	28	0	12.9
WA8305 CL+	43	54.9	95	6/23	20	0	15.5
WB1376CLP	43	59.2	94	6/27	24	0	13.7
VI Presto CL+	42	60.0	96	6/15	24	0	11.8
Stephens	42	58.2	96	6/18	25	0	11.5
M-Idas with SSR	42	59.0	94	6/15	22	0	10.3
M-Idas	40	59.3	94	6/16	23	0	10.3
Average	48	59.2	96	6/18	25	0	12
LSD ($\alpha = 0.05$)	11	2.1	3	10	3	0	2.4
CV (%)	23.7	3.6	3.7	6.3	12.7	.	11.9
Pr >F	0.0801	0.9631	0.5709	0.7924	<0.0001	.	0.6272

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 20. Agronomic Data for Soft White Winter Wheat at Kimberly, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
Norwest Duet	---	181	182	61.1	99	5/26	33	0	10.6
AP Iliad	---	---	180	61.9	100	5/27	37	0	11.1
LCS Blackjack	---	190	177	59.7	98	5/27	36	0	9.6
WA8293	---	---	175	60.8	100	5/31	41	0	9.2
IDO1708	122	192	175	59.8	99	5/27	37	0	7.5
LCS Hulk	---	177	173	61.8	98	5/29	38	0	8.5
Jasper	118	177	172	60.1	97	5/30	38	0	9.8
Nixon	120	189	171	61.0	100	5/29	44	0	9.3
LWW16-71088	---	---	168	60.5	100	5/28	37	0	7.1
LCS Ghost	---	205	167	57.9	98	5/27	37	0	9.0
WA8306 CL+	---	---	166	59.8	100	5/29	42	10	9.9
SY Raptor	---	171	165	59.9	97	5/30	40	0	9.3
M-Idas	---	---	164	60.8	99	5/29	37	0	8.3
LCS Shark	---	186	163	59.1	98	5/27	35	0	9.5
Brundage	117	180	162	61.1	98	5/26	38	0	9.3
M-Press	---	---	162	60.8	95	5/25	33	0	8.5
VI Voodoo CL+	---	171	159	61.1	100	5/30	44	0	8.8
Rosalyn	135	174	158	58.9	99	5/27	37	0	8.1
UI Sparrow	---	190	158	60.4	98	5/28	34	0	7.8
Stingray CL+	---	---	157	61.0	98	5/28	38	0	8.6
Norwest Tandem	119	171	157	60.8	98	5/31	40	0	8.9
M-Idas with SSR	---	---	155	60.2	99	5/24	35	0	9.3
UI Magic CL+	115	172	155	60.7	100	5/31	42	0	8.9
SY Ovation	123	188	155	60.6	98	5/25	38	5	9.7
UI Castle CL+	122	200	155	61.7	99	5/27	36	0	9.3
Stephens	129	181	154	59.5	97	5/29	36	0	8.2
LCS Drive	107	179	152	59.1	98	5/25	30	0	8.8
OR2X2CL+	107	146	152	60.6	90	5/28	39	0	10.3
VI Bulldog	---	176	152	61.2	97	5/27	37	0	8.8
LCS Artdeco	116	184	152	59.6	95	5/27	33	0	8.3
VI Shock	---	207	151	58.8	98	5/27	37	0	7.8
SY Assure	125	180	151	61.6	100	5/26	34	0	8.7
WA8305 CL+	---	---	151	60.5	98	5/28	40	0	9.1
WB 456	108	171	150	62.8	96	5/26	38	0	10.1
WA8307	---	---	149	59.9	97	6/1	41	0	9.8
Purl	---	192	149	61.5	96	5/30	38	0	9.1
Appleby CL+	---	171	147	61.1	98	5/27	37	0	9.7
WB1783	135	189	145	62.7	98	5/29	37	0	9.4
WB1529	137	166	116	62.4	96	5/28	35	0	8.4
WB1376CLP	92	162	103	62.2	94	5/29	36	0	9.0
Average	124	179	159	60.6	98	5/28	37	0.4	9
LSD ($\alpha=.05$)	23	16	23	0.7	5	2	2	5	
CV (%)	13.5	6.5	9.9	0.8	3.3	0.79	4.5	946.0	
Pr > F	0.0003	<0.0001	<0.0001	<0.0001	0.0636	<0.0001	<0.0001	0.5243	

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 21. Agronomic Data for Soft White Winter Wheat at Rupert, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
WA8306 CL+	---	---	158	58.9	100	5/31	40	0	9.9
VI Shock	---	167	158	59.0	95	5/31	35	0	9.2
WA8305 CL+	---	---	153	59.7	95	6/4	38	0	9.1
WA8293	---	---	152	59.1	98	6/2	36	0	9.5
WA8307	---	---	152	58.2	92	6/2	37	0	10.4
IDO1708	160	141	151	58.2	99	5/28	33	0	10
Norwest Duet	142	153	151	59.8	96	6/2	38	0	9.2
SY Ovation	159	147	147	59.6	98	5/31	34	0	9.8
M-Press	---	---	146	59.1	98	6/1	35	0	9.6
WB1529	161	133	139	61.3	96	5/30	32	0	10.1
LCS Hulk	152	160	138	60.4	98	5/30	33	0	9.7
Norwest Tandem	---	160	137	59.4	98	5/28	29	0	9.2
UI Sparrow	146	144	137	57.4	98	6/3	39	0	10.3
VI Voodoo CL+	---	152	137	59.3	97	5/31	32	0	10.2
M-Idas with SSR	---	---	134	59.4	100	5/27	31	0	9.5
WB1783	150	169	133	60.8	93	6/1	34	0	10.1
LCS Drive	144	142	133	57.9	98	5/28	28	0	10
Rosalyn	135	157	132	58.2	93	6/3	34	0	9.3
Purl	---	145	131	59.8	96	5/30	35	0	9.4
Jasper	149	151	131	56.3	99	5/31	35	0	10
WB 456	136	135	130	61.0	97	5/28	32	0	10.9
AP Iliad	---	---	130	57.6	100	5/28	31	0	10.9
LWW16-71088	---	---	130	58.9	96	5/31	32	0	8.4
Nixon	145	146	130	59.2	96	5/31	36	0	9.2
UI Magic CL+	152	159	129	60.3	95	5/28	32	0	9.7
UI Castle CL+	145	150	128	60.4	96	6/3	37	0	10.6
WB1376CLP	147	127	128	62.4	98	5/29	35	0	11.0
LCS Blackjack	---	165	128	57.9	99	5/31	32	0	9
LCS Shark	146	146	127	58.0	96	5/29	31	0	9.7
OR2X2CL+	134	138	126	59.0	96	5/31	36	0	10.1
Brundage	144	154	125	59.9	95	5/28	35	0	10
Stingray CL+	---	---	123	59.4	96	6/1	33	0	10.3
Stephens	148	142	123	57.5	90	5/30	32	0	10.4
VI Bulldog	---	147	123	59.6	95	5/29	34	0	10.5
LCS Artdeco	160	156	121	57.4	95	5/29	30	0	9
SY Assure	149	155	120	59.2	93	5/27	30	0	10.6
SY Raptor	---	147	120	57.6	95	5/30	32	0	9.9
M-Idas	---	---	117	58.8	99	5/28	30	0	9.1
Appleby CL+	---	146	113	60.1	91	5/29	34	0	11
LCS Ghost	---	164	109	55.6	87	5/31	34	0	9.3
Average	148	150	134	59.0	96	5/30	34	0	9.8
LSD ($\alpha=.05$)	15	18	18	1.3	8	2	2	0	
CV (%)	7.3	8.6	9.4	1.5	6.2	1.1	3.8	.	
Pr > F	0.001	0.0011	<0.0001	<0.0001	0.7247	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 22. Agronomic Data for Soft White Winter Wheat at Aberdeen, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
YSC-215	---	---	178	60.9	99	6/1	38	0	10.7
VI Voodoo CL+	---	162	177	60.4	98	6/2	38	0	11.0
VI Bulldog	---	161	174	60.1	98	6/3	39	0	10.6
LWW16-71088	---	---	173	59.4	99	6/2	36	0	9.8
WB1529	181	157	169	61.1	91	6/2	37	0	11.6
LCS Hulk	181	175	169	60.5	98	6/2	38	0	10.8
OR2X2CL+	150	154	161	59.1	98	6/1	38	0	10.3
WA8293	---	---	159	59.5	100	6/3	42	0	10.0
M-Idas	---	---	158	58.7	98	6/3	38	0	10.0
LCS Blackjack	---	187	157	58.4	97	6/2	37	0	11.0
WA8305 CL+	---	---	157	60.0	100	6/1	41	0	11.0
SY Assure	167	157	157	60.7	100	5/30	35	0	10.9
Stingray CL+	---	171	157	60.4	99	6/2	37	0	11.0
IDO1708	174	169	156	60.6	97	5/30	35	0	10.0
UI Magic CL+	187	160	153	60.8	99	6/4	43	0	11.9
LCS Ghost	---	196	153	58.3	98	5/31	37	0	9.6
Nixon	175	174	153	59.2	100	6/4	40	0	12.4
Stephens	163	156	152	59.4	99	6/1	37	0	10.8
SY Raptor	---	178	151	60.3	100	6/5	39	0	10.9
Rosalyn	167	173	151	58.4	99	6/2	37	0	10.4
LCS Artdeco	176	178	150	58.7	93	5/31	33	0	9.9
Purl	---	168	149	60.3	98	6/5	40	0	11.9
WB1376CLP	163	141	148	61.5	100	6/1	36	0	11.3
Norwest Duet	---	177	146	58.8	98	5/31	31	0	10.2
Jasper	178	174	145	58.5	95	6/4	38	0	11.4
M-Press	---	---	145	60.0	96	5/30	31	0	10.3
UI Castle CL+	159	157	145	60.2	96	5/31	34	0	9.8
AP Iliad	---	---	144	58.8	99	6/1	40	0	9.9
UI Sparrow	184	148	141	59.4	99	6/3	33	0	11.6
WB1783	197	165	140	60.4	99	5/31	37	0	10.9
YSC-201	---	---	140	59.4	100	6/3	37	0	10.6
Brundage	177	143	139	61.2	91	6/1	37	0	10.8
SY Ovation	182	174	138	60.8	98	6/2	33	0	10.4
Norwest Tandem	159	160	137	59.7	98	6/2	41	0	11.6
WA8306 CL+	---	---	137	59.8	99	6/2	40	0	10.3
M-Idas with SSR	---	---	137	60.4	97	5/30	32	0	10.8
VI Shock	---	167	136	59.6	96	5/31	35	0	10.4
LCS Shark	178	163	134	58.6	98	5/31	34	0	10.3
WB 456	167	152	134	61.5	98	5/31	37	0	11.6
LCS Drive	157	161	134	59.3	98	5/30	29	0	10.8
Appleby CL+	---	162	134	60.5	98	5/31	37	0	11.6
WA8307	---	---	129	59.9	95	5/31	36	0	10.2
Average	173	165	150	59.8	98	6/1	37	0	10.7
LSD ($\alpha=.05$)	13	13	16	1.8	6	2	3	0	
CV (%)	5.5	5.5	7.5	2.1	4.6	0.8	5.5	.	
Pr > F	<0.0001	<0.0001	<0.0001	0.0042	0.6583	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 23. Agronomic Data for Soft White Winter Wheat at Ririe, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
LCS Blackjack	---	---	164	60.2	98	6/5	32	0	10.2
VI Shock	---	---	164	61.5	99	6/6	34	0	9.3
UI Sparrow	---	---	162	60.6	99	6/10	39	0	9.2
WA8305 CL+	---	---	160	61.1	99	6/6	37	0	8.7
LCS Hulk	---	---	158	62.9	99	6/8	33	0	9.3
YSC-215	---	---	158	62.2	98	6/8	35	0	8.8
WA8293	---	---	158	61.8	96	6/6	36	0	9.7
LWW16-71088	---	---	157	61.3	99	6/6	33	0	8.9
Nixon	---	---	154	62.0	99	6/6	35	0	9.7
WA8306 CL+	---	---	154	60.4	98	6/7	38	0	9.3
LCS Ghost	---	---	154	58.7	99	6/5	34	0	9.3
LCS Artdeco	---	---	152	61.2	98	6/6	31	0	9.1
IDO1708	---	---	151	60.1	98	6/6	33	0	8.3
Brundage	---	---	149	61.9	98	6/4	35	0	9.7
VI Voodoo CL+	---	---	148	61.5	98	6/6	32	0	9.6
Norwest Duet	---	---	148	62.3	98	6/6	36	0	8.9
Norwest Tandem	---	---	147	61.8	99	6/4	30	0	9.4
M-Press	---	---	147	61.1	98	6/9	34	0	8.9
Stingray CL+	---	---	146	62.1	98	6/8	33	0	9.4
Jasper	---	---	146	61.1	98	6/8	34	0	9.4
Rosalyn	---	---	144	60.2	99	6/8	35	0	9.4
WB1783	---	---	144	63.0	98	6/7	34	0	9.9
Purl	---	---	143	62.2	98	6/5	33	0	9.2
UI Castle CL+	---	---	143	62.1	95	6/10	36	0	9.9
VI Bulldog	---	---	143	62.3	98	6/6	33	0	9.2
M-Idas	---	---	142	61.0	99	6/4	29	0	9.2
SY Ovation	---	---	141	61.1	98	6/7	34	0	9.4
SY Assure	---	---	140	63.2	99	6/4	29	0	10.1
Stephens	---	---	140	60.5	98	6/5	33	0	9.7
UI Magic CL+	---	---	139	62.0	98	6/6	33	0	9.8
OR2X2CL+	---	---	139	61.5	98	6/6	36	0	9.8
SY Raptor	---	---	137	60.4	98	6/6	31	0	9.2
LCS Drive	---	---	135	60.6	94	6/4	25	0	9.3
WB1376CLP	---	---	134	64.3	98	6/5	34	0	10.5
WB1529	---	---	134	63.0	98	6/5	30	0	9.7
M-Idas with SSR	---	---	133	60.5	98	6/6	30	0	9.3
WA8307	---	---	132	60.7	95	6/8	36	0	9.1
AP Iliad	---	---	132	61.7	100	6/6	32	0	10.1
WB 456	---	---	131	63.6	98	6/6	32	0	10.3
LCS Shark	---	---	130	60.3	99	6/5	31	0	9.8
YSC-201	---	---	129	61.0	94	6/5	35	0	10.1
Appleby CL+	---	---	126	61.9	99	6/5	33	0	10.5
Average	---	---	145	61.5	98	6/6	33	0	9.5
LSD ($\alpha=.05$)	---	---	13	0.5	4	2	2	0	
CV (%)	---	---	6.3	0.6	2.6	1.0	3.9	.	
Pr > F	---	---	<0.0001	<0.0001	0.4162	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 24. Agronomic Data for Soft White Winter Wheat at Ririe, Dryland, 2020*.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020**						
UI Sparrow	65	24	48	54.4	99	6/23	28	0	15.0
Devote	58	25	47	56.6	98	6/24	23	0	15.0
Eltan 11-52-0	---	23	47	56.1	97	6/23	24	0	14.8
Otto	57	24	46	54.6	98	6/23	25	0	15.5
LWW16-71088	---	---	45	54.7	99	6/23	23	0	14.0
WA8293	---	---	44	53.9	90	6/23	23	0	15.3
OR2X2CL+	52	22	43	54.6	100	6/22	25	0	16.1
SY Raptor	---	---	43	54.1	100	6/21	23	0	15.1
WA8306 CL+	---	---	43	55.6	95	6/22	25	0	14.7
Eltan	59	25	43	56.0	93	6/22	25	0	15.0
Rosalyn	48	23	43	54.1	93	6/23	24	0	14.8
WA8305 CL+	---	---	43	54.9	95	6/23	20	0	15.5
SY Ovation	---	26	42	57.8	99	6/22	24	0	14.5
M-Press	---	---	41	55.3	93	6/23	23	0	14.7
WB1783	57	22	41	59.1	97	6/22	22	0	14.6
Norwest Duet	51	27	40	55.6	96	6/23	23	0	14.3
WA8307	---	---	40	53.4	97	6/22	23	0	15.3
WB 456	---	---	40	56.5	95	6/21	23	0	15.5
IDO1810	---	28	39	55.7	99	6/23	24	0	15.2
LCS Sonic	---	23	39	56.7	99	6/21	23	0	14.5
OR2130755	---	---	39	56.2	90	6/20	24	0	14.5
UIL17-6834 CL+	---	20	38	56.7	95	6/22	24	0	15.5
LCS Hulk	56	25	37	56.3	94	6/23	23	0	14.8
Nixon	43	26	37	55.9	99	6/22	23	0	14.6
Norwest Tandem	55	25	37	55.3	97	6/21	24	0	14.5
Jasper	52	24	36	52.5	97	6/23	24	0	15.8
LCS Shine	---	24	36	57.4	98	6/18	24	0	13.5
Purl	---	25	36	56.0	93	6/22	24	0	15.3
WB1376CLP	51	24	36	57.3	91	6/22	23	0	15.9
Stingray CL+	---	23	36	55.7	98	6/23	21	0	15.0
WB1529	52	22	36	58.1	93	6/23	20	0	14.5
Appleby CL+	---	26	35	56.5	98	6/22	23	0	15.0
IDO1708	51	20	35	53.2	93	6/22	24	0	14.6
UI Castle CL+	50	23	35	56.4	90	6/24	23	0	15.9
SY Assure	---	22	34	56.4	93	6/22	18	0	14.2
UI Magic CL+	52	19	34	56.3	94	6/21	23	0	15.2
Brundage	50	19	34	56.4	98	6/20	22	0	14.3
M-Idas with SSR	---	---	34	57.0	93	6/18	25	0	12.7
Stephens	46	21	34	53.6	93	6/24	26	0	14.8
VI Presto CL+	---	25	33	57.5	93	6/21	21	0	13.8
IDO1808	---	16	33	54.7	90	6/23	21	0	15.1
VI Voodoo CL+	---	21	32	55.0	90	6/24	26	0	15.2
M-Idas	---	---	32	57.2	92	6/20	25	0	12.5
Average	33	23	39	55.8	95	6/22	23	0	14.8
LSD ($\alpha=0.05$)	5	5	6	1.3	11	2	5	0	
CV (%)	9.2	16.1	8.2	1.2	5.5	0.6	10	.	
Pr > F	<0.0001	0.0037	<0.0001	<0.0001	0.8507	0.0006	0.4734	.	

* This is the result of only two replications. Two replications were damaged by high winds.

** Varieties or selections in bold are not statistically different from the top yielding variety.

Table 25. Agronomic Data for Soft White Winter Wheat at Rockland, Dryland, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
Otto	---	29	55	61.5	94	6/10	26	0	10.8
WA8293	---	---	52	60.3	94	6/6	23	0	10.7
Devote	---	---	51	62.7	94	6/9	23	0	11.3
Eltan 11-52-0	---	23	51	61.7	95	6/10	24	0	10.0
Eltan	---	27	50	61.1	95	6/8	25	0	9.4
Jasper	40	21	50	59.6	93	6/7	23	0	10.9
UI Sparrow	44	15	49	62.2	94	6/7	26	0	9.5
Norwest Duet	41	33	49	61.4	95	6/5	26	0	10.2
M-Press	---	---	48	60.9	95	6/6	23	0	9.7
WA8306 CL+	---	---	48	60.7	95	6/5	25	0	9.9
Stingray CL+	---	---	47	61.3	94	6/5	23	0	11.2
OR2X2CL+	---	---	47	61.1	94	6/5	24	0	10.6
WA8307	---	---	47	60.3	95	6/9	24	0	10.1
LCS Sonic	---	32	46	60.5	94	6/6	24	0	10.2
SY Ovation	---	29	46	61.4	94	6/5	23	0	10.4
LCS Hulk	44	30	46	61.2	95	6/5	23	0	10.8
LWW16-71088	---	---	46	60.5	95	6/7	21	0	9.1
Nixon	---	---	46	60.7	94	6/5	23	0	11.4
LCS Shine	---	32	45	60.0	93	6/1	22	0	9.4
Purl	---	24	45	61.0	95	6/6	23	0	10.2
Rosalyn	---	---	45	59.8	92	6/7	24	0	9.4
SY Raptor	---	---	45	59.8	95	6/3	21	0	10.3
Norwest Tandem	43	39	45	60.8	94	6/2	20	0	10.3
UI Castle CL+	40	23	42	61.5	94	6/11	22	0	12.9
VI Presto CL+	---	27	42	61.4	94	6/4	23	0	11.1
OR2130755	---	---	42	60.7	94	6/2	23	0	11.5
Appleby CL+	---	---	41	61.3	93	6/3	24	0	10.3
Stephens	---	---	41	59.9	94	6/6	22	0	10.3
M-Idas with SSR	---	---	40	60.6	94	6/6	20	0	9.6
Brundage	---	26	40	61.4	95	6/4	22	0	10.8
WB1783	---	---	40	62.6	94	6/10	22	0	12.3
UI Magic CL+	41	20	40	61.1	94	6/6	22	0	11.5
VI Voodoo CL+	---	26	39	61.5	94	6/7	20	0	10.9
MT1432	---	---	39	60.8	94	6/10	25	0	11.6
UIL17-6834 CL+	---	37	38	60.5	95	6/5	22	0	12.1
WB 456	---	---	38	61.6	94	6/4	22	0	11.4
WB1529	---	---	38	62.6	94	6/5	21	0	10.8
AP Illiad	---	---	38	60.3	94	6/9	21	0	10.5
M-Idas	---	---	37	60.2	94	6/6	21	0	9.5
IDO1708	---	---	35	58.5	95	6/5	23	0	9.7
SY Assure	---	---	34	60.9	93	6/3	21	0	10.9
Average	39	26	44	60.9	94	6/6	23	0	10.6
LSD ($\alpha=.05$)	7	4	6	0.6	1	2	2	0	
CV (%)	13.2	9.8	10.2	0.7	0.9	0.7	5	.	
Pr > F	0.0194	<.0001	<.0001	<.0001	0.0037	<.0001	<.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 26. Agronomic Data for Soft White Winter Wheat at Soda Springs, Dryland, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
AP Iliad	---	---	77	57.8	98	6/29	28	0	10.8
UI Sparrow	81	64	76	57.7	94	7/5	33	0	10.3
SY Raptor	---	---	73	57.7	98	6/26	26	0	10.0
Otto	69	50	71	60.0	100	7/6	30	0	10.5
Eltan 11-52-0	---	54	68	59.9	98	7/4	30	0	10.0
IDO1708	70	58	66	57.3	98	6/24	27	0	9.9
LCS Sonic	---	64	65	59.0	94	6/26	29	0	11.3
LCS Shine	---	56	64	57.4	100	6/24	23	0	9.6
Purl	---	53	64	59.6	99	6/25	26	0	9.9
Jasper	69	55	64	58.4	99	7/1	29	0	9.3
M-Press	---	---	62	58.6	100	6/29	27	0	10.4
LCS Hulk	73	55	62	59.6	99	6/26	28	0	10.6
Stingray CL+	---	58	62	58.5	97	7/1	27	0	10.9
UIL17-6834 CL+	---	42	62	58.7	100	6/24	24	0	11.5
Nixon	78	67	61	58.7	98	6/27	28	0	10.1
Norwest Tandem	70	47	60	58.6	99	6/25	25	0	10.5
WB1529	77	47	60	60.3	98	6/26	25	0	11.4
Eltan	80	56	59	60.8	97	7/5	29	0	11.3
OR2130755	---	---	58	58.9	99	6/24	29	0	9.4
WA8293	---	---	58	59.1	96	7/2	28	0	9.3
Appleby CL+	---	48	58	59.1	97	6/26	27	0	11.5
Brundage	---	---	58	59.5	98	6/22	28	0	10.7
Devote	82	57	58	60.4	98	7/4	27	0	11.4
SY Assure	---	36	58	58.4	94	6/24	22	0	9.8
WB456	---	---	58	59.5	99	6/25	25	0	11.0
Norwest Duet	70	45	57	58.4	98	6/28	31	0	9.2
IDO1808	---	52	56	57.9	99	6/28	28	0	10.4
MT1432	---	---	56	59.0	100	7/2	37	0	11.6
VI Voodoo CL+	---	60	56	59.3	100	6/29	23	0	10.9
SY Ovation	---	54	55	59.7	100	6/29	27	0	10.8
UI Magic CL+	71	51	55	58.8	99	6/25	25	0	11.0
Rosalyn	72	55	55	58.7	96	7/1	26	0	9.8
IDO1810	---	47	53	58.9	100	7/3	30	0	10.9
OR2X2CL+	64	51	53	58.7	99	7/2	27	0	10.6
LWW16-71088	---	---	51	59.3	100	6/24	22	0	9.5
WA8307	---	---	51	58.7	100	7/3	29	0	9.3
WB1783	76	42	50	60.3	99	6/27	26	0	11.3
M-Idas	---	---	50	58.6	95	6/24	26	0	9.0
UI Castle CL+	60	50	49	60.2	100	7/4	28	0	10.1
VI Presto CL+	---	61	49	59.3	100	6/25	28	0	10.6
WA8306 CL+	---	---	49	58.3	98	7/1	30	0	9.1
M-Idas with SSR	---	---	48	58.0	96	6/24	23	0	8.6
Stephens	66	38	48	57.5	100	6/27	27	0	9.4
WB1376CLP	72	38	46	59.5	96	6/30	25	0	11.5
Average	73	52	58	58.9	98	6/28	27	0	10.3
LSD ($\alpha=0.05$)	12	17	16	1.2	4	2	3	0	
CV (%)	11.3	21.7	17.8	1.4	2.9	0.90	8.3	.	
Pr > F	0.0275	0.0151	0.0144	<0.0001	0.0641	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 27. Soft White Winter Wheat Yield Percentage of Location Averages, 2020.

Variety or Selection	(100% = Average)							Variety Average
	Kimberly	Aberdeen	Rupert	Ririe Irrigated	Ririe Dryland	Rockland	Soda Springs	
Otto	---	---	---	---	119	125	122	122
Eltan 11-52-0	---	---	---	---	121	115	117	118
YSC-215	---	119	---	109	---	---	---	114
Devote	---	---	---	---	122	116	99	112
UI Sparrow	100	94	103	112	123	112	130	110
WA8293	111	106	114	109	114	118	99	110
Eltan	---	---	---	---	110	114	101	109
WA8305 CL+	96	105	115	110	110	---	---	107
LCS Blackjack	112	105	96	113	---	---	---	106
LCS Hulk	110	113	104	109	96	104	106	106
LCS Sonic	---	---	---	---	101	105	111	106
Norwest Duet	115	97	113	102	104	110	97	106
LWW16-71088	107	115	98	109	116	104	87	105
VI Shock	96	91	119	113	---	---	---	105
M-Press	103	96	110	101	106	109	107	105
SY Raptor	105	101	90	94	112	101	126	104
WA8306 CL+	105	92	119	106	112	109	84	104
Jasper	109	97	98	100	94	113	109	103
Nixon	109	102	98	106	95	104	105	103
AP Iliad	114	96	98	91	---	86	131	103
IDO1708	111	104	114	104	91	80	113	102
LCS Shine	---	---	---	---	94	103	110	102
Rosalyn	100	101	99	100	110	103	93	101
VI Bulldog	96	116	92	99	---	---	---	101
SY Ovation	98	92	110	97	108	105	94	101
Stingray CL+	100	104	93	101	92	107	105	100
OR2X2CL+	97	107	95	96	112	105	90	100
Purl	94	100	98	99	94	103	110	100
Norwest Tandem	99	92	103	102	95	101	102	99
LCS Ghost	106	102	82	106	---	---	---	99
OR2130755	---	---	---	---	101	95	100	99
VI Voodoo CL+	101	118	103	102	83	88	95	99
LCS Artdeco	96	100	91	105	---	---	---	98
WA8307	95	86	114	91	104	105	87	97
UIL17-6834 (CL+)	---	---	---	---	99	86	106	97
IDO1810	---	---	---	---	101	---	90	96
Brundage	103	93	94	103	87	91	99	95
WB1783	92	94	100	99	105	91	86	95
UI Magic CL+	98	102	97	96	88	90	94	95
WB1529	74	113	105	92	92	86	102	95
LCS Drive	97	89	100	93	---	---	---	95
LCS Shark	103	89	95	90	---	---	---	94
WB456	95	89	98	91	103	86	99	94
UI Castle CL+	98	96	96	99	91	96	84	94
SY Assure	96	105	90	97	88	76	99	93
Stephens	98	101	92	96	87	92	82	93
M-Idas	104	106	88	98	82	84	85	92
M-Idas with SSR	98	91	101	92	87	91	82	92
Appleby CL+	93	89	85	87	91	93	99	91
YSC-201	---	93	---	89	---	---	---	91
IDO1808	---	---	---	---	84	---	95	90
VI Presto CL+	---	---	---	---	86	96	84	89
WB1376CLP	66	98	96	92	94	---	78	87
Location Average (bu/A)	158	150	133	145	39	44	58	

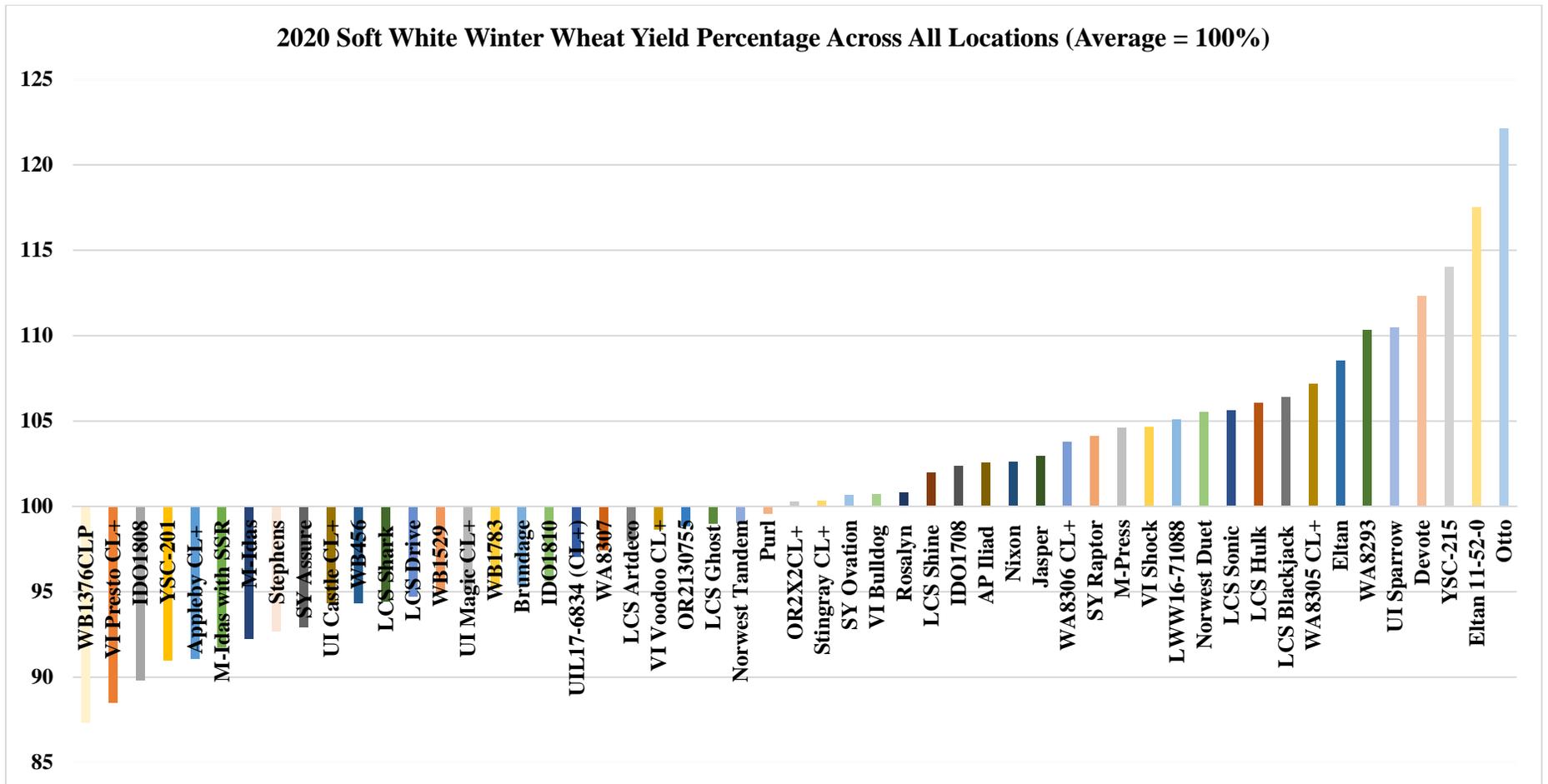


Chart 3. Soft white winter wheat yield percentage across all locations.

Table 28. Winter Barley Irrigated Nurseries, 3-Year Averages (2018-2020; 6 site-years*).

Variety or Selection	Yield** (bu/A)	Test Wt (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plumps (>6/64)	Plumps (>5.5/64)	% thin
Sunstar Pride	175	51.5	97	6/2	37	12	10.4	61.8	18.3	18.1
KWS Somerset	172	53.3	99	5/26	40	13	11.4	96.0	2.3	1.5
LCS Calypso	172	52.5	99	5/22	42	3	11.5	96.6	2.0	1.0
Desiree	171	51.8	96	5/26	41	14	11.4	89.4	6.3	3.6
2WI15-8688	168	52.9	98	5/24	39	22	11.3	89.3	6.1	4.2
KWS Scala	166	51.5	98	5/24	38	21	11.6	94.3	3.0	2.1
Thunder	166	52.2	97	5/23	38	36	11.4	93.9	3.5	2.3
2WI14-7577	160	51.4	98	5/23	40	19	11.7	93.7	3.6	2.0
WintMalt	153	51.4	98	5/27	40	28	11.3	91.3	5.2	3.5
Eight-Twelve	145	51.0	98	5/27	40	35	10.9	67.4	18.4	14.0
Endeavor	142	52.6	97	5/27	42	48	11.3	81.7	10.1	7.4
Charles	135	49.9	97	5/24	38	60	11.3	87.6	7.0	4.9
Upspring***	131	57.3	85	5/30	42	7	15.5	80.2	10.2	5.6
Buck***	119	55.9	88	5/27	39	30	13.9	46.3	26.6	26.8
Average	156	53	97	5/26	40	25	11.8	83.5	8.8	6.9
LSD (a =(0.05)	11	2.1	3	1	2	14	0.4	8.3	3.4	4.7
CV (%)	11	6.3	4.7	1.4	7.1	92	3.0	8.6	36.1	61.1
Pr > F	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

* The 2020 winter plots in Rupert sustained significant winter damaged, hence agronomic data for that specific year and location was not included (only 5 site-year was used for the analyses).

** Varieties or selections in bold are not statistically different from the top yielding variety.

*** Hulless varieties

Table 29. Irrigated Winter Barley Data Combined from Rupert and Aberdeen, 2020.

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump (>6/64)	Plump (>5.5/64)	% Thin
KWS Donau	150	50.9	79	5/24	36	0	11.5	98	1	1
KWS Somerset	150	50.4	84	5/28	36	0	11.4	98	1	1
WintMalt	142	50.4	77	5/30	38	0	11.4	96	3	2
DH140963	140	49.8	78	5/29	37	0	11.3	97	2	1
Sunstar Pride	140	49.0	59	6/5	32	0	10.3	73	16	10
KWS Scala	138	49.3	73	5/27	35	0	11.7	97	2	1
Desiree	129	46.9	63	5/25	34	0	11.8	81	12	7
Charles	125	49.7	53	5/25	36	0	11.3	95	3	2
Eight-Twelve	125	48.4	57	5/29	33	0	11.1	75	17	9
KWS Faro	124	49.7	74	5/20	29	0	11.2	95	3	2
Thunder	123	51.5	54	5/27	36	0	11.3	98	1	1
05ARS849-15	122	50.6	70	5/27	39	0	11.3	97	2	1
Lightning	120	51.4	68	5/25	35	0	11.9	97	2	1
2WI15-8688	119	51.1	159	5/27	35	0	11.5	94	4	2
2WI14-7577	118	49.9	56	5/28	38	0	11.7	96	3	1
13ARS537-25	112	50.7	52	5/26	36	0	11.3	95	3	2
LCS Calypso	111	50.9	79	5/23	36	0	11.4	97	2	1
Endeavor	103	52.1	57	5/30	40	0	11.5	93	5	2
10.1492**	91	58.0	58	5/27	31	0	14.5	79	13	8
Upspring**	90	59.1	21	6/3	39	0	15.8	85	9	5
Buck**	78	57.3	25	5/29	35	0	14.9	54	24	23
Average	122	51.3	62	5/27	35	0	11.9	90.0	6.2	3.9
LSD ($\alpha=0.05$)	38	1.7	7	3	4	0	0.6	9.9	4.0	6.9
CV (%)	31.6	3.4	56.7	2.2	10.9	.	2.5	5.3	30.7	86
Pr > F	0.0114	<0.0001	0.0272	<0.0001	<0.0001	.	<0.0001	<0.0001	<0.0001	0.0003

Note: Spring stand and yield were very low compared to a normal growing season due to damage sustained by the heavy winter. As a result the associated CVs were also high.

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Indicates hulless varieties.

Table 30. Agronomic Data for Winter Barley at Rupert, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)**	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		
	2018	2019	2020*							(>6/64)	(>5.5/64)	% Thin
KWS Somerset	154	146	157	49.4	80	5/27	35	0	11.3	97	2	1
KWS Donau	---	173	136	49.8	64	5/20	34	0	11.5	97	2	1
WintMalt	148	109	130	49.3	54	5/30	36	0	11.6	95	3	2
DH140963	---	161	127	48.6	58	5/29	35	0	11.6	96	3	1
KWS Scala	154	137	126	47.8	49	5/25	33	0	11.6	96	3	1
Desiree	---	143	109	45.4	39	5/24	32	0	12.1	72	17	11
Charles	113	88	105	48.4	26	5/22	34	0	11.4	94	4	2
Sunstar Pride	166	149	105	48.4	21	6/3	29	0	10.6	74	16	10
Lightning	148	109	101	50.5	39	5/23	31	0	12.1	96	3	1
KWS Faro	---	---	95	49.1	49	5/17	27	0	11.1	94	4	2
Eight-Twelve	143	105	92	45.8	38	5/27	30	0	11.6	68	20	12
Thunder	161	136	91	50.4	14	5/28	34	0	11.2	97	2	1
LCS Calypso	164	151	87	49.5	57	5/19	33	0	11.8	95	3	2
2WI15-8688	154	125	83	50	21	5/27	33	0	11.6	91	6	3
Endeavor	128	109	82	50.8	39	5/28	38	0	11.5	90	7	3
05ARS849-15	---	97	78	49.6	41	5/26	38	0	11.3	98	1	1
13ARS537-25	131	118	77	49.2	20	5/26	34	0	11.4	93	5	2
Upspring***	116	98	75	59.1	17	6/2	37	0	15.8	85	10	5
2WI14-7577	147	126	73	48.2	15	5/28	35	0	11.4	94	4	2
10.1492***	---	---	69	55.6	34	5/27	28	0	15.0	70	18	12
Buck***	122	91	57	56.1	28	5/26	33	0	15.0	42	26	32
Average	147	124	98	50.0	38	5/26	33	0	12.0	87.3	7.5	5.1
LSD ($\alpha=.05$)	17	21	44	1.6	38.4	4.5	4.0	0				
CV (%)	8.3	11.59	31.2	2.1	70.3	2.1	8.4	.				
Pr > F	<0.0001	0.0011	0.0013	<0.0001	0.0476	<0.0001	<0.0001	.				

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Spring stand and yield were very low compared to a normal growing season due to damage sustained by the heavy winter.

*** Indicates hullless variety

Table 31. Agronomic Data for Winter Barley at Aberdeen, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		
	2018	2019	2020*							(>6/64)	(>5.5/64)	% Thin
Eight-Twelve	178	126	184	50.3	95	5/31	36	0	10.6	81	14	5
Sunstar Pride	203	180	174	49.6	97	6/8	35	0	10.0	73	17	10
13ARS537-25 (QC)	---	---	168	51.6	100	5/28	41	0	11.5	96	3	1
Charles	163	165	165	51.1	98	5/29	38	0	11.2	96	3	1
13ARS537-25	181	172	164	52.9	98	5/27	38	0	11.1	97	2	1
KWS Donau	---	199	164	52.0	95	5/27	39	0	11.4	99	1	0
KWS Somerset	202	193	163	51.5	100	5/28	36	0	11.4	98	1	1
2WI14-7577	175	188	163	51.6	96	5/27	41	0	12.0	97	2	1
05ARS849-15	---	165	159	51.6	100	5/28	40	0	11.3	97	2	1
Thunder	182	194	156	52.7	95	5/26	39	0	11.4	98	1	1
2WI15-8688	207	196	155	52.2	97	5/27	38	0	11.3	97	2	1
WintMalt	187	167	154	51.6	100	5/30	40	0	11.2	96	3	1
KWS Faro	---	---	154	50.2	100	5/24	32	0	11.3	96	2	2
DH140963	---	214	154	51.1	98	5/28	40	0	11.0	97	2	1
Lightning	188	184	149	52.3	97	5/28	38	0	11.6	98	1	1
KWS Scala	192	200	149	50.8	98	5/29	38	0	11.7	97	2	1
Desiree	---	192	149	48.4	86	5/25	36	0	11.4	90	7	3
Endeavor	165	158	144	53.3	93	6/1	42	0	11.5	96	3	1
LCS Calypso	212	196	135	52.4	100	5/26	39	0	11.0	98	1	1
Upspring**	---	171	133	59.1	30	6/4	42	0	15.7	86	8	6
10.1492**	---	---	119	60.5	93	5/28	34	0	14.0	87	9	4
Buck**	142	132	110	58.9	30	6/1	38	0	14.8	65	22	13
Average	185	178	155	52.5	95	5/29	38.0	0	11.7	92.5	5	2.5
LSD ($\alpha=.05$)	22	20	22	1.1	8	3	3	0				
CV (%)	8.5	7.8	8.7	1.4	5.3	1.3	5.6	.				
Pr > F	<0.0001	0.0011	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	.				

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Indicates hulless variety.

Table 32. Winter Barley Yield Percentage of Location Averages, 2020.

Variety or Selection	(100% = Average)		Variety Average
	Aberdeen	Rupert*	
KWS Somerset	107	162	134
KWS Donau	107	140	124
WintMalt	101	134	117
DH140963	100	131	115
KWS Scala	98	130	114
Sunstar Pride	114	108	111
Charles	108	108	108
Eight-Twelve	120	94	107
Desiree	97	112	105
Lightning	98	104	101
KWS Faro	100	98	99
Thunder	102	94	98
2WI15-8688	101	86	94
13ARS537-25	107	80	93
05ARS849-15	104	81	92
2WI14-7577	106	76	91
Endeavor	94	85	90
LCS Calypso	88	89	89
Upspring**	87	77	82
10.1492**	78	71	74
Buck**	72	58	65
Location Average (bu/A)	153	97	

* Yield were very low compared to a normal growing season due to damages sustained by the heavy winter.

** Indicates hullless variety.

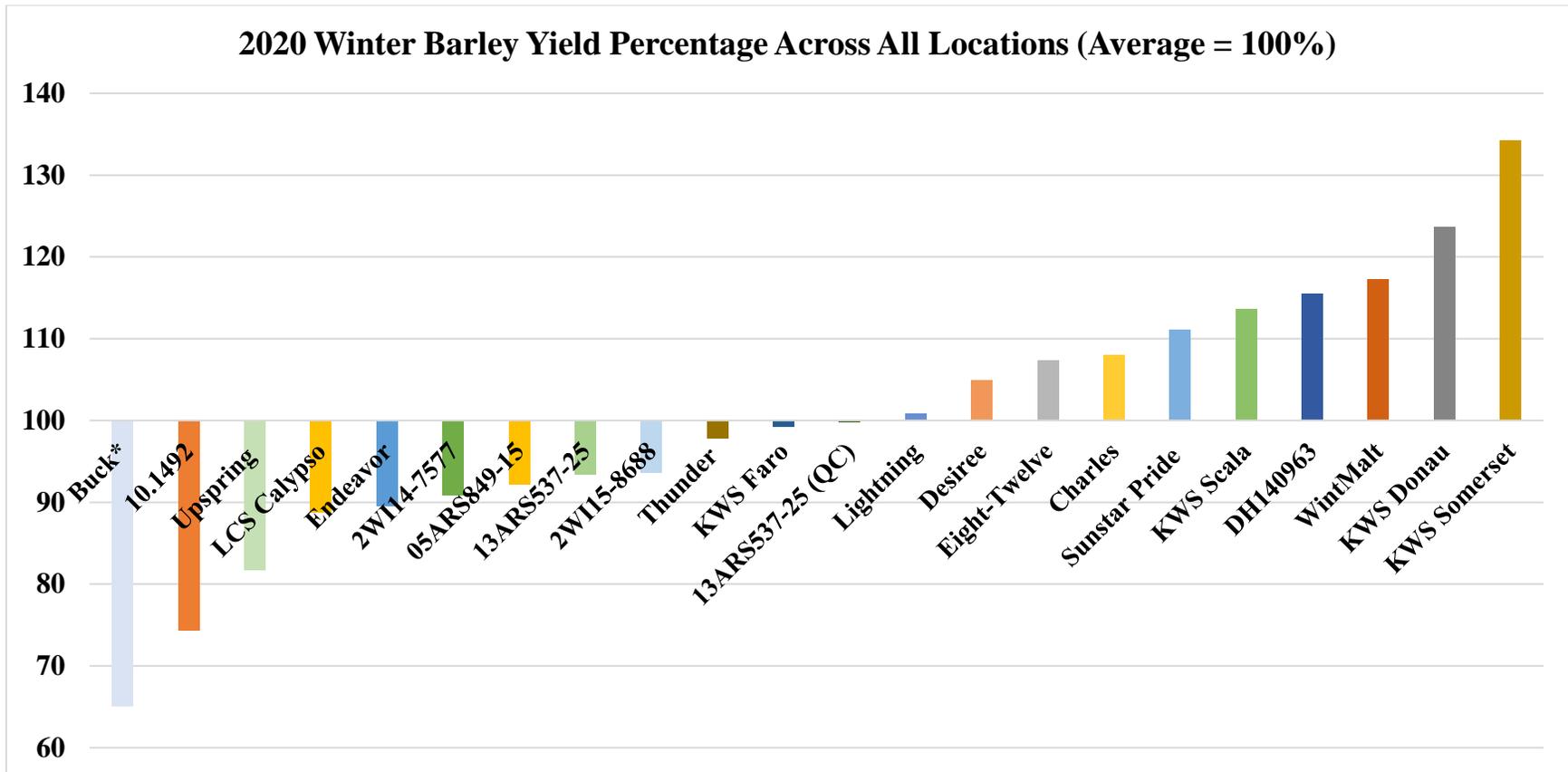


Chart 4. Winter barley yield percentage across all locations.

* hulless

QC = Planted twice as a quality control

Table 33. Hard Spring Wheat Irrigated Nurseries, 3 Year Averages (2018 - 2020; 12 site-years).

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Dayn (W)	124	62.4	99	6/18	35	0	13.4
AP Renegade	118	61.4	99	6/23	36	0	13.5
SY-Teton (W)	117	60.5	100	6/17	32	0	13.0
SY Gunsight	114	61.4	100	6/20	31	0	13.5
Alum	112	62.1	99	6/22	37	4	14.4
Jefferson	111	61.8	99	6/20	36	6	13.8
WB9590	111	61.9	99	6/19	31	2	14.9
IDO1603S	110	61.8	99	6/18	32	0	14.7
UI Platinum (W)	110	62.3	100	6/16	31	0	13.1
WB7202CLP (W)	110	62.2	99	6/16	29	0	13.0
Glee	109	62.1	100	6/17	35	4	13.7
IDO1701S	108	62.3	100	6/18	33	2	14.7
WB7589 (W)	108	61.9	99	6/18	27	0	13.9
WB9668	108	62.6	100	6/18	30	0	15.4
Klasic (W)	107	62.3	99	6/16	27	0	13.5
WB7328 (W)	105	62.2	99	6/16	28	0	14.6
Average	111	61.9	99	6/18	32	1	13.9
LSD ($\alpha = .05$)	9	0.6	1	4	1	3	0.5
CV (%)	18.6	2.2	3.2	6.2	9.2	571	4.0
Pr>F	0.0021	<.0001	0.9919	0.1325	<.0001	<.0001	<0.0001

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = Hard White

Table 34. Hard Spring Wheat Dryland Nurseries, 3 Year Averages (2018 - 2020; 3 site-years).

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Dayn (W)	67	60.6	96	7/7	32	0	11.8
SY-Teton (W)	64	59.2	97	7/8	29	0	11.5
Jefferson	62	60.9	97	7/9	31	0	13.1
WB7202CLP (W)	62	61.7	96	7/6	27	0	11.0
DuClair	60	60.0	96	7/7	31	0	12.2
Glee	60	61.0	98	7/9	31	0	12.0
WB7589 (W)	59	61.0	96	7/8	25	0	12.7
Alum	58	60.8	95	7/11	32	0	12.7
UI Platinum (W)	57	61.4	96	7/6	28	0	11.9
WB9668	54	61.5	96	7/7	26	0	14.0
WB9590	53	60.1	96	7/8	26	0	13.5
IDO1603S	53	60.5	97	7/8	28	0	13.4
IDO1701S	52	61.0	97	7/8	30	0	---
MT1673	52	58.7	95	7/8	31	0	13.8
WB7328 (W)	51	60.6	97	7/5	25	0	12.4
Klasic (W)	50	60.5	96	7/6	23	0	12.1
Average	57	60.6	96	7/8	28	0	12.5
LSD ($\alpha = .05$)	6	1	2	1	1	0	0.9
CV (%)	12	1	3	1	6	.	4.4
Pr>F	<0.0001	<0.0001	0.4525	<0.0001	<0.0001	.	<0.0001

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = White

Table 35. Irrigated Hard Spring Wheat Data Combined from Rupert, Idaho Falls, Ashton and Aberdeen, 2020.

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Alum	127	62.7	97	6/27	38	0	13.9
IDO1904S	124	61.3	99	6/21	34	0	13.3
WB7202CLP (W)	123	62.4	100	6/27	32	0	12.7
Dayn (W)	122	62.6	99	6/15	36	0	13.3
Dagmar	119	62.3	100	6/18	39	0	14.9
IDO1805S	118	61.2	100	6/26	35	9	13.3
WB9707	118	63.0	99	6/20	36	0	14.4
AP Renegade + base + root	116	61.7	100	6/16	35	0	13.3
WB9879CLP	116	62.0	99	6/28	37	0	14.2
SY-Teton (W)	116	60.7	99	6/17	32	0	12.7
WB9590	116	62.4	100	6/24	32	2	14.5
IDO2004S (W)	115	61.9	100	6/18	35	0	12.3
AP Renegade	115	61.6	99	6/24	36	0	13.0
IDO1804S (W)	115	61.8	98	6/19	34	0	13.0
AP Venom	114	60.6	96	6/16	33	0	12.6
Glee	114	62.7	98	6/22	36	0	13.1
Jefferson	113	62.4	95	6/21	36	3	13.7
09W821030-32	113	63.0	99	6/17	28	0	14.2
WB9668	112	63.0	100	6/20	31	0	14.8
IDO1603S	111	62.1	98	6/19	33	0	14.4
IDO1701S	111	62.6	100	6/20	35	0	14.7
BZ917-099	111	61.7	100	6/15	33	0	15.2
WB7696 (W)	111	62.8	97	6/15	29	0	13.1
CP3066	110	62.2	98	6/15	31	0	14.0
SY Gunsight	110	62.1	98	6/21	31	0	13.2
MT1716	109	62.3	100	6/24	37	0	14.3
IDO2002S (W)	108	62.0	92	6/17	31	0	12.6
Net CL+	106	62.4	100	6/25	37	0	13.7
AP Renegade + base	106	61.6	99	6/21	36	0	13.0
WB7328 (W)	105	62.2	99	6/15	28	0	14.3
Klasic (W)	105	62.6	100	6/9	25	0	13.3
Espresso	105	61.8	98	6/20	32	0	14.4
MT1775	105	61.4	98	6/18	39	6	13.9
WB7589 (W)	103	62.3	98	6/16	27	0	13.4
LAR17-0125	100	61.4	99	6/17	37	0	13.4
WB9303	98	62.4	99	6/13	35	0	15.6
Lanning	98	61.6	100	6/19	34	0	15.2
AP Octane	96	60.0	97	6/12	29	0	13.7
UI Platinum (W)	96	62.0	100	6/22	31	0	13.0
Average	110	62.0	99	6/19	33	0.4	13.7
LSD ($\alpha = .05$)	22	0.7	5	13	2	4	1.0
CV (%)	18.8	1.5	4.6	7.6	7.1	959	5.4
Pr > F	0.5483	<0.0001	0.5842	0.8229	<0.0001	0.3179	<0.0001

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = Hard White

Table 36. Agronomic Data for Hard Spring Wheat at Rupert, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in)	Lodging (%)	Protein (%)
	2018	2019	2020*						
IDO1804S (W)	---	---	140	61.5	100	6/7	34	0	12.4
IDO2004	---	---	129	61.8	100	6/4	35	0	10.6
Dayn (W)	144	145	126	62.4	100	6/3	36	0	12.5
SY Gunsight	120	137	125	61.5	100	6/6	31	0	13.0
IDO1904S	---	---	123	61.2	100	6/8	34	0	12.1
LAR17-0125	---	---	123	61.3	100	6/8	38	0	12.7
WB9707	---	---	121	62.0	100	6/2	35	0	13.8
AP Renegade + base + root	---	---	120	61.7	100	6/7	36	0	12.9
IDO1805S	---	126	120	61.5	100	6/7	32	0	12.7
SY-Teton (W)	131	151	120	60.1	100	6/1	31	0	13.3
IDO2002	---	---	120	61.3	100	6/3	32	0	12.4
AP Renegade + base	---	---	119	62.0	100	6/8	35	0	12.2
AP Renegade	---	131	118	62.0	100	6/9	35	0	12.7
Glee	115	128	117	61.9	100	6/2	33	0	13.2
Net CL+	---	123	117	62.8	100	6/9	38	0	12.9
WB9879CLP	---	128	117	62.1	100	6/9	35	0	13.1
CP3066	---	---	117	61.3	100	6/1	30	0	13.9
Jefferson	122	125	116	62.3	100	6/5	35	0	13.0
WB7202CLP (W)	118	129	115	61.9	100	6/2	29	0	13.0
IDO1603S	121	131	115	61.7	100	6/2	29	0	13.8
09W821030-32	---	---	114	62.2	100	6/3	28	0	13.1
Alum	122	121	114	62.4	100	6/6	34	0	13.4
UI Platinum (W)	123	144	113	60.9	100	5/31	32	0	13.0
MT1775	---	---	113	61.1	100	6/7	36	0	13.1
WB9668	104	129	112	63.1	100	6/3	31	0	14.8
Klasic (W)	118	133	111	62.1	100	5/31	25	0	13.5
AP Venom	---	132	111	60.1	100	6/7	34	0	12.8
WB7696 (W)	---	139	110	62.5	100	6/2	29	0	12.2
WB7589 (W)	110	123	110	60.7	100	6/3	26	0	14.6
IDO1701S	106	124	107	62.5	100	6/2	32	0	14.4
Dagmar	---	---	107	62.4	100	6/3	35	0	14.7
Espresso	---	---	106	61.4	100	6/5	31	0	13.5
BZ917-099	---	---	105	61.2	100	6/2	32	0	15.6
WB9590	125	126	103	61.8	100	6/3	31	0	14.9
WB7328 (W)	105	123	100	61.4	100	5/31	28	0	14.2
WB9303	---	---	98	62.4	100	5/31	33	0	14.7
Lanning	---	---	97	61.0	99	6/3	34	0	15.5
MT1716	---	---	96	60.5	100	6/3	35	0	16.0
AP Octane	---	137	93	56.7	100	6/3	28	0	15.1
Average	120	131	114	61.5	100	6/4	32	0	13.5
LSD ($\alpha=.05$)	20	11	12	0.8	1	1	2	0	0
CV (%)	12.0	5.7	7.3	1.0	0.40	0.6	4.9	.	.
Pr > F	0.0123	<0.0001	<0.0001	<0.0001	0.4824	<0.0001	<0.0001	.	.

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = Hard White

Table 37. Agronomic Data for Hard Spring Wheat at Aberdeen, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
Dayn (W)	142	114	102	62.9	93	6/13	34	0	14.0
AP Renegade + base + root	---	---	101	61.2	100	6/17	34	0	13.7
09W821030-32	---	---	98	62.5	91	6/13	27	0	14.2
AP Venom	---	103	98	60.6	88	6/18	31	0	12.0
AP Renegade	---	105	97	61.3	91	6/17	34	0	13.4
MT1775			96	61.1	95	6/19	38	0	14.1
IDO2004			95	61.9	95	6/14	35	0	13.7
Alum	127	83	95	63.1	90	6/17	35	0	14.0
AP Octane	---	104	95	61.6	94	6/13	30	0	12.8
WB7696 (W)	---	95	94	62.6	91	6/14	30	0	12.7
SY Gunsight	126	104	93	62.3	95	6/14	30	0	13.7
WB9590	129	83	92	62.4	93	6/13	31	0	14.1
IDO2002			92	62.0	83	6/13	30	0	12.8
IDO1904S			91	61.1	95	6/13	31	0	14.2
IDO1804S (W)			90	62.5	86	6/17	32	0	12.0
SY-Teton (W)	127	112	90	61.2	99	6/11	30	0	11.7
IDO1805S	---	102	89	61.5	85	6/16	34	0	12.8
MT1716			89	62.7	96	6/15	36	0	12.8
Glee	127	94	89	63.1	95	6/12	35	0	13.8
IDO1603S	122	103	88	61.9	91	6/12	32	0	14.1
Jefferson	135	83	88	63.1	86	6/13	34	0	13.8
WB9707			87	63.0	89	6/11	35	0	13.7
WB7202CLP (W)	121	111	86	62.3	95	6/11	25	0	12.5
WB9879CLP	---	76	85	61.4	92	6/19	36	0	13.8
AP Renegade + base	---	---	84	61.0	99	6/16	34	0	13.7
BZ917-099	---	---	84	61.4	95	6/12	34	0	16.2
CP3066	---	---	84	62.7	95	6/13	30	0	14.3
WB7589 (W)	129	104	83	62.6	93	6/12	26	0	13.5
LAR17-0125			82	61.6	99	6/17	36	0	13.4
Dagmar			81	62.2	93	6/11	33	0	14.1
WB9668	125	101	81	62.3	98	6/11	30	0	14.3
WB9303			80	61.6	93	6/9	33	0	15.5
IDO1701S	118	103	80	62.2	96	6/12	34	0	14.8
Net CL+	---	90	80	62.6	94	6/17	36	0	13.8
UI Platinum (W)	133	106	78	62.2	96	6/11	29	0	13.2
Espresso			71	61.4	94	6/15	30	0	14.8
Lanning			71	61.5	100	6/12	32	0	13.9
WB7328 (W)	119	97	70	62.2	93	6/10	26	0	15.3
Klasic (W)	124	79	63	62.2	95	6/10	26	0	13.0
Average	126	96	87	62.0	93	6/14	32	0	13.7
LSD ($\alpha=.05$)	11	10	16	0.6	12	3	2	0	
CV (%)	6.2	7.5	13.1	0.7	8.9	1.4	4.8	.	
Pr > F	<.0001	<0.0001	0.0002	<0.0001	0.562	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = Hard White

Table 38. Agronomic Data for Hard Spring Wheat, Idaho Falls, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
Dayn (W)	140	139	143	63.4	100	6/22	36	0	13.8
IDO1804S (W)	---	---	132	62.3	100	6/25	36	1	14.7
Alum	130	125	129	63.4	100	6/23	39	0	14.6
IDO1904S	---	---	129	62.0	100	6/25	33	0	13.7
AP Venom	---	125	128	61.0	100	6/25	35	0	12.8
AP Renegade	---	124	124	62.8	100	6/26	37	0	13.3
IDO2004	---	---	122	62.8	100	6/26	38	0	12.6
Jefferson	128	116	122	63.1	100	6/22	38	0	14.4
WB9879CLP	---	114	121	63.1	100	6/25	39	0	15.3
WB7202CLP (W)	118	112	121	63.6	100	6/18	31	0	12.4
SY-Teton (W)	122	123	119	61.4	100	6/20	33	0	12.5
AP Renegade + base	---	---	118	62.8	100	6/24	36	1	13.4
09W821030-32	---	---	117	64.0	100	6/23	28	0	16.2
WB7696 (W)	---	109	117	63.5	100	6/23	32	0	14.9
LAR17-0125	---	---	117	62.0	100	6/25	39	0	13.8
CP3066	---	---	116	63.0	100	6/22	32	0	14.0
WB9707	---	---	115	63.9	100	6/20	37	0	15.8
WB9668	110	112	115	63.6	100	6/21	32	0	15.5
AP Renegade + base + root	---	---	114	62.5	100	6/26	37	0	12.7
Klasic (W)	132	107	114	64.1	100	6/19	28	0	12.6
AP Octane	---	121	114	61.8	100	6/25	30	0	13.2
SY Gunsight	114	122	114	62.8	100	6/25	31	0	13.3
IDO1805S	---	97	114	62.0	100	6/22	35	0	13.8
Dagmar	---	---	113	63.1	100	6/23	40	0	15.6
Net CL+	---	116	113	62.7	100	6/26	39	0	14.7
WB7328 (W)	126	112	112	63.7	100	6/18	30	0	14.1
Glee	123	105	111	63.3	100	6/19	39	0	12.9
WB9590	114	119	111	63.1	100	6/24	33	4	15.0
IDO1603S	120	115	108	62.8	100	6/21	34	0	14.5
WB7589 (W)	116	115	107	63.0	100	6/21	28	0	12.4
IDO2002	---	---	107	62.2	100	6/20	31	0	13.1
MT1775	---	---	107	62.0	100	6/24	42	9	15.2
Lanning	---	---	106	62.2	100	6/23	38	1	15.9
MT1716	---	---	106	63.4	100	6/22	39	0	14.6
BZ917-099	---	---	105	62.8	100	6/19	34	0	16.9
UI Platinum (W)	120	114	105	63.0	100	6/19	31	0	12.4
WB9303	---	---	102	63.1	100	6/18	36	0	16.5
Espresso	---	---	101	63.0	100	6/26	33	0	15.1
IDO1701S	107	100	100	63.3	100	6/20	35	0	15.2
Average	119	116	115	62.8	100	6/22	35	0.4	14.2
LSD ($\alpha=.05$)	15	9	14	0.6	0	1	2	4	
CV (%)	9.1	5.8	8.9	0.7	0	2.7	3.8	817	
Pr > F	<.0001	<0.0001	<0.0001	<0.0001	.	<0.0001	<0.0001	0.5415	

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = Hard White

Table 39. Agronomic Data for Hard Spring Wheat at Ashton, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
Dayn (W)			154	61.9	100	7/7	38	0	12.9
IDO1804S (W)	---	---	150	61.0	100	7/12	36	0	12.8
WB9707	---	---	138	62.9	100	7/5	35	0	14.5
IDO1904S	---	---	137	61.1	100	7/10	34	0	13.0
IDO2002	---	---	137	62.4	100	7/6	35	0	12.3
CP3066	---	---	137	61.8	100	7/8	33	0	13.6
WB7696 (W)	---	73	137	62.5	100	7/8	30	0	12.4
IDO1603S	72	67	135	61.9	100	7/8	33	0	15.1
IDO2004	---	---	135	61.3	100	7/10	35	0	12.3
Dagmar	---	---	133	61.6	100	7/5	39	8	15.3
09W821030-32	---	---	133	63.2	100	7/6	30	0	13.3
Espresso	---	---	132	61.6	100	7/11	34	0	14.4
MT1775	---	---	132	61.3	100	7/11	38	13	13.4
MT1716	---	---	131	62.7	100	7/7	37	0	13.7
LAR17-0125	---	---	131	60.7	100	7/10	39	13	13.7
Glee	95	71	130	62.7	100	7/7	36	0	12.4
AP Renegade	---	78	130	60.1	100	7/11	37	0	13.8
SY-Teton (W)	110	83	130	60.1	100	7/6	34	0	13.5
WB9590	110	79	130	62.2	100	7/8	33	0	14.1
Alum	112	73	129	61.8	100	7/9	39	0	13.7
AP Renegade + base + root	---	---	128	61.4	100	7/11	35	0	12.5
AP Renegade + base	---	---	128	60.8	100	7/12	38	0	12.5
WB9668	92	81	127	62.9	100	7/5	33	0	14.5
Net CL+	---	67	127	61.3	100	7/11	37	0	13.4
WB7202CLP (W)	94	69	126	62.0	100	7/4	32	0	13.0
Jefferson	100	76	125	61.3	100	7/10	37	6	13.5
WB9879CLP	---	80	124	61.5	100	7/12	38	0	14.5
IDO1805S	---	64	124	59.8	100	7/10	36	15	14.0
IDO1701S	88	58	123	62.5	100	7/8	36	1	14.5
Lanning	---	---	121	61.8	100	7/6	36	0	15.5
SY Gunsight	105	82	121	61.9	100	7/9	33	0	12.7
WB9303	---	---	119	62.8	100	7/5	36	0	15.7
BZ917-099	---	---	118	61.4	100	7/6	35	0	15.0
UI Platinum (W)	85	82	114	62.0	100	7/5	33	0	13.3
WB7589 (W)	93	67	113	62.7	100	7/7	30	0	13.0
Klasic (W)	104	71	111	62.2	100	7/4	29	0	13.9
WB7328 (W)	72	64	108	61.6	100	7/5	30	0	13.7
Average	100	74	128	61.7	100	7/8	35	1	13.6
LSD ($\alpha=.05$)	21	17	14	1.2	0	2	4	12	
CV (%)	14.7	14.2	7.6	1.4	0	1	8.2	553	
Pr > F	<.0001	0.2034	<0.0001	<0.0001	.	<0.0001	<0.0001	0.6212	

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = Hard White

Table 40. Agronomic Data for Hard Spring Wheat at Soda Springs, Dryland, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
Jefferson	48	76	62	62.1	100	7/10	33	0	10.0
AP Renegade + base + root	---	---	62	61.0	100	7/14	32	0	8.8
WB7202CLP (W)	49	74	62	63.2	100	7/7	28	0	8.2
IDO1804S (W)	---	---	61	61.3	100	7/12	32	0	8.9
Alum	49	64	61	62.0	100	7/14	34	0	9.4
Dayn (W)	60	76	60	62.2	100	7/10	34	0	10.3
SY-Teton (W)	52	78	60	61.2	100	7/9	30	0	8.1
AP Renegade + base	---	---	59	61.3	100	7/14	33	0	10.2
IDO2004	---	---	59	61.6	100	7/13	34	0	8.6
WB7589 (W)	48	71	58	62.7	100	7/10	25	0	9.9
Glee	52	66	57	62.7	100	7/11	34	0	8.8
Dagmar	---	80	57	62.5	100	7/11	35	0	11.3
UI Platinum (W)	46	68	57	63.1	99	7/7	29	0	8.9
IDO2002	---	---	57	62.3	100	7/12	28	0	9.0
IDO1805S	---	69	57	61.0	100	7/14	32	0	10.0
WB7696 (W)	---	67	56	62.4	100	7/10	27	0	8.7
Net CL+	---	73	56	61.7	100	7/13	34	0	9.5
Espresso	---	---	55	62.2	99	7/13	31	0	11.2
CP3066	---	---	55	62.7	99	7/11	29	0	10.2
MT1775	---	---	55	60.2	100	7/11	37	0	9.9
LAR17-0125	---	---	53	60.3	100	7/17	34	0	9.3
WB9707	---	---	53	63.1	100	7/10	32	0	10.8
DuClair	56	72	53	61.8	100	7/10	34	0	9.2
WB7328 (W)	41	62	53	63.1	99	7/5	27	0	9.3
BZ917-099	---	---	52	61.1	100	7/9	32	0	10.8
IDO1904S	---	---	52	61.1	100	7/12	31	0	9.9
Lanning	---	---	52	61.9	100	7/13	34	0	10.1
Klasic (W)	40	58	52	63.2	100	7/7	25	0	8.5
MT 1865	---	68	52	60.1	100	7/15	35	0	11.1
MT1716	---	---	51	62.8	100	7/10	33	0	9.1
WB9668	43	63	50	63.5	100	7/9	28	0	10.7
AP Renegade	---	---	50	60.7	100	7/12	32	0	9.3
IDO1603S	42	68	49	62.0	100	7/10	31	0	10.1
IDO1701S	41	63	49	62.8	100	7/11	32	0	10.4
WB9879CLP	---	63	48	61.9	100	7/14	33	0	10.3
Choteau	---	---	47	62.2	100	7/11	32	0	10.0
WB9590	43	64	46	62.3	100	7/12	29	0	10.7
MT1673	47	62	41	60.6	100	7/10	33	0	11.0
WB9303	---	---	40	63.4	100	7/7	32	0	10.1
Average	46	67	54	62	100	7/11	31	0	9.8
LSD ($\alpha=.05$)	8	10	9	0.6	1	3	2	0	
CV (%)	12.4	10.5	11.5	0.7	0.7	1	4.8	.	
Pr > F	<.0001	<0.0001	0.0001	<0.0001	0.4477	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

(W) = Hard White

Table 41. Hard Spring Wheat Yield Percentage of Location Averages, 2020.

Variety or Selection	(100% = Average)					Variety Average
	Aberdeen	Ashton	Idaho Falls	Rupert	Soda Springs	
Dayn (W)	117	120	124	110	111	116
IDO1804S (W)	103	116	114	123	113	114
IDO2004	109	105	106	113	108	108
AP Venom	112	---	111	97	---	107
Alum	109	100	112	100	112	106
IDO1904S	105	106	112	108	96	105
AP Renegade + base + root	116	92	99	105	114	105
SY-Teton (W)	103	101	104	105	111	105
09W821030-32	113	103	102	100	---	104
Jefferson	101	97	106	102	115	104
WB7202CLP (W)	99	98	105	101	114	103
WB7696 (W)	108	106	101	97	104	103
IDO2002	105	106	93	105	105	103
AP Renegade	111	99	108	103	92	103
WB9707	100	107	100	106	98	102
AP Renegade + base	96	99	103	104	109	102
SY Gunsight	106	93	99	109	---	102
Glee	102	101	97	103	106	102
CP3066	96	106	101	102	102	102
IDO1805S	103	96	99	105	105	101
MT1775	111	103	93	99	101	101
LAR17-0125	95	101	101	108	99	101
Dagmar	93	103	98	94	106	99
Net CL+	92	98	98	103	103	99
IDO1603S	101	105	94	101	91	98
WB9879CLP	98	96	105	102	89	98
DuClair	---	---	---	---	98	98
AP Octane	109	101	99	81	---	97
WB9668	93	98	100	98	93	96
WB7589 (W)	95	88	93	96	108	96
WB9590	106	100	96	90	85	95
MT1865	---	---	---	---	95	95
UI Platinum (W)	90	89	91	99	106	95
MT1716	102	102	92	84	94	95
BZ917-099	96	---	91	92	96	94
Espresso	82	103	88	93	102	94
IDO1701S	92	95	87	94	91	92
Klasic (W)	72	86	99	98	95	90
Lanning	81	93	92	85	95	89
WB7328 (W)	80	83	97	88	97	89
Choteau	---	---	---	---	87	87
WB9303	92	92	88	86	73	86
MT1673	---	---	---	---	76	76
Location Average (bu/A)	87	129	115	114	54	

(W) = Hard White

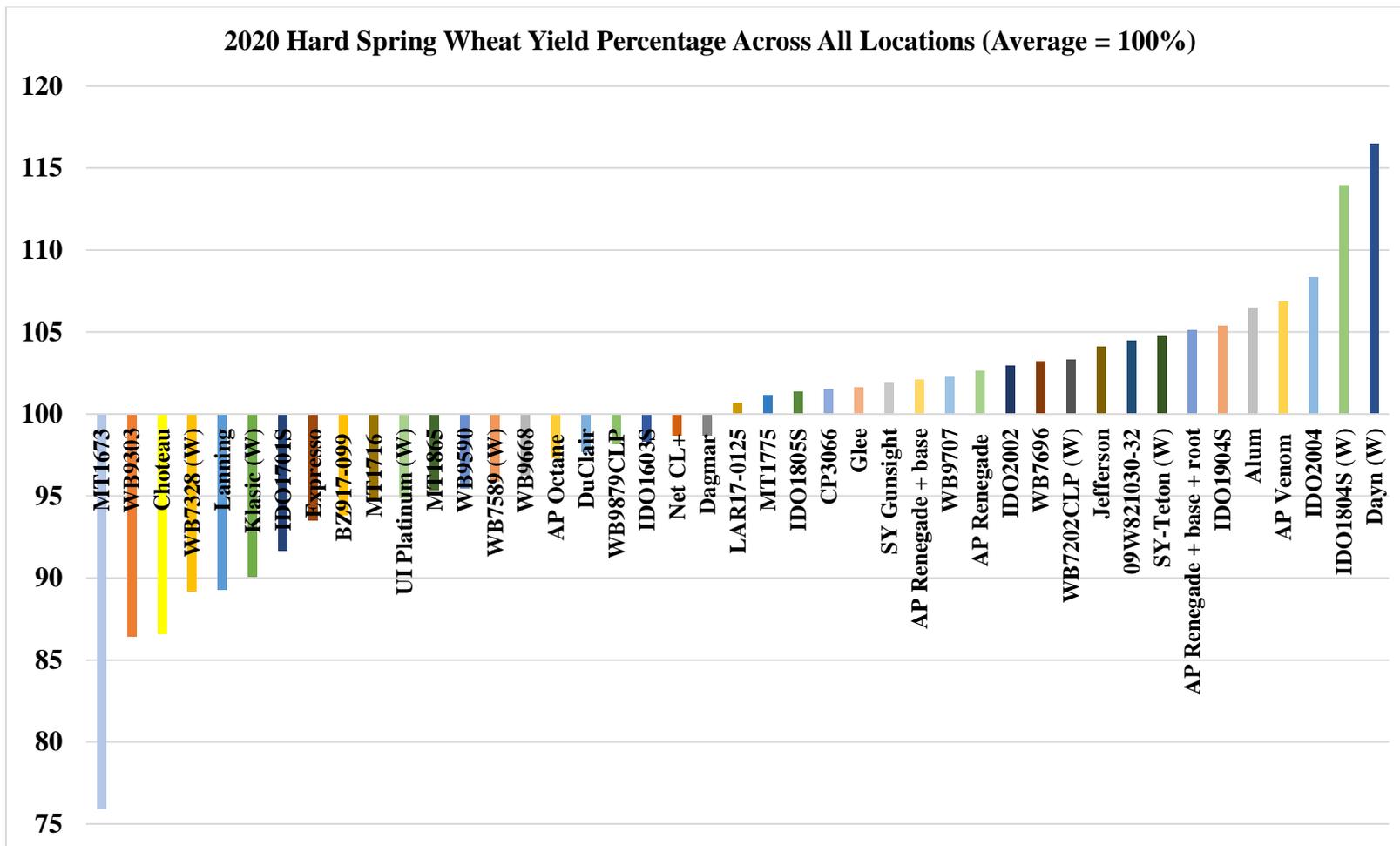


Chart 5. Hard spring wheat yield percentage across all locations.

(W) = white winter wheat

Table 42. Soft White Spring Wheat Irrigated Nurseries, 3 Year Averages (2018 - 2020; 12 site-years*).

Variety or Selection	Yield** (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
WB6430	124	60.9	100	6/19	33	0	10.0
UI Stone	119	60.9	99	6/19	36	1	10.1
UI Cookie	119	60.3	99	6/19	37	0	10.4
Seahawk	117	61.5	99	6/24	37	5	10.5
Alturas	117	60.9	99	6/22	36	0	9.9
Melba***	117	61.1	99	6/25	36	2	10.0
Tekoa	117	61.7	99	6/24	37	3	10.0
Ryan	116	60.7	99	6/18	35	4	10.2
UI Pettit	114	60.6	99	6/17	35	2	10.4
Louise	109	60.6	100	6/23	39	12	10.6
WB-1035CL+	103	61.4	100	6/18	34	0	11.3
Average	116	61.0	99	6/21	36	2	10.3
LSD ($\alpha = .05$)	10	0.5	1	4	1	5	0.6
CV (%)	21.2	2.1	3.1	6.1	8.6	443	7.1
Pr>F	0.0113	<0.0001	0.9887	0.0002	<0.0001	<0.0001	0.0002

* Spring stand and heading date are from 11 site-years.

** Varieties or selections in bold are not statistically different from the top yielding variety.

*** Club wheat variety.

Table 43. Soft White Spring Wheat Dryland Nurseries, 3-Year Averages (2018-2020; 3 site-years).

Variety or Selection	Yield* (bu/A)	Test Wt (lb/bu)	Spring Stand %	Heading Date	Height (in.)	Lodging (%)	Protein (%)
Tekoa	71	61.6	97	7/12	33	0	10.0
Melba**	70	59.4	97	7/13	31	0	9.7
Louise	66	59.8	96	7/11	32	0	10.4
Ryan	66	59.5	99	7/10	31	0	10.1
UI Stone	66	60.8	97	7/9	30	0	10.1
Seahawk	65	60.0	96	7/12	30	0	10.3
UI Pettit	65	60.4	97	7/7	29	0	10.3
WB-1035CL+	64	60.0	97	7/9	29	0	11.4
Alturas	64	59.8	96	7/11	30	0	9.9
WB6430	63	60.6	96	7/8	27	0	10.2
UI Cookie	60	59.2	95	7/10	31	0	11.0
Average	65	60.1	97	7/10	30	0	10.3
LSD ($\alpha = .05$)	11	1.3	5	4	2	0	1.5
CV (%)	20	3	6	3	9	.	8.3
Pr>F	1	0	1	0	0	.	0.0011

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Indicates club wheat variety.

Table 44. Irrigated Soft White Spring Wheat Data Combined from Aberdeen, Rupert, Idaho Falls and Ashton, 2020.

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
WB6430	131	60.5	100	6/21	34	0	8.9
IDO1902S	131	62.7	100	6/23	38	0	9.4
WA 8327	128	61.9	100	6/23	37	0	8.5
UI Stone	127	60.7	100	6/21	36	0	9.0
UI Pettit	126	60.9	100	6/19	33	0	9.4
UI Cookie	125	60.1	100	6/20	37	0	9.4
Tekoa	124	62.6	100	6/25	38	0	8.5
Seahawk	122	61.6	99	6/24	37	0	9.1
Melba**	122	61.0	100	6/25	35	0	8.7
Alturas	122	61.0	100	6/23	36	0	8.7
IDO1702S	121	61.9	100	6/20	35	0	9.2
IDO1404S	121	61.6	100	6/24	36	1	9.1
WA 8328	119	63.4	100	6/21	34	0	8.9
Louise	118	61.3	100	6/25	39	0	9.3
WA 8326	117	62.1	100	6/22	38	0	9.2
AP Coachman	117	59.2	100	6/25	39	0	8.9
Ryan	114	60.5	100	6/21	35	0	8.8
WB-1035CL+	112	61.5	100	6/20	35	0	9.9
Average	122	61.3	100	6/22	36	0.1	9.0
LSD ($\alpha = .05$)	9	0.5	1	12	2	1	0.8
CV (%)	8.9	1.3	0.6	8.5	6.2	118	6.6
Pr > F	0.0002	<0.0001	0.0632	0.9994	<.0001	0.4986	0.149

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Indicates club wheat variety.

Table 45. Agronomic Data for Soft White Spring Wheat at Rupert, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
UI Pettit	118	142	127	60.3	100	6/1	31	0	9.4
IDO1902S	---	---	126	62.4	100	6/5	36	0	9.4
WA 8327	---	---	123	61.6	100	6/6	34	0	9.0
UI Stone	125	138	122	60.4	100	6/3	36	0	9.3
UI Cookie	124	147	121	59.4	100	6/3	34	0	8.8
WB6430	126	150	121	60.2	100	6/2	32	0	8.9
IDO1702S	---	---	120	61.1	100	6/3	36	0	9.4
WA 8328	---	---	120	63.3	100	6/3	32	0	8.9
Tekoa	125	150	119	62.6	100	6/9	38	0	9.1
Seahawk	137	141	119	61.5	98	6/8	36	0	8.8
IDO1404S	137	150	117	61.6	100	6/8	36	0	8.6
Louise	124	127	115	60.9	100	6/8	38	0	8.8
Melba*	---	142	115	61.0	100	6/13	35	0	9.2
WA 8326	---	---	111	62.1	100	6/6	38	0	8.3
Alturas	115	142	110	60.7	99	6/7	35	0	9.2
AP Coachman	---	---	108	59.6	100	6/10	38	0	8.6
Ryan	133	121	108	59.3	100	6/2	32	0	9.6
WB-1035CL+	101	135	104	60.6	100	6/2	34	0	9.4
Average	123	140	117	61.0	100	6/5	35	0	9.0
LSD ($\alpha=.05$)	21	18	11	0.7	1	2	3	0	
CV (%)	12.3	8.8	6.8	0.8	0.9	0.69	5.3	.	
Pr > F	0.2083	0.078	0.0032	<0.0001	0.0283	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

**= Indicates club wheat variety.

Table 46. Agronomic Data for Soft White Spring Wheat at Aberdeen, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
IDO1902S	---	---	95	62.3	99	6/14	35	0	8.4
Louise	133	87	95	61.2	95	6/19	40	0	9.4
Seahawk	145	108	91	60.7	94	6/17	36	0	7.7
WA 8327	---	---	90	61.8	100	6/17	35	0	7.2
UI Pettit	126	71	89	60.5	89	6/12	31	0	9.3
Melba**	---	101	86	60.6	94	6/20	33	0	7.8
Alturas	132	80	85	60.4	95	6/17	33	0	7.7
IDO1404S	---	---	84	61.3	95	6/17	34	0	9.3
WA 8328	---	---	82	62.6	93	6/14	32	0	8.8
WB-1035CL+	122	76	81	61.3	98	6/13	32	0	9.2
IDO1702S	---	---	80	61.2	91	6/12	31	0	8.7
Tekoa	137	104	80	61.8	94	6/22	38	0	7.1
WB6430	154	103	80	60.2	96	6/13	31	0	8.1
Ryan	145	100	79	60.3	90	6/12	34	0	7.5
WA 8326	---	---	79	61.8	90	6/17	38	0	9.8
UI Cookie	139	106	79	59.8	91	6/14	34	0	9.0
AP Coachman	---	---	77	59.6	93	6/20	38	0	7.6
UI Stone	153	91	71	59.8	93	6/14	33	0	7.6
Average	138	96	83	60.9	94	6/16	34	0	8.3
LSD ($\alpha=.05$)	15	11	18	0.8	12	3	2	0	
CV (%)	7.6	7.9	15.1	0.9	8.7	1.3	4.9	.	
Pr > F	0.0005	<.0001	0.4289	<0.0001	0.9128	<0.0001	<0.0001	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

**= Indicates club wheat variety.

Table 47. Agronomic Data for Soft White Spring Wheat, Idaho Falls, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
WB6430	136	143	141	61.1	100	6/23	34	0	9.6
UI Stone	137	125	137	61.5	100	6/20	37	0	9.9
WA 8327	---	---	133	62.5	100	6/25	40	0	9.0
Seahawk	127	108	133	62.7	100	6/24	38	0	10.3
IDO1902S	---	---	132	62.9	100	6/23	40	0	9.8
UI Cookie	128	127	132	60.8	100	6/20	40	0	10.1
UI Pettit	131	117	129	61.5	100	6/18	34	0	9.4
Alturas	144	131	128	61.4	100	6/24	38	0	9.0
Melba**	136	133	124	61.1	100	6/25	36	0	8.5
IDO1404S	141	130	123	61.5	100	6/25	37	4	9.4
Tekoa	129	114	121	63.2	100	6/25	38	0	9.1
IDO1702S	---	---	121	62.4	100	6/20	36	0	9.1
Ryan	148	97	120	60.8	100	6/22	37	0	9.0
WA 8328	---	---	119	64.3	100	6/24	34	0	9.1
Louise	119	102	119	61.6	100	6/25	40	1	9.6
WA 8326	---	---	116	62.3	100	6/21	40	0	9.4
WB-1035CL+	115	109	115	62.0	100	6/21	36	0	10.6
AP Coachman	---	---	114	59.5	100	6/26	41	1	9.4
Average	132	120	125	61.8	100	6/23	37	0.3	9.5
LSD ($\alpha=.05$)	12	18	13	0.8	0	3	2	3	
CV (%)	6.1	10.3	7.4	0.9	0	1	3.8	684	
Pr > F	<.0001	0.0001	0.0017	<0.0001	.	<0.0001	<0.0001	0.5142	

* Varieties or selections in bold are not statistically different from the top yielding variety.

**= Indicates club wheat variety.

Table 48. Agronomic Data for Soft White Spring Wheat at Ashton, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
WB6430	102	84	147	60.7	100	7/8	37	0	9.1
AP Coachman	---	---	138	58.3	100	7/10	38	0	9.9
Melba**	102	75	138	61.2	100	7/10	35	0	9.3
IDO1902S	---	---	136	63.1	100	7/10	38	0	10.0
WA 8327	---	---	135	---	100	7/9	38	0	8.9
UI Cookie	97	81	132	60.4	100	7/8	38	0	9.6
IDO1404S	105	74	132	61.9	100	7/11	36	0	9.0
Tekoa	98	79	131	62.7	100	7/11	37	0	8.6
Louise	93	72	130	61.4	100	7/12	40	0	9.4
UI Pettit	88	74	129	61.5	100	7/8	35	0	9.7
WA 8328	---	---	129	63.6	100	7/8	35	0	8.9
UI Stone	90	94	129	61.1	100	7/10	35	0	9.3
Alturas	115	71	128	61.7	100	7/10	36	0	8.8
WA 8326	---	---	124	62.2	100	7/10	37	0	9.4
IDO1702S	---	---	122	62.8	100	7/8	34	0	9.4
WB-1035CL+	93	80	116	62.3	100	7/7	34	0	10.3
Seahawk	103	81	116	61.5	100	7/11	36	0	9.4
Ryan	103	79	114	61.5	100	7/8	35	0	9.0
Average	99	79	129	61.6	100	7/9	36	0	9.3
LSD ($\alpha=.05$)	20	15	15	0.8	0	3	3	0	
CV (%)	14.0	13.1	7.7	0.9	0	1.1	6.2	.	
Pr > F	0.6321	0.194	0.002	<0.0001	.	0.0668	0.0368	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

**= Indicates club wheat variety.

Table 49. Agronomic Data for Soft White Spring Wheat at Soda Springs, Dryland, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)
	2018	2019	2020*						
WB-1035CL+	51	75	77	61.4	100	7/12	32	0	8.6
Melba**	66	86	70	57.7	100	7/15	34	0	8.2
IDO1404S	53	81	69	59.9	100	7/13	33	0	8.5
Ryan	50	85	69	60.7	100	7/14	33	0	8.3
IDO1702S	---	---	67	60.0	100	7/14	32	0	9.1
AP Coachman	---	90	67	60.4	100	7/14	34	0	9.1
UI Cookie	53	83	66	60.0	99	7/15	32	0	9.3
UI Stone	60	83	65	62.3	100	7/11	31	0	8.9
IDO1902S	---	---	64	61.3	100	7/11	30	0	8.7
Tekoa	74	89	60	61.0	100	7/13	35	0	8.4
WA8328	---	---	59	60.7	100	7/14	31	0	8.0
UI Pettit	55	74	58	61.0	100	7/10	30	0	8.9
Louise	58	79	58	60.4	100	7/11	31	0	8.7
Alturas	61	80	57	60.1	100	7/13	31	0	9.1
WB6430	58	84	56	61.2	100	7/11	30	0	8.5
Seahawk	56	87	54	59.1	99	7/14	32	0	8.7
WA8326	---	---	53	61.7	100	7/10	33	0	8.0
WA8327	---	---	52	60.5	100	7/13	32	0	8.2
Average	58	83	62	60.5	100	7/13	32	0	8.6
LSD ($\alpha=0.05$)	10	13	11	1.7	1	3	3	0	
CV (%)	12.5	10.1	10.5	2.0	0.9	1.00	7.4	.	
Pr > F	0	0	0.0003	0.0016	0.5787	0.0007	0.1069	.	

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Indicates club wheat variety.

Table 50. Soft White Spring Wheat Yield Percentage of Location Averages, 2020.

(100% = Average)						
Variety or Selection	Aberdeen	Ashton	Idaho Falls	Rupert	Soda Springs	Variety Average
IDO1902S	115	105	105	108	103	107
Melba*	104	107	99	98	113	104
WB6430	96	114	113	103	90	103
UI Cookie	95	102	105	103	106	102
IDO1404S	101	102	98	100	110	102
UI Pettit	107	100	103	108	94	102
WA 8327	108	105	106	105	84	102
UI Stone	86	100	109	104	105	101
Louise	114	100	95	98	93	100
IDO1702S	97	95	97	103	108	100
Seahawk	110	90	106	101	87	99
Tekoa	97	101	97	102	96	99
WB-1035CL+	97	90	92	89	125	99
WA 8328	98	100	95	102	95	98
AP Coachman	92	107	91	93	107	98
Alturas	102	99	103	94	92	98
Ryan	95	89	96	92	110	96
WA 8326	95	96	92	95	85	93
Location Average (bu/A)	83	129	125	117	62	

* Indicates club wheat variety.

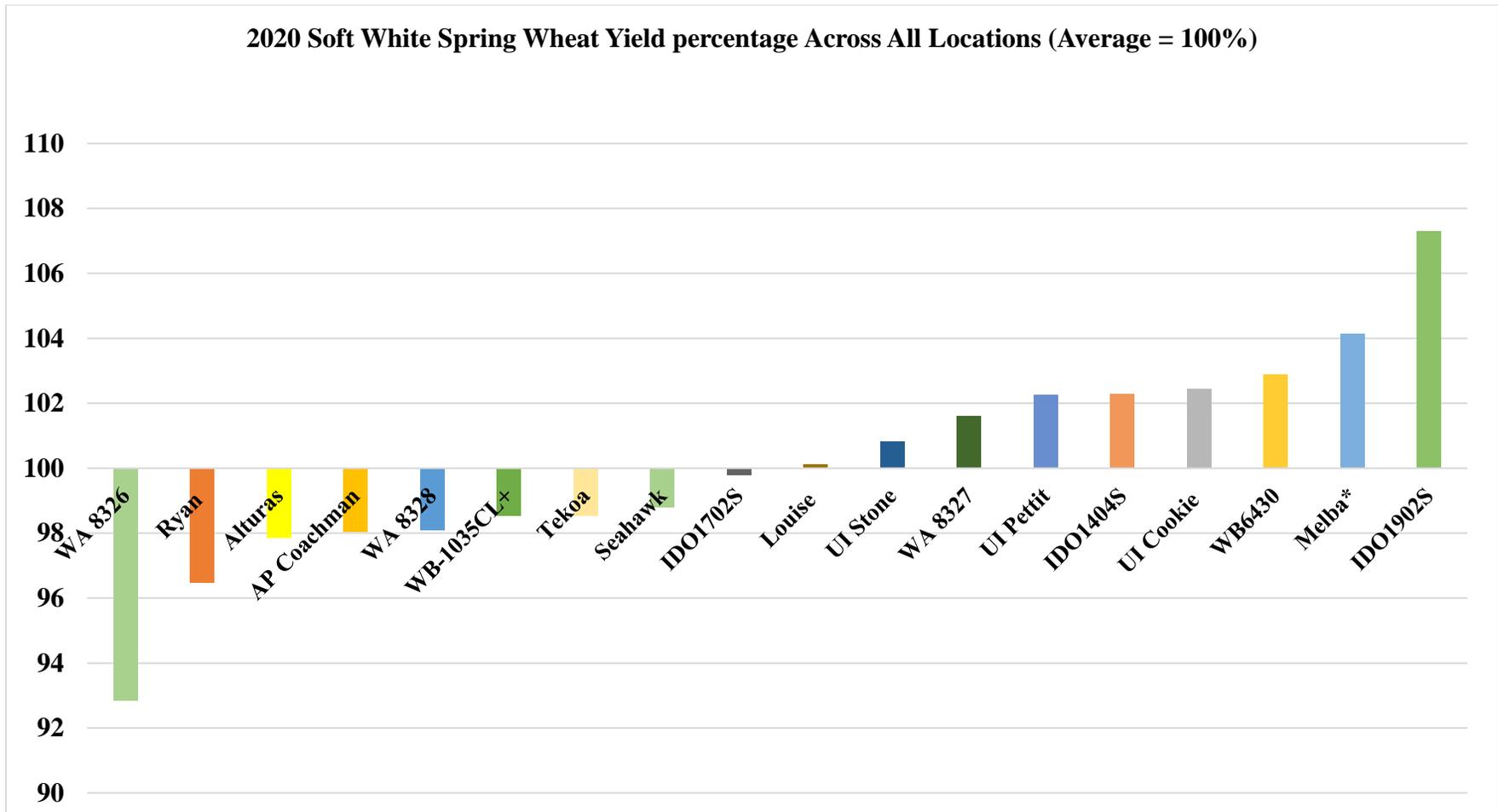


Chart 6. Soft white spring wheat yield percentage across all locations.

* Club wheat

Table 51. Spring Malt Barley Irrigated Nurseries, 3-Year Averages (2018-2020; 12 site-years).

Variety or Selection	Yield* (bu/A)	Test Wt (lb/bu)	Spring Stand %	Heading Date	Height (in.)	Lodging (%)	Protein (%)	(>6/64	Plump (>5.5/64	% Thin
LCS Odyssey	140	50.3	100	6/23	30	14	11.2	90.2	6.1	3.7
Explorer	136	51.9	100	6/22	29	9	11.1	90.6	5.4	4.0
ABI Voyager	135	53.2	99	6/20	38	17	10.8	96.0	2.4	1.6
ABI Eagle	128	52.5	100	6/21	34	12	11.3	89.0	6.7	4.3
GemCraft	126	51.4	100	6/20	36	29	10.8	88.1	7.4	4.5
ACC Synergy	124	52.3	100	6/20	37	22	11.1	92.4	4.3	3.3
Conrad	122	52.8	100	6/21	35	23	11.0	93.9	4.1	2.0
CDC Copeland	121	52.5	100	6/22	40	26	11.2	90.1	5.8	4.1
AAC Connect	119	51.9	100	6/24	37	18	11.3	92.5	4.7	2.8
Merit 57	113	50.2	99	6/22	37	18	11.3	83.5	9.4	7.1
Average	126	51.9	100	6/24	35	19	11.1	90.6	5.6	3.7
LSD ($\alpha = .05$)	10	0.8	1	5	2	12	0.3	4.9	3.2	2.8
CV (%)	19.3	3.9	1.2	4.7	11.3	153	2.7	6.0	57.9	69.3
Pr>F	<0.0001	0.0004	0.2059	0.9036	<.0001	0.0261	<0.0001	<0.0001	<0.0001	<0.0001

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 52. Irrigated Spring Malt Barley Data Combined from Rupert, Idaho Falls, Ashton, and Aberdeen, 2020.

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	(>6/64)	Plump (>5.5/64)	% Thin
KWS Chrissie	166	52.5	100	6/23	30	0	10.6	94.8	3.2	1.9
KWS Fantex	166	52.4	100	6/25	31	1	10.9	95.3	3.2	1.9
LG Diablo	162	50.9	100	6/27	33	0	10.7	95.4	3.4	1.7
KWS Jessie	162	52.1	100	6/22	29	0	10.9	96.6	2.5	1.6
KWS Amadora	161	53.4	100	6/22	31	0	10.9	97.2	2.5	1.2
BC Leandra	161	52.4	100	6/26	31	0	10.5	97.2	2.0	1.0
LCS Odyssey	161	52.7	100	6/25	31	0	10.9	96.0	3.0	1.4
LCS Opera	160	51.4	100	6/27	30	0	10.6	93.3	4.8	2.3
BC Ellinor	160	50.9	100	6/26	32	0	10.9	94.8	3.8	1.6
Esma**	159	53.6	100	6/25	32	0	10.5	97.1	2.1	1.4
Brunilda***	158	52.7	100	6/14	30	0	10.5	97.1	2.0	1.5
10ARS191-3	151	54.1	100	6/24	38	0	10.5	95.0	3.9	1.3
Moravian 179****	150	53.4	100	6/21	31	3	10.7	97.2	2.0	1.4
2IM14-8212	147	52.6	100	6/21	35	1	10.7	95.9	2.0	1.5
GemCraft	146	52.6	100	6/23	34	9	10.4	93.8	4.3	2.5
Explorer	145	53.3	100	6/25	30	0	10.8	97.5	1.8	1.3
ABI Eagle	143	53.0	100	6/24	34	2	10.5	96.2	1.5	0.8
2IM15-9386	142	53.3	100	6/22	35	1	10.5	95.6	2.5	1.6
Merit 57	142	51.8	100	6/25	37	2	10.8	90.2	6.3	3.9
2IM15-9456	141	53.5	100	6/22	35	1	10.7	95.1	3.0	1.6
11ARS183-9	140	52.6	100	6/24	39	3	10.9	95.6	2.9	1.8
ABI Voyager	138	53.4	100	6/22	38	2	10.9	96.2	1.5	1.0
AC Metcalfe*****	135	53.5	100	6/22	39	0	10.7	96.4	2.5	1.3
Moravian 69*****	135	52.3	100	6/21	33	0	10.6	93.1	5.1	2.5
11ARS162-4	134	51.9	100	6/24	40	2	10.5	95.6	3.1	1.5
AAC Synergy	133	53.1	100	6/23	37	0	10.9	92.2	4.4	2.4
Conrad	132	53.5	100	6/24	36	8	10.7	98.1	1.8	0.8
CDC Copeland	130	53.5	100	6/26	42	5	10.8	98.0	1.7	0.9
Moravian 180*****	130	52.4	100	6/15	29	4	11.3	95.4	2.7	2.5
DH120285	126	52.8	100	6/25	30	3	10.6	95.8	2.8	1.2
AAC Connect*****	118	52.9	100	6/24	38	1	10.9	94.3	3.0	1.2
Lightning	109	52.8	100	6/23	36	3	11.1	96.1	2.0	1.5
Average	145	52.7	100	6/23	34	2	10.7	95.5	2.9	1.6
LSD ($\alpha = .05$)	12	0.7	0	10	3	6	0.3	3.0	1.7	1.1
CV (%)	11.1	1.6	.	7.7	10.2	506	1.8	2.1	39.9	45.7
Pr > F	<.0001	<.0001	.	0.9916	<.0001	0.158	<0.0001	0.0002	<.0001	<0.0001

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Only in two locations (Aberdeen and Idaho Falls).

*** Only two locations (Aberdeen and Rupert)

**** Only in three locations ((Aberdeen, Rupert and Idaho Falls

***** Only in three locations (Aberdeen, Rupert and Ashton)

***** Only in three locations (Aberdeen, Rupert and Idaho Falls)

Table 53. Agronomic Data for Two-rowed Spring Malt Barley at Rupert, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		
	2018	2019	2020*							(>6/64)	(>5.5/64)	% Thin
LG Diablo	---	---	180	52.6	100	6/11	30	0	10.7	97.3	1.7	1.0
LCS Opera	---	---	178	52.4	100	6/10	29	0	10.2	96.7	2.2	1.2
KWS Jessie	---	---	173	52.4	100	6/3	26	0	11.1	98.1	1.3	0.6
BC Leandra	---	---	172	53.2	100	6/7	28	0	9.9	98.1	1.4	0.5
KWS Amadora	---	---	170	53.6	100	6/3	28	0	10.9	98.0	1.5	0.5
LCS Odyssey	156	164	168	53.2	100	6/8	29	0	10.6	98.0	1.0	1.0
KWS Chrissie	---	---	167	52.6	100	6/3	29	0	10.6	97.0	2.0	1.0
Merit 57	130	115	163	52.7	100	6/7	35	0	10.4	91.8	5.4	2.8
BC Ellinor	---	---	162	52.3	100	6/7	29	0	10.8	97.5	2.0	0.5
GemCraft	149	135	162	52.5	100	6/6	31	0	10.1	94.0	3.7	2.3
KWS Fantex	---	---	161	53.0	100	6/7	28	0	10.8	95.5	2.6	1.9
11ARS162-4	---	---	161	52.3	100	6/5	37	0	10.4	97.7	1.6	0.7
Explorer	153	159	160	53.6	100	6/5	29	0	10.7	97.4	1.5	1.1
CDC Copeland	138	123	160	53.7	100	6/7	39	0	10.4	98.2	1.3	0.5
10ARS191-3	---	165	160	54.2	100	6/6	38	0	10.3	97.3	2.2	0.5
Moravian 179	147	169	159	53.5	100	6/10	30	0	10.6	98.0	1.0	1.0
2IM14-8212	---	153	158	52.9	100	6/3	30	0	10.8	97.0	2.0	1.0
Brunilda	---	---	156	53.4	100	6/6	28	0	10.4	97.5	1.3	1.2
11ARS183-9	---	---	151	52.9	100	6/4	37	0	10.8	97.6	1.6	0.8
2IM15-9386	---	---	149	53.6	100	6/2	32	0	10.1	97.3	1.6	1.1
ABI Voyager	151	140	146	53.4	100	6/3	36	0	10.3	98.2	1.3	0.5
2IM15-9456	---	---	146	53.3	100	6/3	32	0	10.5	95.4	3.3	1.3
ABI Eagle	147	142	145	53.0	100	6/6	31	0	10.9	94.2	4.5	1.3
Conrad	147	132	145	53.6	100	6/6	33	0	10.6	99.0	0.7	0.3
Moravian 69	159	149	142	52.7	100	6/9	33	0	10.5	97.1	2.3	0.6
AAC Synergy	144	145	142	52.4	100	6/6	35	0	11.0	98.0	1.3	0.7
AC Metcalfe	129	135	137	53.1	100	6/6	37	0	10.5	97.1	2.1	0.8
Moravian 180	---	---	135	52.6	100	6/2	28	0	11.3	94.4	3.0	2.6
AAC Connect	160	150	128	52.1	100	6/5	37	0	10.8	96.8	2.3	0.9
DH120285	134	136	125	53.3	100	6/7	25	0	10.5	97.3	2.0	0.7
Lightning	---	---	114	52.7	100	6/5	33	0	11.2	96.5	2.3	1.2
Average	148	144	154	53.0	100	6/6	32	0	10.6	97	2.1	1.0
LSD ($\alpha=.05$)	18	19	15	0.8	0	2	3	0				
CV (%)	8.4	9.4	6.7	1.1	.	0.82	6.9	.				
Pr > F	0.0004	<.0001	<0.0001	<0.0001	.	<0.0001	<0.0001	.				

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 54. Agronomic Data for Two-row Spring Malt Barley, Aberdeen, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		
	2018	2019	2020*							(>6/64)	(>5.5/64)	% Thin
AAC Synergy	131	103	170	53.1	100	6/23	28	0	11.1	96.9	1.8	1.2
Lightning	---	---	167	52.8	100	6/23	32	0	11.0	95.8	1	0.9
Brunilda	---	---	166	52.1	100	6/15	34	0	10.5	96.2	2.7	1.7
CDC Copeland	126	97	164	53.2	100	6/23	30	0	10.6	98	1.5	1.1
Conrad	118	113	162	53.0	100	6/15	32	0	10.8	99	1.3	0.6
AAC Connect	136	100	160	52.7	100	6/23	34	0	10.8	94.7	3.4	1.4
ABI Eagle	118	108	159	52.7	100	6/23	31	0	11.2	94.4	3.7	1.9
DH120285	140	112	157	52.4	100	6/23	28	0	10.8	95.7	1.4	0.9
Esma	174	131	156	53.2	100	6/24	30	0	10.4	97.7	2	1.1
Explorer	154	119	156	52.4	100	6/24	33	0	10.9	97.5	1.6	1.5
Accordine	---	---	153	52.8	100	6/22	32	0	10.7	94.5	3.6	1.6
GemCraft	---	---	150	52.6	99	6/20	39	0	10.2	96.9	2.8	1.2
BC Ellinor	---	---	150	50.5	100	6/22	33	0	11.1	94	3.9	2.1
2IM15-9456	---	---	147	53.1	100	6/21	33	0	10.9	93.3	2.7	1.5
Moravian 179	---	---	146	53.0	100	6/15	38	0	10.9	96.9	2.1	1.3
LCS Opera	---	---	146	51.2	100	6/15	38	0	10.9	94	4.2	2.1
Merit 57	117	98	145	51.8	99	6/15	38	0	11.0	92.8	4.4	2.8
BC Leandra	---	---	144	51.0	100	6/18	34	4	10.7	97.4	1.9	1.1
KWS Amadora	---	---	143	52.9	100	6/22	31	8	10.6	97.2	2.4	1.6
11ARS183-9	---	---	142	52.5	100	6/21	34	0	10.9	95.4	3.2	2.1
AC Metcalfe	122	101	137	53.6	100	6/16	38	18	11.0	94.9	2.9	2.2
2IM15-9386	---	---	137	52.7	99	6/19	41	0	10.9	93.9	2.1	1.6
11ARS162-4	---	---	136	51.9	100	6/15	37	0	10.4	96.6	2.8	1.3
LCS Odyssey	136	132	136	52.4	100	6/19	42	0	11.0	95.8	3	1.7
2IM14-8212	---	128	134	52.3	100	6/15	39	0	10.8	94.7	1.4	1.5
KWS Jessie	---	---	133	52.0	100	6/21	39	0	11.0	96.6	2.3	1.6
KWS Fantex	---	---	132	51.6	100	6/24	31	0	11.0	95.4	3	2.2
KWS Chrissie	---	---	131	51.5	100	6/16	28	0	10.7	94.9	3.3	2.7
Moravian 180	---	---	126	51.8	100	6/22	30	0	11.5	96.6	1.7	2.2
LG Diablo	---	---	125	50.5	100	6/21	41	0	10.7	95	2.7	2.3
Moravian 69	139	112	123	52.1	100	6/20	37	0	10.6	93.9	4.5	2.2
ABI Voyager	134	114	122	53.0	100	6/22	44	1	10.7	96.6	2.1	0.9
10ARS191-3	---	137	118	53.8	100	6/21	37	0	10.8	95.1	3.9	1.4
Average	138	114	145	52.4	100	6/20	35	1	10.8	95.7	2.6	1.6
LSD ($\alpha=.05$)	22	15	20	1.0	1	3	4	9				
CV %	11.4	9	9.7	1.4	0.5	1.1	8.4	728				
Pr > F	<.0001	<.0001	<0.0001	<0.0001	0.5306	<0.0001	<0.0001	0.4808				

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 55. Agronomic Data for Two-row Spring Malt Barley at Idaho Falls, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		% Thin
	2018	2019	2020*							(>6/64)	(>5.5/64)	
KWS Jessie	---	---	172	51.8	100	6/28	31	0	10.6	93.6	4.3	2.8
KWS Chrissie	---	---	167	52.9	100	6/30	32	0	10.5	89.1	6.1	2.9
LCS Opera	---	---	167	51.2	100	6/30	34	0	10.7	88.1	8.4	4
BC Leandra	---	---	166	52.5	100	6/30	32	0	10.9	94.9	3.7	1.6
KWS Amadora	---	---	163	54.4	100	6/27	33	0	11.2	95.8	3.1	1.5
KWS Fantex	---	---	161	52.5	100	6/29	33	5	10.8	93.8	4.8	1.9
BC Ellinor	---	---	158	50.1	100	6/30	33	0	10.9	90.9	7	2.4
LCS Odyssey			156	52.6	100	6/29	32	0	11.0	92.1	6.4	2.1
LG Diablo	---	---	156	50.6	100	6/30	35	0	10.7	91	7	2.3
Esma	---	---	152	54.0	100	6/28	32	0	10.5	96.5	2.2	1.7
10ARS191-3	---	129	150	54.3	100	6/29	38	0	10.5	90.5	7.5	2.3
Moravian 179	153	112	150	53.7	100	6/30	31	0	10.7	96.5	2.4	1.8
Explorer	138	114	145	53.8	100	6/28	29	0	10.9	97.5	2.1	1.1
ABI Voyager	153	126	141	54.3	100	6/27	37	8	10.2	98.3	1.2	0.8
2IM15-9386	---	---	140	53.1	100	6/28	36	3	10.6	93.6	4.6	2.6
11ARS183-9	---	---	138	52.7	100	6/30	38	8	11.2	93.6	4.3	3.1
ABI Eagle	146	117	137	53.0	100	6/30	37	6	10.6	88.9	6.6	5.3
2IM14-8212	---	126	137	52.3	100	6/27	37	3	10.5	94.2	3.7	2.7
Merit 57	148	130	136	52.0	100	6/30	37	0	11.0	87.7	8.2	4.7
AAC Synergy	130	106	136	53.5	100	6/28	38	0	10.8	97.8	1.4	0.9
2IM15-9456	---	---	134	53.8	100	6/29	35	3	10.9	94.7	4	2.2
GemCraft	125	82	134	52.9	100	6/26	35	30	10.9	88.7	7.1	4.7
Moravian 180	---	---	134	52.7	100	6/28	31	13	11.1	95.1	3.1	2.6
AAC Connect	---	103	132	53.7	100	6/27	37	4	10.8	94.6	4.3	1.2
Moravian 69	123	105	131	52.2	100	6/29	35	0	10.8	88.2	8.2	4.6
DH120285	---	92	130	52.3	100	6/28	33	10	10.5	92.5	6	2.4
Conrad	119	104	130	53.5	100	6/29	35	14	10.9	95	4	1.7
11ARS162-4	---	---	127	51.6	100	6/29	41	6	10.6	93.5	4.6	2.5
CDC Copeland	120	96	122	54.3	100	6/29	42	18	11.1	97.9	1.8	0.8
Lightning	---	---	103	52.6	100	6/28	36	13	11.2	94	3.6	3.2
Average	136	108	143	52.8	100	6/29	35	5	10.8	93.3	4.7	2.5
LSD (0.05)	18.3	19.1	14	1.3	0	1.4	5.2	18				
CV (%)	9.5	11.5	7.5	1.8	0	3.5	10.6	273				
Pr > F	<.0001	<.0001	<.0001	<.0001	.	0.712	0.0002	0.2724				

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 56. Agronomic Data for Two-row Spring Malt Barley at Ashton, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		
	2018	2019	2020*							(>6/64)	(>5.5/64)	% Thin
KWS Fantex	---	---	179	52.5	100	7/13	30	0	10.8	96.9	2.3	1.4
KWS Chrissie	---	---	165	53.0	100	7/13	30	0	10.8	97.7	1.4	0.8
10ARS191-3	---	99	163	54.4	100	7/12	36	0	10.6	97	2	1
BC Ellinor	---	---	161	50.7	100	7/13	33	0	10.8	96.6	2.2	1.1
LG Diablo	---	---	158	49.9	100	7/13	35	0	10.8	98	1.9	1.2
BC Leandra	---	---	157	53.0	100	7/12	35	0	10.6	98.3	1	0.7
LCS Odyssey	118	105	155	52.6	100	7/13	30	0	10.9	98	1.4	0.7
ABI Eagle	102	107	148	53.5	100	7/11	36	0	10.9	91.4	2.3	0.9
KWS Amadora	---	---	147	52.7	100	7/12	28	0	11.0	97.3	2.4	0.9
KWS Jessie	---	---	147	52.4	100	7/13	29	0	11.0	97.9	1.6	1.1
2IM14-8212	---	85	146	52.9	100	7/11	36	0	10.5	97.7	0.9	0.8
GemCraft	103	107	145	52.4	100	7/13	37	1	10.4	95.5	3.3	1.7
LCS Opera	---	---	140	50.7	100	7/14	28	0	10.4	94.2	4.2	1.7
2IM15-9456	---	---	139	53.8	100	7/11	34	0	10.6	96.8	2.1	1.2
2IM15-9386	---	---	136	53.8	100	7/11	35	0	10.4	97.5	1.3	1.2
11ARS183-9	---	---	135	52.2	100	7/12	39	5	10.8	95.7	2.6	1.1
AAC Synergy	89	77	133	53.7	100	7/12	38	0	10.8	91.7	1.4	1
ABI Voyager	101	102	132	53.0	100	7/11	39	0	10.8	91.8	1.4	1
AC Metcalfe	86	91	132	53.7	100	7/10	40	0	10.7	97	2.1	0.9
Merit 57	88	96	131	50.6	100	7/13	38	6	10.8	88.4	7.1	5.3
Explorer	98	83	125	53.3	100	7/13	32	0	10.8	97.4	1.8	1.3
CDC Copeland	99	97	125	52.9	100	7/11	42	0	10.9	97.3	1.9	1
Conrad	103	104	124	53.8	100	7/13	39	0	10.4	98.9	1.2	0.6
11ARS162-4	---	---	122	51.7	100	7/12	40	0	10.5	94.4	3.1	1.4
DH120285	---	93	121	53.2	100	7/12	30	0	10.5	97.4	1.9	0.6
AAC Connect	91	99	113	53.1	100	7/12	39	0	11.0	90.9	1.8	1.2
Lightning	---	---	110	53.3	100	7/12	37	0	11.2	98.2	1	0.8
Average	101	96	140	52.7	100	7/12	35	0.4	10.7	95.9	2.1	1.2
LSD ($\alpha=0.05$)	15	15	17	1.0	0	2	5	4				
CV (%)	10.8	10.4	8.5	1.4	0	0.6	10.9	713				
Pr > F	<.0001	<.0001	<0.0001	<0.0001	.	0.0013	<0.0001	0.5473				

* Varieties or selections in bold are not statistically different from the top yielding variety.

Table 57. Agronomic Data for Two-row Spring Malt Barley at Soda Springs, Dryland, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		
	2018	2019	2020*							(>6/64)	(>5.5/64)	% Thin
10ARS191-3	---	125	55	52.8	100	7/14	29	0	10.2	86.0	12.2	1.9
LCS Opera	---	---	53	51.9	100	7/16	22	0	10.5	96.2	3.1	0.6
KWS Fantex	---	---	52	51.5	100	7/16	20	0	10.4	94.0	4.2	1.4
LCS Odyssey	---	108	52	51.6	100	7/17	25	0	10.8	96.4	3.0	1.1
BC Leandra	---	---	51	50.3	100	7/18	20	0	10.5	98.2	1.1	0.4
Moravian 69	52**	122**	51	50.8	100	7/17	23	0	10.4	94.9	4.1	1.2
KWS Chrissie	---	---	50	52.2	100	7/15	23	0	10.5	95.3	3.3	0.9
2IM15-9456	---	---	49	52.7	100	7/12	29	0	10.6	94.7	2.6	1.0
Accordine	---	---	49	51.5	100	7/15	23	0	10.3	85.5	10.9	3.0
Brunilda	---	---	49	51.1	100	7/16	23	0	10.4	93.7	4.9	1.3
BC Ellinor	---	---	48	50.1	100	7/15	25	0	10.5	91.6	5.9	1.9
ABI Eagle	68	114	48	51.4	100	7/15	27	0	11.1	90.3	6.9	1.9
KWS Amadora	---	---	48	52.5	100	7/14	20	0	10.6	93.9	4.4	1.2
Merit 57	59	107	48	50.8	100	7/15	28	0	11.0	93.9	4.8	1.5
KWS Jessie	---	---	47	51.8	100	7/14	20	0	10.5	96.9	2.3	0.8
11ARS183-9	---	---	46	52.6	100	7/14	32	0	10.8	98.7	1.2	0.6
CDC Copeland	---	113	46	51.8	100	7/16	31	0	10.6	97.3	1.7	0.7
GemCraft	63	117	46	51.4	100	7/14	27	0	10.2	91.7	6.8	1.3
11ARS162-4	---	---	45	50.7	100	7/14	30	0	10.6	95.1	3.6	1.2
Moravian 179	46**	89**	45	51.6	100	7/18	23	0	10.8	96.1	2.6	1.1
LG Diablo	---	---	45	50.3	100	7/20	25	0	10.5	95.7	2.8	1.5
2IM14-8212	---	109	43	50.9	100	7/13	27	0	10.6	98.7	1.5	0.8
Explorer	66**	80**	43	52.5	100	7/15	21	0	10.4	98.9	1.4	0.4
2IM15-9386	---	---	42	52.2	100	7/12	27	0	10.2	96.6	3.0	1.0
Conrad	---	95	40	52.8	100	7/15	30	0	10.5	97.6	1.9	0.6
AC Metcalfe	---	100	38	52.7	100	7/14	30	0	10.8	94.9	3.2	1.0
ABI Voyager	73	101	38	52.2	100	7/13	29	0	10.4	96.8	2.0	0.6
DH120285	---	57**	38	53.0	100	7/18	21	0	10.5	93.1	1.3	0.3
AAC Connect	61	110	37	52.0	100	7/13	27	0	11.0	94.7	3.9	0.8
AAC Synergy	---	101	37	51.6	100	7/14	28	0	10.7	96.4	2.1	0.8
Moravian 180	---	---	37	52.0	100	7/8	21	0	11.0	95.5	2.9	2.2
Lightning	---	---	27	53.6	100	7/14	24	0	11.0	98.2	0.7	0.4
AVERAGE	65	108	45	51.8	100	7/15	25	0	10.6	94.9	3.6	1.1
LSD	10	13	7	0.9	0	1	3	0				
CV	10.8	8	10.7	1.2	0	0.5	8.5	.				
P>F	0.0074	0.0002	<0.0001	<0.0001	.	<0.0001	<0.0001	.				

* Varieties or selections in bold are not statistically different from the top yielding variety.

** 1-rep demonstration plots

Table 58. 2-Row Spring Malt Barley Yield Percentage of Location Averages, 2020.

Variety or Selection	(100% = Average)					Variety Average
	Aberdeen	Rupert	Idaho Falls	Ashton	Soda Springs	
BC Leandra	99	112	116	112	113	110
KWS Fantex	91	105	113	128	115	110
LCS Opera	100	116	116	100	118	110
KWS Chrissie	91	108	116	118	111	109
Brunilda	115	101	---	---	108	108
BC Ellinor	104	105	110	115	106	108
LCS Odyssey	93	109	109	110	114	107
Esma	108	---	106	---	---	107
Accordine	105	---	---	---	109	107
KWS Amadora	99	110	114	105	106	107
KWS Jessie	92	112	120	105	104	107
10ARS191-3	82	104	105	116	123	106
LCS Diabolo	86	117	109	113	100	105
ABI Eagle	110	94	96	106	106	102
Moravian 179	101	103	105	---	101	102
GemCraft	104	105	94	103	101	101
Merit 57	100	106	95	94	106	100
2IM15-9456	102	95	94	99	109	100
Explorer	107	104	101	89	95	99
CDC Copeland	113	104	85	89	101	99
11ARS183-9	98	98	97	96	102	98
2IM14-8212	92	102	96	104	95	98
AAC Synergy	117	92	95	95	82	96
2IM15-9386	94	97	98	97	93	96
Moravian 69	85	92	92	---	112	95
11ARS162-4	94	104	89	87	101	95
Conrad	111	94	91	88	89	95
ABI Voyager	84	95	98	94	83	91
AC Metcalfe	95	89	---	94	84	90
DH120285	108	81	91	87	83	90
AAC Connect	110	83	92	81	82	90
Moravian 180	87	88	94	---	81	87
Lightning	115	74	72	78	61	80
Location Average (bu/A)	145	154	143	140	45	

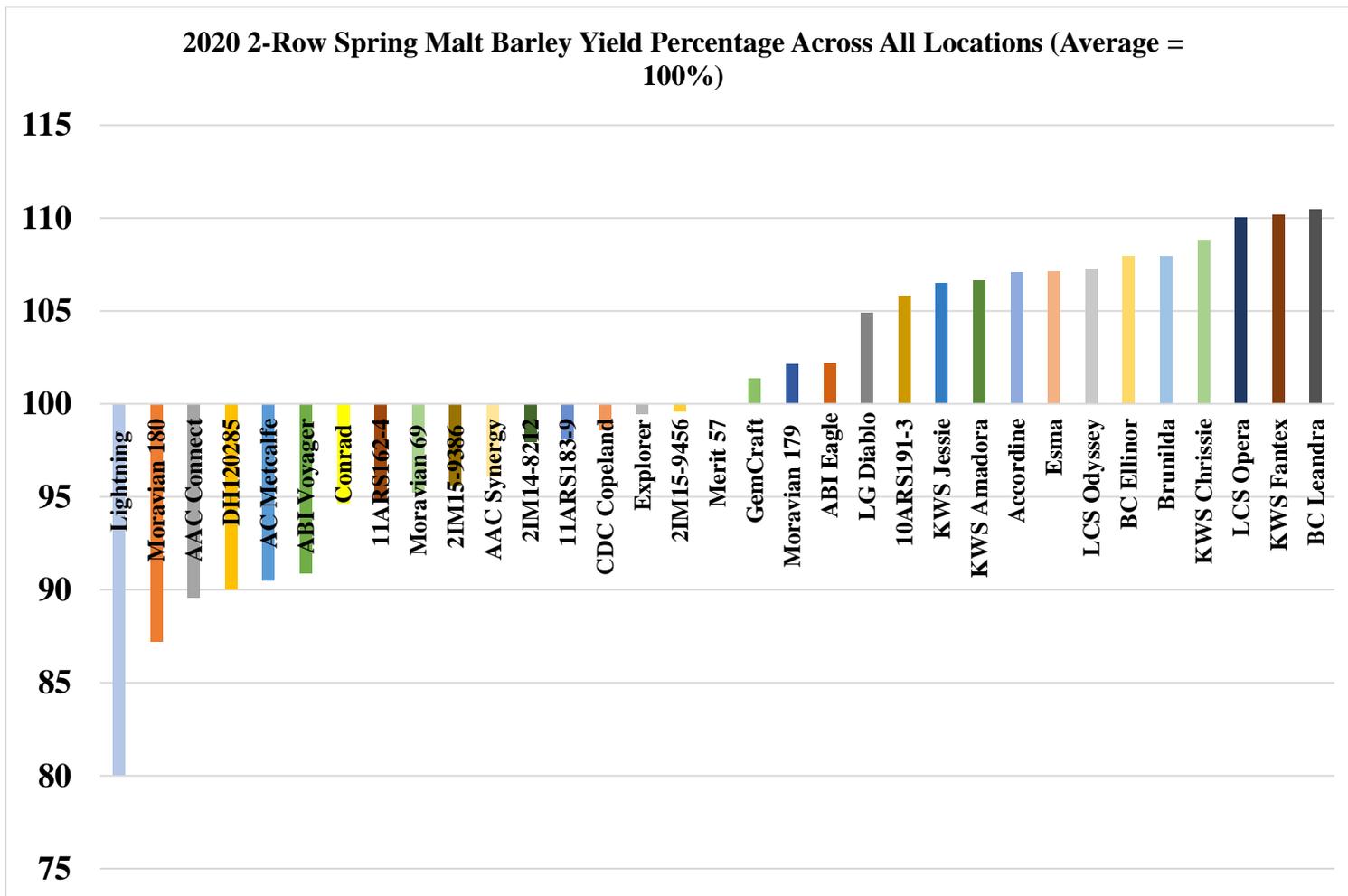


Chart 7. 2-Row spring malt barley yield percentage across all locations.

Table 59. 2-Row Spring Feed Barley Irrigated Nurseries, 3-Year Averages (2018-2020; 12 site-years)

Variety or Selection	Yield* (bu/A)	Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	(> 6/64)	Plump (5.5/64)	% Thin
Altorado	139	53.5	100	6/22	35	14	10.7	88.9	6.9	4.2
Oreana	135	52.6	99	6/24	32	20	11.0	82.3	10.6	7.1
Champion	130	53.7	100	6/20	37	22	11.2	88.6	6.7	4.7
Claymore	130	51.6	100	6/23	37	24	10.6	84.5	9.1	6.4
Xena	130	53.1	100	6/22	37	16	10.9	87.8	7.1	5.1
Lenetah	122	53.1	100	6/22	39	27	11.1	90.3	5.6	4.1
Idagold II	120	52.8	100	6/22	34	19	10.9	86.4	9.4	4.2
Kardia	118	50.6	100	6/26	38	31	11.2	79.2	11.7	9.1
Julie**	112	56.9	99	6/25	36	14	13.0	87.3	8.2	4.5
Transit**	105	55.5	98	6/23	38	15	12.5	86.5	9.1	4.4
Goldenhart**	94	58.9	95	6/24	37	26	14.8	86.3	8.7	5.0
Average	121	53.9	99	6/23	36	21	11.6	86.2	8.5	5.3
LSD ($\alpha = .05$)	10	0.9	1	5	2	13	0.6	6.3	3.7	3.2
CV (%)	19.9	4.2	3.4	6.5	11.5	146	6.1	9	52.6	73
Pr > F	<.0001	<.0001	<.0001	0.4233	<.0001	0.0997	<.0001	0.0404	0.0201	0.0491

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Indicates hulless variety.

Table 60. Irrigated 2-Row Spring Feed and Food Barley Data Combined from Rupert, Idaho Falls, Ashton, and Aberdeen, 2020.

Variety or Selection	Yield* (bu/A)	Test Wt (lb/bu)	Spring Stand (%)	Heading Date	Height (in)	Lodging (%)	Protein (%)	(>6/64)	Plumps (>5.5/64)	% Thin
HO516-429	157	53.5	100	6/23	38	0	10.4	95.2	3.0	1.5
Charger	147	52.3	100	6/21	33	1	10.5	90.4	6.6	3.3
Altorado	143	54.0	99	6/23	35	0	10.4	92.9	5.0	1.8
Xena	141	53.6	100	6/22	36	0	10.6	94.2	3.8	1.7
Claymore	139	52.6	99	6/23	37	1	10.3	93.0	4.9	2.3
HO516-579	138	52.8	100	6/25	29	0	10.6	78.7	14.8	6.5
Kardia	137	51.9	99	6/26	37	5	10.8	92.1	6.1	2.4
Oreana	135	53.1	98	6/25	31	0	10.6	88.3	8.1	4.1
Champion	135	54.5	99	6/21	36	0	10.8	95.0	3.6	1.6
FeedMor1	132	53.6	100	6/24	29	0	10.9	97.5	1.5	1.5
Idagold II	130	53.6	100	6/22	33	1	10.7	95.4	3.3	1.5
Bill Coors 100	130	52.3	99	6/23	29	0	10.8	95.3	2.7	1.7
Lenetah	130	53.9	100	6/22	40	1	10.7	96.3	2.3	1.3
Moravian 164	126	52.4	98	6/25	29	0	10.8	95.8	2.9	1.9
Goldenhart**	104	60.3	91	6/25	36	5	14.6	89.5	8.1	2.6
Julie**	103	61.1	96	6/27	35	1	14.4	91.5	6.3	2.4
12ARS358-5	99	60.4	92	6/26	36	0	14.1	85.9	10.0	3.9
Transit**	95	58.0	94	6/24	39	0	13.6	87.5	10.3	2.9
Average	129	54.7	98	6/24	34	1	11.4	91.9	5.7	2.5
LSD ($\alpha = .05$)	18	0.8	3	10	2	3	0.8	5.6	3.9	2.0
CV (%)	19.3	2.0	5	8	9.4	484	4.7	4.3	47.5	55.6
Pr > F	<.0001	<0.0001	<0.0001	0.9992	<0.0001	0.0092	<0.0001	<0.0001	<0.0001	0.0002

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Indicates hullless variety.

Table 61. Agronomic Data for Spring Feed and Food Barley at Rupert, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		
	2018	2019	2020*							(>6/64)	(>5.5/64)	% Thin
2-Row Spring Feed Barley												
HO516-429	---	---	173	53.2	100	6/4	35	0	10.3	96.7	2.5	0.8
Claymore	163	134	170	51.8	100	6/4	36	1	10.3	94.2	3.6	2.2
Charger	---	---	166	51.1	100	6/3	31	0	10.6	93.1	5.3	1.6
HO516-579	---	---	165	53.4	100	6/8	27	0	10.5	92.0	5.5	2.5
Oreana	170	155	161	54.1	99	6/8	30	0	10.4	96.2	2.7	1.1
Xena	150	143	159	52.4	100	6/3	35	1	10.8	94.9	3.8	1.3
Bill Coors 100	---	---	155	51.7	99	6/8	27	0	10.6	97.2	2.0	0.8
Lenetah	137	130	154	53.6	100	6/4	38	1	10.9	97.0	2.0	1.0
Idagold II	131	126	153	53.3	100	6/4	31	0	10.4	97.4	2.0	0.6
Moravian 164	---	---	150	53.0	100	6/10	28	0	10.6	98.2	1.1	0.7
FeedMor1	---	---	149	53.4	100	6/6	31	1	10.8	98.1	1.1	0.8
Champion	139	142	146	53.3	99	6/3	33	0	10.9	96.2	2.8	1
Altorado	142	146	142	53.3	100	6/4	31	0	10.4	95.4	3.2	1.4
Feed Average	151	139	157	52.9	100	6/5	32	0.3	10.6	95.9	2.9	1.2
2-Row Spring Food Barley												
Kardia	129	116	155	51.3	100	6/9	37	13	10.5	88.8	7.4	3.8
Julie**	132	137	125	60.9	100	6/13	36	0	14.7	93.1	4.5	2.4
12ARS358-5	---	---	121	59.6	98	6/9	35	0	13.8	86.7	9.5	3.8
Goldenhart**	112	108	119	59.8	97	6/8	35	8	14.4	93.8	4.2	2.0
Transit**	128	128	115	57.5	100	6/6	38	0	13.5	86.1	10.8	3.1
Food Average	125	122	127	57.8	99	6/9	36	4	13.4	89.7	7.3	3.0
LSD ($\alpha=0.05$)	19	21	16	1.7	2	2	3	9				
CV (%)	9.0	11.1	7.6	2.2	1.3	0.80	5.6	495.0				
Pr > F	<0.0001	0.0004	<0.0001	<0.0001	0.0321	<0.0001	<0.0001	0.4388				

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Indicates hullless variety.

Table 62. Agronomic Data for Spring Feed and Food Barley, Aberdeen, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		% Thin
	2018	2019	2020*							(>6/64)	(>5.5/64)	
2-Row Spring Feed Barley												
Altorado	174	128	131	53.8	96	6/20	36	0	10.1	90.5	7.3	2.4
Champion	157	129	122	54.4	100	6/15	37	0	10.9	93.3	4.7	2
Charger	---	---	120	51.9	100	6/14	28	0	10.5	91.9	6.7	2
HO516-429	---	---	118	53.6	100	6/21	36	0	10.4	93.4	2.8	1.8
Xena	144	121	115	53.6	100	6/16	34	0	10.7	91.4	4.2	1.9
HO516-579	---	---	115	53.3	100	6/23	27	0	11.0	83.8	10.7	3.5
FeedMor	---	---	115	53.2	100	6/21	27	0	10.7	98.2	0.8	1.6
Claymore	140	116	113	53.0	98	6/21	35	0	10.2	94.9	3.9	1.6
Idagold II	116	110	113	53.2	100	6/19	32	0	10.6	96.3	2.8	1.4
Lenetah	138	117	112	53.6	100	6/18	42	0	10.6	94.8	1.9	1.2
Bill Coors 100	---	---	111	52.2	98	6/16	28	0	10.8	94.7	3.2	2.2
Oreana	155	123	108	52.5	95	6/23	29	0	10.5	90.1	6.4	4.1
Moravian 164	---	---	97	52.3	98	6/22	25	0	10.4	96.6	1.4	2.2
Feed Average	146	121	115	53.1	99	6/19	32	0	10.6	93.1	4.4	2.1
2-Row Spring Food Barley												
Kardia	124	87	109	52.3	98	6/25	34	5	10.6	93	6	2
Julie*	140	97	77	60.7	94	6/25	31	4	12.8	85	11	4
Goldenhart*	77	71	75	61.1	91	6/23	35	4	14.3	84	12	4
12ARS358-5	---	---	72	60.9	96	6/25	32	0	13.9	78.9	14.2	4.5
Transit**	131	108	63	58.1	89	6/25	34	0	13.0	83.6	13.6	3.8
Food Average	114	85	79	59	94	6/25	33	3	12.9	85.0	11.4	3.6
LSD	14	22	23	0.9	7	3	4	5.4				
CV	7.5	11	15.2	1.2	5.1	1.2	8.8	390				
P>F	<0.0001	<.0001	<0.0001	<0.0001	0.0542	<0.0001	<0.0001	0.4736				

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Indicates hullless variety.

Table 63. Agronomic Data for Spring Feed and Food Barley at Idaho Falls, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		
	2018	2019	2020*							(>6/64)	(>5.5/64)	% Thin
2-Row Spring Feed Barley												
HO516-429	---	---	182	54.3	100	6/24	42	0	10.4	95	3	1
Altorado	157	146	163	55.1	100	6/25	37	0	10.5	93	5	1
HO516-579	---	---	161	53.3	100	6/25	31	0	10.3	71	21	8
Claymore	126	116	159	53.5	100	6/24	40	4	10.5	91	6	3
Charger	---	---	156	52.6	100	6/23	37	4	10.6	83	10	7
Bill Coors 100	---	---	154	52.7	100	6/25	30	0	11.0	93	4	2
Xena	130	97	153	54.6	100	6/26	39	0	10.4	95	4	2
Oreana	145	137	150	53.3	100	6/26	35	1	10.9	83	12	5
FeedMor1	---	---	148	54.3	100	6/26	31	0	11.2	96	2	2
Champion	137	105	146	55.4	100	6/24	39	1	10.7	95	4	2
Idagold II	132	116	141	54.5	100	6/25	36	1	11.2	93	5	3
Lenetah	127	94	135	54.9	100	6/24	41	4	11.0	97	3	2
Moravian 164	---	---	131	52.9	100	6/24	31	0	11.6	94	5	3
Feed Average	137	115	152	54.0	100	6/24	36	1	10.8	90.6	6.4	3.2
2-Row Spring Food Barley												
Kardia	130	96	145	52.5	100	6/26	40	2	11.2	90.9	6.4	2.7
12ARS358-5	---	---	112	61.6	100	6/24	40	0	13.0	88.3	8.9	2.8
Julie**	131	114	111	61.5	100	6/24	38	0	14.2	94.8	4.2	1.0
Goldenhart*	106	70	108	61.5	100	6/24	40	9	13.7	84.8	12.0	3.2
Transit *	120	94	106	58.4	100	6/22	43	0	13.4	90.2	8.0	1.8
Food Average	122	93	116	59.1	100	6/24	40	2	13.1	89.8	7.9	2.3
LSD ($\alpha=0.05$)	16	19	17	1	0	3	3	6				
CV (%)	8.6	10.9	8.4	1.3	0	1.3	5	819				
Pr > F	0.0002	<0.0001	<0.0001	<0.0001	.	0.6887	<0.0001	0.1987				

* Variety or selection in bold is not statistically different from the top yielding variety.

** Indicates hullless variety.

Table 64. Agronomic Data for Spring Feed and Food Barley at Ashton, Irrigated, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		
	2018	2019	2020*							(>6/64)	(>5.5/64)	% Thin
2-Row Spring Feed Barley												
HO516-429	---	---	157	53.0	100	7/13	38	0	10.5	95.1	3.2	1.6
Charger	---	---	146	53.8	100	7/13	35	0	10.4	93.1	4.6	2.5
Xena	105	94	137	53.8	100	7/12	37	0	10.5	95.3	2.9	1.6
Altorado	132	95	134	54.0	100	7/13	35	0	10.4	92.9	4.9	2
Champion	121	92	124	54.8	100	7/12	36	0	10.8	95.7	3.1	1.4
Oreana	105	90	120	52.3	100	7/13	28	0	10.6	83.2	11	5.7
Bill Coors 100	---	---	120	52.6	100	7/14	30	0	10.6	96.3	2	1.5
Idagold II	112	93	119	53.6	100	7/12	33	0	10.5	95.1	3.1	1.4
Lenetah	112	93	118	53.6	100	7/13	39	0	10.5	96.1	2.5	1.1
Claymore	113	98	117	52.2	100	7/13	37	0	10.2	91.6	5.7	2.7
FeedMor1	---	---	115	53.6	99	7/13	26	0	11.0	97.4	1.6	1.2
HO516-579	---	---	111	51.1	100	7/13	27	0	10.7	67.5	21.1	11.4
Moravian 164	---	---	105	51.3	96	7/14	28	0	10.7	94.4	3.3	2.1
Feed Average	109	90	125	53.1	99	7/12	33	0	10.6	91.8	5.3	2.8
2-Row Spring Food Barley												
Kardia	103	94	138	51.6	100	7/15	37	0	10.7	95.2	3.5	1.3
Goldenhart**	90	86	99	58.7	78	7/14	35	0	15.8	94.9	3.8	1.3
Julie**	91	95	98	61.1	91	7/15	36	0	16.1	93.3	4.8	1.9
12ARS358-5	---	---	89	59.5	73	7/15	39	0	15.8	89.0	7.2	3.8
Transit**	89	86	83	57.9	88	7/14	40	0	14.4	89.5	8.1	2.4
Food Average	93	90	101	57.8	86	7/14	37	0	14.5	92.4	5.5	2.1
LSD ($\alpha=0.05$)	28	13	16	1.0	6	1	3	0				
CV %	18.8	10.0	9.6	1.3	4.5	0.4	5.8	.				
Pr > F	0.0018	0.0937	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	.				

* Varieties or selections in bold are not statistically different from the top yielding variety.

** Indicates hullless variety.

Table 65. Agronomic Data for Spring Barley at Soda Springs, Dryland, 2020.

Variety or Selection	Yield (bu/A)			Test Wt. (lb/bu)	Spring Stand (%)	Heading Date	Height (in.)	Lodging (%)	Protein (%)	Plump		
	2018	2019	2020*							(>6/64)	(>5.5/64)	% Thin
2-Row Spring Feed Barley												
Claymore	57	96	61	51.7	100	7/13	33	0	10.0	86.8	10.2	3.0
HO516-429	---	---	55	52.7	100	7/14	31	0	10.3	91.0	7.2	1.8
Oreana	---	72	55	52.7	100	7/16	26	0	10.6	90.5	7.2	2.2
HO516-579	---	---	54	53.1	100	7/15	23	0	10.4	76.5	19.2	4.2
Altorado	96**	101	53	53.5	100	7/13	29	0	10.0	82.3	15.2	2.6
Xena	58	94	53	52.4	100	7/12	33	0	10.4	86.3	11.2	2.5
Lenetah	71	92	53	52.5	100	7/14	34	0	10.3	93.9	4.6	1.4
Champion	64	97	51	54.5	100	7/13	32	0	10.6	91.7	6.4	1.9
FeedMor1	---	---	51	52.2	100	7/14	24	0	11.2	95.7	2.6	1.7
Bill Coors 100	---	---	50	49.7	100	7/14	26	0	10.7	93.6	4.7	1.8
Charger	---	---	49	51.9	100	7/11	27	0	10.5	86.9	10.6	2.5
Idagold II	65	93	49	52.5	100	7/14	28	0	10.6	87.5	8.5	3.9
Moravian 164	---	72	48	50.7	100	7/13	22	0	10.8	95.1	3.4	1.6
Feed Average	64	97	52	52.3	100	7/13	28	0	10.5	89.1	8.5	2.4
2-Row Spring Food Barley												
Goldenhart***	---	72	43	60.4	95	7/15	28	0	14.0	73.4	18.1	8.5
Kardia	---	79	41	51.0	100	7/16	27	0	11.1	92.9	5.6	1.5
Julie***	---	99	40	60.0	96	7/20	29	0	14.7	78.6	17.0	4.3
12ARS358-5	---	---	40	59.3	97	7/17	31	0	14.1	75.9	17.2	6.9
Transit***	---	92	36	58.0	95	7/15	33	0	14.4	78.8	16.9	4.2
Food Average		85	40	57.7	97	7/16	30	0	13.7	79.9	15.0	5.1
LSD ($\alpha=.05$)	14	9	7	1.1	2	2	3	0				
CV %	15.8	6.5	9.6	1.4	1.3	0.7	7.7	.				
Pr > F	0.0002	< 0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	.				

* Varieties or selections in bold are not statistically different from the top yielding variety.

** 1-rep demonstration plot.

*** Indicates hullless variety.

Table 66. 2-Row Spring Feed and Food Barley Yield Percentage of Location Averages, 2020.

(100% = Average)						
Variety or Selection	Aberdeen	Rupert	Idaho Falls	Ashton	Soda Springs	Variety average
Feed Barley						
Altorado	106	95	115	114	109	108
Bill Coors 100	116	104	109	101	101	106
Champion	115	98	103	105	103	105
Charger	107	111	110	124	101	111
Claymore	109	114	112	99	123	111
FeedMor1	72	100	104	97	103	95
HO516-429	74	116	128	133	113	113
HO516-579	103	110	113	94	111	106
Idagold II	93	103	99	100	100	99
Lenetah	109	103	95	100	107	103
Moravian 164	69	101	92	89	98	90
Oreana	112	108	106	102	112	108
Xena	107	107	107	116	109	109
Food Barley						
12ARS358-5*	125	81	79	76	82	89
Goldenhart*	107	80	76	84	81	85
Julie*	103	84	78	83	73	84
Kardia	60	104	102	117	84	93
Transit*	109	77	75	70	87	84
Location Average	105	149	142	118	49	

* Indicates hullless varieties.

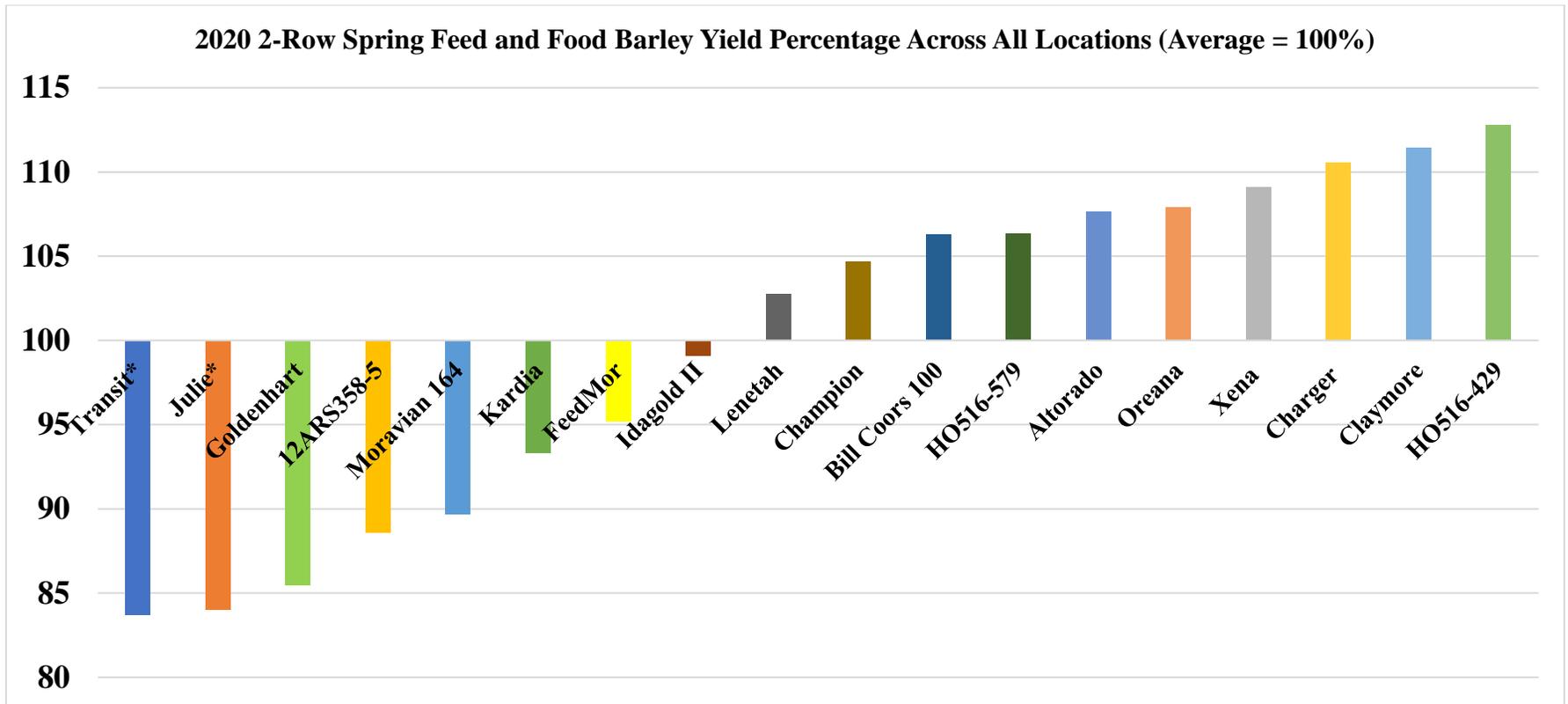


Chart 8. 2-Row spring food and feed barley yield percentage across all locations.

Table 67. Hard Winter Wheat Grain Protein & Kernel Hardness, 2019.

Variety or Selection	-----Grain Protein %-----							-----Kernel Hardness 0-100-----						
	Kimberly	Aberdeen	Rupert	Ririe	Rockland	Soda Springs	Average	Kimberly	Aberdeen	Rupert	Ririe	Rockland	Soda Springs	Average
FourOsix	11.2	12.6	11.5	10.0	10.5	10.9	11.1	75	77	77	57	72	63	70.2
Greenville	11.4	12.8	12.2	10.1	11.7	12.6	11.8	64	66	65	57	56	64	62.0
IDO1506 (W)	11.6	13.7	11.3	8.9	9.6	12.0	11.2	76	77	75	67	72	70	72.8
IDO1607	11.6	13.4	12.7	9.1	11.0	10.7	11.4	72	71	76	56	62	63	66.7
UI Bronze Jade (W)	10.8	12.1	11.6	8.9	10.0	12.0	10.9	81	83	73	57	66	69	71.5
IDO1806 (W)	11.7	12.5	13.5	10.6	10.3	13.5	12.0	72	77	75	61	71	73	71.5
Irv (W)	11.3	12.9	12.5	9.9	11.9	12.6	11.9	79	75	73	59	63	64	68.8
Keldin	11.1	12.5	12.5	8.9	9.8	12.8	11.3	70	69	65	57	63	63	64.5
Keldin + 11-52-0	10.8	12.9	11.9	10.4	9.3	12.8	11.3	75	62	67	62	58	50	62.3
LCS Zoom	10.5	12.5	10.8	8.4	9.7	11.4	10.6	74	75	76	54	60	54	65.5
LCS Jet	10.9	11.8	10.6	8.7	9.9	10.5	10.4	78	75	72	55	61	52	65.5
LCS Rocket	10.6	12.0	10.9	9.5	9.8	11.3	10.7	76	74	73	56	67	56	67.0
LCS Yeti (W)	13.2	15.1	14.6	9.2	11.1	13.6	12.8	71	69	71	54	66	61	65.3
Ray	12.0	13.3	12.9	10.1	10.5	11.1	11.6	80	83	82	65	66	72	74.7
Bobcat	12.3	14.4	12.7	8.6	10.7	11.3	11.7	73	71	74	59	58	54	64.8
Norwest 553	11.0	12.7	12.3	10.3	10.4	11.4	11.3	72	74	72	63	62	55	66.3
Norwest 553/Yellowstone (50/50)	11.3	12.6	12.9	9.9	10.9	13.1	11.8	72	74	76	62	61	62	67.8
Nugrain (W)	12.3	12.4	12.5	---	---	---	12.4	81	74	78	---	---	---	77.7
Millie (W)	11.1	13.0	12.6	10.2	10.8	12.6	11.7	70	69	71	66	65	60	66.8
Sequoia	---	13.0	---	10.3	11.1	13.4	12.0	85	72	84	64	69	57	71.8
Utah 100	10.8	13.2	13.1	8.8	10.7	13.5	11.7	85	80	80	68	75	74	77.0
WA8252 (W)	10.7	13.5	11.7	8.1	10.0	12.8	11.1	79	73	75	52	64	61	67.3
Scorpio	11.0	11.0	11.3	9.0	10.3	12.8	10.9	72	69	71	52	59	53	62.7
WA8289	10.2	13.2	10.3	8.7	9.9	11.4	10.6	68	67	64	49	55	51	59.0
WB4311	12.3	15.6	12.3	9.9	10.5	12.7	12.2	78	76	80	59	63	60	69.3
WB4623CLP	13.7	11.3	14.3	9.6	12.2	13.1	12.4	80	75	72	60	55	63	67.5
WB4792	9.3	13.6	10.5	7.7	9.7	12.9	10.6	83	81	75	60	65	69	72.2
Whetstone	11.8	13.2	13.2	9.5	11.0	14.2	12.1	79	73	76	65	65	63	70.2
Yellowstone	11.0	12.8	12.2	9.8	10.2	12.2	11.4	78	72	74	60	66	62	68.7
Curlew	---	---	---	9.4	10.8	13.7	11.3	---	---	---	60	59	63	60.7
Deloris	---	---	---	10.9	11.4	13.1	11.8	---	---	---	70	66	62	66.0
Golden Spike (W)	---	---	---	9.7	11.2	12.3	11.0	---	---	---	59	60	61	60.0
IDO1608	---	---	---	12.2	11.1	13.2	12.2	---	---	---	64	65	63	64.0
Juniper	---	---	---	11.9	11.6	14.6	12.7	---	---	---	67	72	76	71.7
MT1491	---	---	---	9.4	11.3	11.4	10.7	---	---	---	62	68	64	64.7
Promontory	---	---	---	9.8	10.9	11.5	10.7	---	---	---	61	62	62	61.7
SY Clearstone 2CL (W)	---	---	---	10.0	10.3	12.1	10.8	---	---	---	54	57	53	54.7
SY Touchstone	---	---	---	10.3	11.3	14.6	12.1	---	---	---	66	65	65	65.3
UI Silver	---	---	---	10.2	10.4	11.6	10.7	---	---	---	71	75	71	72.3
UI SRG	---	---	---	9.2	11.4	13.4	11.3	---	---	---	73	69	79	73.7
UICF Grace	---	---	---	9.9	10.3	13.2	11.2	---	---	---	75	74	68	72.3
AP Redeye	10.3	---	11.6	---	---	---	11.0	85	---	84	---	---	---	84.5
Greenville (QC)	11.1	---	12.8	---	---	---	11.9	72	61	67	---	---	---	66.7
Location Average	11.3	13.0	12.2	9.6	10.6	12.5	11.4	76.0	73.1	74.0	61.0	64.4	62.6	67.8

(W) = Hard White Winter
(QC) = Double entry for data quality analysis

Table 68. Percent Flour Protein and Flour Yield for Hard Winter Wheat at Aberdeen, Kimberly, Ririe, Rockland, and Soda Springs, 2019.

Variety or Selection	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														
FourOsix	10.3	11.8	11.5	8.5	9.5	10.6	10.4	76.4	75.7	75.2	75.3	75.4	75.3	75.9
Greenville	10.4	11.3	10.9	9.5	10	11.2	10.6	69.8	69.0	68.4	70.1	69.0	69.7	69.7
IDO1607	9.8	11.7	11.1	7.9	9.7	9.7	10.0	76.5	72.5	73.1	72.5	70.4	73.0	74.8
Keldin	10.3	11.8	10.5	8.4	9.2	11.7	10.3	77.5	73.4	73.9	72.9	73.3	75.4	76.4
Keldin + 11-52-0	10.2	11.6	10.2	9.2	8.8	11.5	10.3	77.6	73.6	73.6	73.3	73.7	72.8	75.2
LCS Zoom	9.2	11.2	9.7	7.8	8.8	10.6	9.6	74.7	72.0	72.7	71.3	70.8	72.4	73.5
LCS Jet	9.5	10.7	9.6	8.1	8.7	9.5	9.4	76.8	74.7	75.4	72.6	72.1	73.3	75.0
LCS Rocket	9.1	10.7	9.2	8.3	8.8	9.8	9.3	75.6	74.3	74.1	74.0	75.3	74.4	75.0
Ray	10.5	12.5	11.3	8.9	9.5	11.4	10.7	76.1	74.4	72.8	72.8	73.2	75.8	76.0
Bobcat	10.4	12.7	10.7	8.6	10	10.8	10.5	77.6	75.3	75.2	74.5	75.4	76.9	77.3
Norwest 553	9.7	11.1	10.8	9.1	9.2	10.7	10.1	74.6	73.7	73.4	73.9	74.7	74.6	74.6
Norwest 553/Yellowstone	10	11.6	11.6	8.7	9.8	11.8	10.6	75.4	73.8	73.1	72.7	73.1	74.7	75.1
Sequoia	8.7	12	9.6	8.8	9.4	11.6	10.0	75.0	76.0	72.7	77.8	75.1	76.1	75.6
Utah 100	9.6	11.3	11	8.2	9.7	12.7	10.4	74.8	71.2	71.7	74.0	73.4	74.1	74.4
Scorpio	9.3	11.7	9.9	8	9	11.4	9.9	74.0	72.3	74.8	74.3	73.6	73.0	73.5
WA8289	8.4	9.3	8.5	7.3	8.7	9.9	8.7	75.4	74.9	76.1	74.9	74.2	75.3	75.3
WB4311	10.3	10.6	11	9.3	9.5	11.6	10.4	76.0	75.7	74.1	73.6	72.1	72.7	74.4
WB4623CLP	12.3	13.4	12.8	9.4	10.8	11.9	11.8	72.5	73.5	71.2	71.7	70.2	70.2	71.4
WB4792	8.2	9.9	9.4	7.8	8.5	11.6	9.2	72.8	73.5	72.6	72.3	72.3	71.8	72.3
Whetstone	10.3	11.9	12.2	9.1	10.2	12.9	11.1	74.8	73.5	71.7	72.6	74.3	73.8	74.3
Yellowstone	9.6	11.5	11	9.4	9.4	10.9	10.3	76.4	73.9	73.5	72.9	72.6	73.4	74.9
Greenville (QC)	9.6	10.9	11.3	---	---	---	10.6	69.8	70.0	68.9	---	---	---	69.8
Curlw	---	---	---	8.9	10.2	12.4	10.5	---	---	---	73.8	75.2	73.5	73.5
Deloris	---	---	---	11.1	10.7	12.2	11.3	---	---	---	75.2	75.4	75.0	75.0
IDO1608	---	---	---	9.5	10.2	12	10.6	---	---	---	74.8	74.7	74.1	74.1
Juniper	---	---	---	10.6	11	13.5	11.7	---	---	---	73.1	74.3	72.8	72.8
Promontory	---	---	---	8.4	10.2	11.3	10.0	---	---	---	76.3	74.3	74.3	74.3
SY Touchstone	---	---	---	9.5	10.6	13.1	11.1	---	---	---	74.2	73.2	70.6	70.6
UI SRG	---	---	---	8.5	10.4	12.7	10.5	---	---	---	74.6	73.5	73.9	73.9
Location Average	9.8	11.4	10.6	8.8	9.7	11.5	10.3	75.0	73.5	73.1	73.6	73.4	73.7	74.3
Hard White Winter Wheat														
IDO1506 (W)	10.4	11.8	10.4	7.6	8.9	11.9	11.2	74.4	73.2	73.1	73.2	73.5	72.0	73.2
UI Bronze Jade (W)	9.5	11.2	10.6	8.1	9.2	10.2	9.9	77.3	73.7	72.4	74.8	75.0	75.3	76.3
IDO1806 (W)	10.9	12	12.4	9.3	9.1	11.7	11.3	77.0	74.8	74.8	74.3	73.7	73.8	75.4
Irv (W)	10.1	11.3	10.8	9	9.8	10.5	10.3	75.2	73.2	74.2	73.8	72.5	73.6	74.4
LCS Yeti (W)	11.3	13.4	13.4	8.2	10	13.1	12.2	75.5	72.8	71.9	72.4	74.4	72.6	74.0
Millie (W)	9.3	11.3	10.4	9.1	9.5	11.4	10.4	73.7	72.7	72.7	74.9	73.7	74.1	73.9
WA8252 (W)	8.8	11.5	9.7	7.2	8.6	10.6	9.7	74.3	72.1	71.5	72.8	71.6	73.2	73.8
Golden Spike (W)	---	---	---	8.7	10.5	10.8	10.8	---	---	---	74.0	74.7	75.9	75.9
MT1491 (W)	---	---	---	9.9	10.5	10.6	10.6	---	---	---	73.5	73.6	75.2	75.2
SY Clearstone 2CL (W)	---	---	---	9.3	10.1	10.6	10.6	---	---	---	72.5	70.5	70.9	70.9
UI Silver (W)	---	---	---	9.4	9.4	11	11.0	---	---	---	75.4	72.8	73.8	73.8
UICF Grace (W)	---	---	---	8.7	9.6	11.7	11.7	---	---	---	71.1	70.5	69.9	69.9
Location Average	10.0	11.8	11.1	8.7	9.6	11.2	10.6	75.4	73.2	73.0	73.6	73.0	73.3	74.4

mb = moisture basis

(SWW) = Soft white winter wheat

(QC) = Double entry for data quality analysis

Table 69. Bake Volume for Hard Winter Wheat at Aberdeen, Kimberly, Rupert, Ririe, 2019.

Variety or Selection	Bake Volume (cc)					Average
	Aberdeen	Kimberly	Rupert	Rockland	Soda Springs	
Hard Red Winter Wheat						
FourOsix	1050	950	975	950	1025	990
Greenville	950	850	925	950	975	930
IDO1607	975	775	975	925	925	915
Keldin	1025	650	800	850	875	840
Keldin + 11-52-0	1000	825	775	825	950	875
LCS Zoom	950	800	800	800	875	845
LCS Jet	1025	825	775	850	800	855
LCS Rocket	950	800	825	875	925	875
Ray	1050	950	1025	925	900	970
Bobcat	1050	925	950	925	950	960
Norwest 553	1025	900	1000	850	975	950
Norwest 553/Yellowstone	1100	950	1050	1000	1050	1030
Sequoia	950	725	725	850	850	820
Utah 100	1025	775	975	900	875	910
Scorpio	1025	875	925	900	925	930
WA8289	875	750	700	900	825	810
WB4311	850	875	825	825	900	855
WB4623CLP	1025	1000	950	950	975	980
WB4792	725	650	675	725	775	710
Whetstone	1075	925	1000	875	1050	985
Yellowstone	1100	925	1000	950	1050	1005
Greenville QC	975	900	925	---	---	933
Curlew	---	---	---	925	1000	963
Deloris	---	---	---	975	1050	1013
IDO1608	---	---	---	875	900	888
Juniper	---	---	---	1000	1075	1038
Promontory	---	---	---	925	975	950
SY Touchstone	---	---	---	950	1050	1000
UI SRG	---	---	---	950	1000	975
UICF Grace	---	---	---	850	950	900
Location Average	990	845	890	898	947	914
Hard White Winter Wheat						
IDO1506 (W)	800	850	825	800	1025	860
UI Bronze Jade (W)	975	800	875	875	825	870
IDO1806 (W)	1075	900	1000	900	975	970
Irv (W)	1025	800	975	900	900	920
LCS Yeti (W)	1075	950	1025	900	1050	1000
Nugrain (W)	1075	900	925	---	---	967
Millie (W)	975	775	850	850	1000	890
WA8252 (W)	900	700	750	775	850	795
Golden Spike (W)	---	---	---	975	950	963
MT1491 (W)	---	---	---	1025	1000	1013
SY Clearstone 2CL (W)	---	---	---	975	1000	988
UI Silver (W)	---	---	---	950	1000	975
Location Average	988	834	903	902	961	918

(QC) = Double entry for data quality analysis.

Table 70. Soft White Winter Wheat Grain Protein & Kernel Hardness, 2019.

Variety or Selection	-----Grain Protein %-----							-----Kernel Hardness 0-100-----						
	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average
Brundage	9.6	9.1	9.2	8.8	---	10.6	9.5	28	32	26	28	---	27	28
Bruneau	10.8	9.3	8.1	9.3	10.5	10.6	9.7	28	27	21	31	16	26	25
IDO1708	10.6	8.5	7.8	9.2	10.1	---	9.2	25	29	20	22	19	---	23
Jasper	12.2	8.4	8.9	8.9	11.0	11.1	10.1	28	30	24	23	23	26	26
LCS Ghost	10.2	8.1	8.8	---	---	---	9.1	24	25	17	---	---	---	22
LCS Artdeco	9.8	8.1	8.4	---	---	---	8.8	24	27	15	---	---	---	22
LCS Drive	10.4	9.0	8.3	---	---	---	9.3	30	34	24	---	---	---	29
LCS Hulk	11.1	10.1	8.4	8.5	11.0	10.4	9.9	31	30	24	27	19	28	27
LCS Shark	10.5	9.5	8.6	---	---	---	9.6	28	28	21	---	---	---	26
LCS Blackjack	10.8	8.6	8.4	---	---	---	9.3	22	28	14	---	---	---	21
Norwest Duet	11.3	8.9	8.6	9.9	11.3	10.2	10.1	35	37	31	37	26	28	32
Norwest Tandem	11.0	9.0	9.1	9.3	11.2	9.5	9.9	29	35	33	25	25	24	29
Nixon	11.3	9.6	8.5	10.4	11.7	---	10.3	29	31	27	31	26	---	29
OR2X2CL+	12.3	9.2	9.2	12.1	12.7	---	11.1	28	29	24	34	21	---	27
Appleby CL+	10.6	9.8	9.4	11.4	12.7	---	10.8	30	32	26	35	22	---	29
Purl	11.1	9.1	9.0	9.0	11.3	9.7	9.8	26	37	31	28	29	32	31
Rosalyn	9.8	8.4	9.3	8.4	8.7	---	8.9	27	31	24	37	24	---	29
Stephens	10.9	9.3	9.0	10.3	11.2	---	10.2	24	33	25	25	21	---	26
SY Ovation	11.3	9.4	8.1	11.6	11.9	10.1	10.4	29	32	24	35	23	26	28
SY Assure	10.7	8.8	8.8	9.2	11.4	---	9.8	32	31	21	23	18	---	25
SY Raptor	10.1	8.1	8.1	---	---	---	8.8	25	36	27	---	---	---	29
UI Castle CL+	13.3	9.1	9.4	11.2	12.3	11.6	11.1	30	34	23	40	28	25	30
UI Magic CL+	11.1	8.9	8.9	9.6	12.8	11.1	10.4	26	33	25	36	22	24	28
UI Sparrow	10.9	9.7	8.3	10.0	11.3	9.5	9.9	28	33	22	32	31	27	29
UIL 07-28017B	10.6	8.8	9.0	---	---	---	9.5	27	25	21	---	---	---	24
UIL 11-456031A	10.2	7.9	8.4	8.1	10.9	9.1	9.1	26	28	19	27	12	21	22
VI Voodoo (CL+)	10.4	8.4	8.7	10.3	12.3	10.1	10.0	24	23	17	25	23	21	22
UIL 17-6333 (CL+)	12.3	9.2	9.7	---	---	11.0	10.6	30	29	32	---	---	27	30
UIL 17-6546 (CL+)	12.6	8.8	9.4	9.7	12.4	10.6	10.6	24	30	24	31	26	25	27
UIL 17-6834 (CL+)	11.8	8.0	10.1	9.8	12.8	11.2	10.6	32	30	28	42	27	28	31
VI Shock	11.3	8.4	8.3	---	---	10.4	9.6	25	25	19	---	---	18	22
WA8275CL+	---	---	---	9.0	13.9	---	11.4	---	---	---	33	25	---	29
WB 456	11.8	9.9	8.8	---	---	---	10.2	36	24	32	---	---	---	31
WB1376CLP	13.0	9.7	9.6	10.7	13.8	---	11.4	31	34	30	40	19	---	31
WB1529	11.9	8.9	9.8	9.6	11.2	---	10.3	32	27	31	28	21	---	28
WB1783	11.3	8.6	9.9	9.4	13.5	---	10.5	34	28	33	39	35	---	34
Bobtail (QC)	9.0	---	8.9	---	9.6	---	9.2	23	36	20	---	18	---	24
Eltan	---	---	---	8.0	12.0	10.3	10.1	---	---	---	23	25	21	23
IDO1808	---	---	---	9.0	11.2	---	10.1	---	---	---	38	24	---	31
IDO1810	---	---	---	10.5	10.6	---	10.5	---	---	---	25	15	---	20
LCS 72916	---	---	---	8.0	8.9	9.1	8.7	---	---	---	18	19	22	20
LCS Sonic	---	---	---	8.9	11.4	9.8	10.1	---	---	---	15	19	16	17
Otto	---	---	---	9.6	12.2	10.6	10.8	---	---	---	36	26	23	28
SY Dayton	---	---	---	11.0	11.5	---	11.3	---	---	---	36	24	---	30
VI Presto (CL+)	---	---	---	9.6	10.8	10.5	10.3	---	---	---	27	21	21	23
Eltan 11-52-0	---	---	---	9.2	12.3	10.5	10.7	---	---	---	25	21	23	23
WA8271	---	---	---	9.9	12.0	---	10.9	---	---	---	35	28	---	32
Average	11.1	8.9	8.9	9.6	11.6	10.3	10.0	28	30	24	30	23	24	27

(QC) = Double entry for data quality analysis.

Table 71. Percent Flour Protein and Flour Yield for Soft White Winter Wheat at Kimberly, Ririe, and Aberdeen, 2019.

Variety or Selection	Flour Protein (%)							Flour Yield (%)						
	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average
Brundage	9.2	9.8	9.4	9.6	---	11	9.8	77.4	75.9	76.1	76.3	---	75.8	76.3
Bruneau	9.9	10.8	9.1	9.7	10.1	11.1	10.1	76.7	75.3	76.2	77.8	74.7	75.5	76.0
IDO1708	9.3	11	9	9.4	10.1	---	9.8	76.3	75.7	74.7	76.5	74.3	---	75.5
Jasper	8.6	11.8	9.4	8.9	10.2	11.1	10.0	79.8	75.9	76.3	77.9	76.2	74.5	76.8
LCS Ghost	7.9	9.1	8.8	---	---	---	8.6	79.2	77.2	76.1	---	---	---	77.5
LCS Artdeco	8.4	10.2	9.2	---	---	---	9.3	77.1	74.9	74.5	---	---	---	75.5
LCS Drive	9	10.6	8.5	---	---	---	9.4	76.2	75.2	76.4	---	---	---	75.9
LCS Hulk	9.6	11.2	8.5	8.7	10.8	10.7	9.9	77.8	75.1	78.3	77.6	74.1	74.2	76.2
LCS Shark	9.7	10.6	8.4	---	---	---	9.6	78.2	76.6	76.1	---	---	---	76.9
LCS Blackjack	8.6	10.4	7.9	---	---	---	9.0	79.3	77.8	79.2	---	---	---	78.8
Norwest Duet	9.1	10.9	8.5	9.6	10.4	10.5	9.8	78.9	76.8	77.8	78.2	76.3	76.0	77.3
Norwest Tandem	8.4	10.6	8.6	9.3	11	9.9	9.6	75.8	74.6	74.5	75.5	74.4	74.5	74.9
Nixon	9.5	10.9	8.8	9.8	11.4	---	10.1	78.5	76.6	77.2	77.6	76.3	---	77.2
OR2X2CL+	8.9	11.7	9.2	11.8	11.8	---	10.7	78.3	76.9	77.9	76.8	76.8	---	77.3
Appleby CL+	9.6	10.8	9.4	11	11.8	---	10.5	77.5	76.5	76.1	74.2	73.8	---	75.6
Purl	8.9	11.2	9.1	8.8	11	10.3	9.9	78.1	77.4	77.1	76.0	75.5	75.4	76.6
Rosalyn	8.3	9.8	8.8	9.5	8.5	---	9.0	77.0	76.6	76.7	76.2	76.4	---	76.6
Stephens	9	10.6	9.1	10.4	10.1	---	9.8	77.4	77.0	76.1	77.1	76.4	---	76.8
SY Ovation	9.4	11	7.8	10.9	11.8	10.7	10.3	77.9	76.6	76.2	77.8	74.8	76.8	76.7
SY Assure	9.7	10.7	8.7	8.7	10.5	---	9.7	78.1	75.4	74.9	75.2	73.6	---	75.4
SY Raptor	7.9	10.5	8.5	---	---	---	9.0	79.0	76.2	74.8	---	---	---	76.7
UI Castle CL+	9.7	13	10	11.4	12	11.8	11.3	78.9	76.4	78.0	78.2	77.3	76.2	77.5
UI Magic CL+	8.8	11.1	9	9.5	12.2	11.5	10.4	77.2	76.4	75.9	76.3	73.4	73.8	75.5
UI Sparrow	9.2	11.1	8.7	9.4	11.2	10.1	10.0	77.2	76.9	79.2	76.4	78.6	75.1	77.2
UIL 07-28017B	9.1	11.2	9.5	---	---	---	9.9	78.7	79.0	78.7	---	---	---	78.8
UIL 11-456031A	8.4	10.3	8.3	7.9	11	10	9.3	77.9	78.8	77.3	77.0	77.0	77.0	77.5
VI Voodoo (CL+)	8.5	10.7	9.2	10.1	11.1	10.7	10.1	76.5	77.7	77.2	76.5	76.5	75.0	76.6
UIL 17-6333 (CL+)	9.6	12.2	10.2	---	---	11.2	10.8	76.5	77.1	75.8	---	---	73.1	75.6
UIL 17-6546 (CL+)	8.2	12.5	9.4	9.4	12	10.8	10.4	77.8	78.5	77.0	77.0	76.5	75.8	77.1
UIL 17-6834 (CL+)	8.2	11.4	9.4	9.4	12.1	11.1	10.3	75.0	74.8	74.4	74.9	73.2	72.4	74.1
VI Shock	8.5	11.2	8.7	---	---	10.7	9.8	77.4	77.5	77.0	---	---	74.3	76.6
WA8275CL+	---	11.4	---	8.6	12.7	---	10.9	---	75.6	---	76.1	72.4	---	74.7
WB 456	9.9	11.9	9.1	---	---	---	10.3	77.6	76.7	76.8	---	---	---	77.0
WB1376CLP	9.3	12.6	9.9	10.3	12.3	---	10.9	75.7	74.3	74.7	75.5	73.3	---	74.7
WB1529	8.9	11.1	10.1	9	11.3	---	10.1	74.3	74.1	73.4	74.2	72.8	---	73.8
WB1783	8.5	11.6	9.5	8.4	12.2	---	10.0	76.8	76.0	76.5	77.6	74.6	---	76.3
Bobtail (QC)	8.4	---	8.8	---	8.9	---	8.7	79.0	---	77.7	---	77.8	---	78.1
Eltan	---	---	---	8.3	11.7	10.9	10.3	---	---	---	77.6	75.2	75.2	76.0
IDO1808	---	---	---	9.1	10.7	---	9.9	---	---	---	77.0	75.0	---	76.0
IDO1810	---	---	---	10.6	10.5	---	10.6	---	---	---	76.5	75.5	---	76.0
LCS 72916	---	---	---	7.8	8.7	9.5	8.7	---	---	---	76.0	76.4	75.1	75.8
LCS Sonic	---	---	---	9.4	10.6	10.5	10.2	---	---	---	76.9	74.8	74.8	75.5
Otto	---	---	---	10.2	11.2	10.8	10.7	---	---	---	76.2	74.1	73.6	74.6
SY Dayton	---	---	---	10.6	11	---	10.8	---	---	---	75.9	74.3	---	75.1
VI Presto (CL+)	---	---	---	9.7	10.4	10.9	10.3	---	---	---	76.7	74.5	75.8	75.7
Eltan 11-52-0	---	---	---	9.3	12	11	10.8	---	---	---	77.0	74.8	74.7	75.5
WA8271	---	---	---	9.8	11.1	---	10.5	---	---	---	75.8	73.9	---	74.8
Average	8.9	11.0	9.0	9.6	11.0	10.7	10.0	77.5	76.4	76.5	76.5	75.1	75.0	76.2

(QC) = Double entry for data quality analysis.

Table 72. Percent Break Flour Yield and Cookie Diameter for Soft White Winter Wheat at Kimberly, Ririe, and Aberdeen, 2019.

Variety or Selection	Break Flour Yield (%)							Cookie Diameter (cm)						
	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average	Kimberly	Aberdeen	Rupert	Ririe	Soda Springs	Rockland	Average
Brundage	50.7	50.2	49.1	57.5		54.7	52.5	9.0	9.0	9.1	9.0		8.8	9.0
Bruneau	50.4	50.0	49.6	56.8	51.1	52.5	51.7	9.3	9.1	9.4	9.0	8.9	9.1	9.1
IDO1708	50.3	47.8	48.6	56.9	51.5		51.0	9.0	9.1	9.3	9.1	9.0		9.1
Jasper	56.4	51.6	51.6	60.7	54.5	53.7	54.7	9.1	8.9	9.3	9.1	9.3	9.2	9.1
LCS Ghost	56.1	52.7	53.4	---	---	---	54.1	9.1	9.3	9.2	---	---	---	9.2
LCS Artdeco	50.2	46.2	48.6	---	---	---	48.3	8.9	9.0	9.2	---	---	---	9.0
LCS Drive	49.5	46.4	50.2	---	---	---	48.7	9.0	9.0	9.2	---	---	---	9.1
LCS Hulk	50.3	47.9	51.0	56.6	49.4	49.7	50.8	8.9	8.7	9.2	9.0	8.7	8.7	8.9
LCS Shark	50.3	47.9	50.1	---	---	---	49.4	9.1	9.1	9.2	---	---	---	9.1
LCS Blackjack	52.6	49.6	53.5	---	---	---	51.9	9.4	9.2	9.3	---	---	---	9.3
Norwest Duet	50.2	48.9	51.2	56.5	50.5	52.1	51.6	9.0	9.0	9.0	8.8	8.6	8.8	8.9
Norwest Tandem	48.5	46.5	45.2	55.8	51.2	51.1	49.7	9.0	9.0	9.1	8.9	8.9	8.9	9.0
Nixon	51.6	49.1	50.2	56.4	51.2	---	51.7	9.2	9.1	9.6	8.9	8.8	---	9.1
OR2X2 CL+	50.2	49.7	49.6	54.5	51.1	---	51.0	9.2	9.1	9.0	8.7	8.7	---	8.9
Appleby CL+	47.6	45.8	47.0	50.6	48.1	---	47.8	9.1	9.0	9.3	8.9	8.6	---	9.0
Purl	48.1	46.7	48.3	54.8	49.7	48.4	49.3	8.8	8.6	8.9	9.0	8.4	8.7	8.7
Rosalyn	49.0	48.7	49.6	53.4	53.4	---	50.8	9.1	9.0	9.1	8.7	8.8	---	8.9
Stephens	45.9	46.0	46.3	54.2	51.4	---	48.8	9.1	9.0	9.2	8.8	8.4	---	8.9
SY Ovation	48.6	48.0	48.1	53.7	48.4	50.4	49.5	9.0	9.0	9.3	8.7	8.8	8.8	8.9
SY Assure	52.2	46.8	47.6	55.4	50.5	---	50.5	8.9	9.2	9.3	9.3	9.1	---	9.1
SY Raptor	50.9	46.1	46.2	---	---	---	47.7	8.8	8.9	9.5	---	---	---	9.1
UI Castle CL+	54.2	51.4	52.3	55.1	51.5	50.6	52.5	9.1	8.8	9.3	8.9	8.8	8.6	8.9
UI Magic CL+	50.9	48.7	48.0	54.5	47.1	48.4	49.6	9.1	9.0	9.2	8.8	8.4	8.7	8.9
UI Sparrow	49.5	51.7	53.4	54.6	53.3	50.0	52.1	8.9	8.7	9.0	8.7	8.5	8.9	8.8
UIL 07-28017B	50.9	52.8	53.4	---	---	---	52.4	9.1	9.0	9.1	---	---	---	9.1
UIL 11-456031A	49.9	52.4	51.6	56.8	53.6	52.5	52.8	9.3	9.3	9.5	9.1	8.8	9.1	9.2
VI Voodoo CL+	51.2	53.2	53.0	55.4	53.6	50.8	52.9	9.1	9.2	9.3	8.9	8.5	8.8	9.0
UIL 17-6333 CL+	46.9	49.0	46.9	---	---	47.3	47.5	8.8	8.6	8.9	---	---	8.8	8.8
UIL 17-6546 CL+	52.7	52.0	51.7	58.5	55.1	52.8	53.8	9.3	8.9	9.2	8.9	8.8	9.0	9.0
UIL 17-6834 CL+	44.9	47.3	46.3	50.7	49.1	45.8	47.4	8.8	8.7	8.7	8.5	8.1	8.4	8.5
VI Shock	51.9	53.3	52.6	---	---	51.1	52.2	9.3	9.0	9.4	---	---	8.9	9.2
WA8275CL+	---	50.7	---	54.9	49.1	---	51.6	---	9.1	---	9.3	8.8	---	9.0
WB 456	48.4	48.1	47.4	---	---	---	48.0	9.1	8.7	9.2	---	---	---	9.0
WB1376CLP	46.5	45.9	44.7	51.9	48.0	---	47.4	9.1	8.9	9.0	9.1	8.4	---	8.9
WB1529	46.3	45.8	44.2	54.1	50.2	---	48.1	9.1	8.6	9.1	9.1	8.7	---	8.9
WB1783	46.6	46.3	46.8	51.6	47.7	---	47.8	8.7	8.9	8.9	8.7	7.9	---	8.6
Bobtail (QC)	52.9	---	53.6	---	57.3	---	54.6	9.2	---	9.4	---	9.0	---	9.2
Eltan	---	---	---	56.4	48.8	49.7	51.6	---	---	---	9.1	8.6	8.8	8.8
IDO1808	---	---	---	54.9	50.4	---	52.6	---	---	---	9.0	8.7	---	8.9
IDO1810	---	---	---	56.7	51.8	---	54.3	---	---	---	9.3	8.4	---	8.8
LCS 72916	---	---	---	60.2	55.2	52.2	55.8	---	---	---	9.3	8.7	9.1	9.0
LCS Sonic	---	---	---	57.9	49.6	49.9	52.5	---	---	---	9.2	8.8	9.0	9.0
Otto	---	---	---	55.1	48.4	48.4	50.7	---	---	---	9.0	8.5	8.7	8.7
SY Dayton	---	---	---	53.9	49.4	---	51.6	---	---	---	8.9	8.7	---	8.8
VI Presto CL+	---	---	---	55.1	48.3	47.1	50.2	---	---	---	9.1	8.9	8.8	8.9
Eltan 11-52-0	---	---	---	55.9	48.7	48.9	51.2	---	---	---	9.3	8.5	8.9	8.9
WA8271	---	---	---	54.0	48.5	---	51.2	---	---	---	8.9	8.4	---	8.7
Location average	50.1	48.9	49.5	55.3	50.7	50.4	50.8	9.0	9.0	9.2	9.0	8.7	8.8	8.9

(QC) = Double entry for data quality analysis.

Table 73. SRC (Solvent Retention Capacity) data for Soft White Winter Wheat at Aberdeen, Kimberly, Rupert, Ririe, Rockland and Soda Springs, 2019.

Variety or Selection	Aberdeen				Kimberly				Rupert				Rockland			
	Water	Sucrose	Na2CO3	LacticAcid												
Brundage	51.1	92.0	66.6	64.7	53.7	88.3	70.9	63.8	51.3	92.2	68.1	59.9	51.3	98.3	72.8	84.9
Bruneau	50.6	98.2	67.8	95.1	51.8	89.2	67.7	69.6	50.1	91.1	67.4	68.5	51.9	98.5	73.8	98.2
IDO1708	52.8	96.1	66.8	77.9	53.4	90.7	71.3	74.7	51.5	93.8	66.5	60.7	---	---	---	---
Jasper	49.3	96.8	64.4	78.7	52.7	86.3	68.1	65.0	49.6	93.3	65.7	67.8	49.4	99.1	71.7	88.3
LCS 74143	50.0	90.6	63.5	72.4	54.8	88.3	71.0	70.3	50.3	89.1	67.1	68.6	---	---	---	---
LCS Artdeco	52.5	99.9	66.3	84.9	53.9	93.5	70.0	78.3	52.2	97.3	69.8	78.5	---	---	---	---
LCS Drive	51.1	94.4	65.5	95.8	54.7	91.1	74.0	85.6	52.9	91.5	69.3	76.1	---	---	---	---
LCS Hulk	51.6	98.4	67.3	80.0	53.1	89.1	69.6	65.0	51.8	88.6	69.1	61.7	53.0	102.1	73.8	85.7
LCS Shark	50.7	90.5	60.6	75.7	51.4	87.5	67.0	76.0	49.5	85.8	62.6	60.5	---	---	---	---
LWW15-71945	51.4	89.6	64.6	69.5	51.4	83.6	65.7	64.2	53.0	85.5	66.3	61.4	---	---	---	---
Norwest Duet	52.5	95.5	69.6	76.2	54.4	90.3	72.8	66.0	53.9	90.0	71.0	68.0	52.3	98.4	76.7	86.4
Norwest Tandem	52.1	93.5	64.8	70.3	55.4	93.6	73.3	68.4	54.3	91.1	68.1	60.6	52.6	95.2	70.6	86.8
Nixon	49.8	92.5	63.9	63.0	52.8	88.4	67.5	55.3	51.0	86.6	65.5	54.7	---	---	---	---
OR2X2 CL+	50.5	97.2	63.7	75.2	52.1	89.6	66.9	60.2	52.0	88.8	67.1	56.8	---	---	---	---
Appleby CL+	50.8	91.9	64.1	59.7	52.9	90.1	67.5	61.5	51.0	86.7	65.6	53.7	---	---	---	---
Purl	51.9	94.3	67.6	64.4	55.5	90.4	72.1	60.5	51.8	89.1	66.8	59.3	53.2	96.3	72.5	77.5
Rosalyn	52.3	90.8	70.9	68.6	54.2	90.9	69.1	59.7	53.4	92.2	72.3	62.7	---	---	---	---
Stephens	51.6	87.5	66.4	62.3	53.4	90.3	67.6	57.3	51.3	90.6	65.2	57.3	---	---	---	---
SY Ovation	50.9	86.2	66.5	64.4	53.4	88.2	65.9	63.9	50.9	84.9	64.4	54.0	52.7	91.6	72.1	74.2
SY Assure	50.8	89.3	65.6	59.1	55.4	94.9	74.0	67.5	51.5	89.7	65.6	57.6	---	---	---	---
SY Raptor	49.3	85.1	64.2	51.0	54.3	89.6	70.3	55.5	48.3	86.3	61.5	50.2	---	---	---	---
UI Castle CL+	51.9	92.7	67.6	94.3	52.7	89.7	66.1	73.0	52.2	89.5	70.6	75.2	51.1	96.3	66.6	99.5
UI Magic CL+	51.6	88.0	65.9	84.8	54.1	90.8	70.3	75.8	52.4	89.8	64.9	69.5	51.7	96.8	68.1	101.7
UI Sparrow	53.4	92.1	73.3	88.7	56.9	91.1	70.3	76.4	54.5	90.2	74.6	71.7	52.8	94.7	72.6	93.9
UIL 07-28017B	50.4	87.9	68.3	58.5	51.5	89.6	68.9	59.7	51.1	90.3	69.7	55.9	---	---	---	---
UIL 11-456031A	52.0	86.2	66.8	65.3	53.7	87.1	67.5	64.9	50.9	86.2	65.7	56.6	51.0	90.2	70.8	85.3
VI Voodoo CL+	51.1	89.3	67.0	89.5	52.5	91.0	70.0	81.0	52.1	91.3	66.4	73.6	52.9	97.8	69.4	108.5
UIL 17-6333 CL+	53.1	90.3	69.5	83.8	52.8	92.7	72.0	77.8	52.4	92.7	68.6	70.2	52.4	102.6	76.3	101.6
UIL 17-6546 CL+	52.0	90.1	65.6	66.2	53.4	90.1	72.2	66.6	51.4	89.3	64.6	57.3	50.0	96.7	66.4	83.6
UIL 17-6834 CL+	54.4	96.7	70.4	76.8	56.7	96.0	76.2	73.2	56.1	98.8	70.0	69.4	53.2	103.6	69.9	95.9
VI Shock	51.8	93.1	68.5	78.1	51.7	88.8	67.0	67.9	51.2	90.1	61.8	65.9	51.5	101.9	69.7	99.9
WA8275 CL+	49.6	90.6	67.4	64.6	---	---	---	---	---	---	---	---	---	---	---	---
WB 456	52.1	86.8	66.0	60.3	54.1	87.5	72.4	65.9	52.1	88.9	66.4	55.7	---	---	---	---
WB1376CLP	51.2	91.6	68.5	67.0	55.9	90.5	68.6	64.0	53.0	92.4	67.6	56.9	---	---	---	---
WB1529	57.0	96.6	75.5	69.2	55.4	92.2	81.0	76.8	54.7	94.5	69.8	71.0	---	---	---	---
WB1783	52.3	91.9	68.4	78.9	60.1	99.0	84.6	71.3	57.7	100.4	77.7	67.7	---	---	---	---
Eltan	---	---	---	---	---	---	---	---	---	---	---	---	53.5	104.5	78.6	108.5
LCS 72916	---	---	---	---	---	---	---	---	---	---	---	---	51.4	94.0	69.4	82.5
LCS Sonic	---	---	---	---	---	---	---	---	---	---	---	---	52.2	96.4	68.0	99.6
Otto	---	---	---	---	---	---	---	---	---	---	---	---	53.9	104.2	73.3	110.2
VI Presto CL+	---	---	---	---	---	---	---	---	---	---	---	---	49.3	85.8	65.0	73.3
Eltan 11-52-0	---	---	---	---	---	---	---	---	---	---	---	---	52.6	98.1	77.3	109.4
Bobtail (QC)	---	---	---	---	52.1	87.0	68.7	68.6	51.4	87.7	65.2	66.8	---	---	---	---
Location average	53.1	91.7	69.6	68.8	55.9	92.2	75.7	70.2	54.2	93.7	70.1	65.6	52.1	97.2	71.9	97.3

(QC) = Double entry for data quality analysis.

Table 74. Hard Spring Wheat Grain Protein & Kernel Hardness, 2019.

Variety or Selection	-----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												
12SB0224 (W)	13.0	13.8	12.5	14.6	---	13.4	81	74	71	71	---	74.3
Alum	14.8	15.9	14.1	16.5	14.0	15.0	80	83	80	85	62	78.0
Alzada (D)	14.6	15.7	13.2	14.7	---	14.5	100		100	91	---	97.0
AP Octane	13.0	14.3	12.4	---	---	13.2	67	67	62	---	---	65.3
AP Renegade	14.3	14.0	12.2	15.1	---	13.9	80	91	74	87	---	83.0
AP Venom	13.9	13.7	12.6	---	---	13.4	60	62	59	---	---	60.3
Cabernet	13.7	13.5	12.7	15.2	---	13.8	70	66	67	58	---	65.3
CPX36619	14.5	14.8	13.2	15.0	14.0	14.3	75	83	76	77	61	74.4
Dayn (W)	13.4	14.3	13.0	14.5	14.2	13.9	82	82	81	74	75	78.8
Glee	14.1	14.6	13.8	15.5	13.0	14.2	75	79	74	72	64	72.8
IDO1603S	15.0	14.8	14.0	14.9	15.6	14.9	71	73	70	76	60	70.0
IDO1701S	14.4	15.3	14.0	16.1	15.3	15.0	71	76	68	77	62	70.8
IDO1702S	11.2	11.5	10.6	13.1	11.5	11.6	30	28	20	40	20	27.6
IDO1805S	14.3	14.7	13.4	16.1	14.7	14.6	72	80	70	73	68	72.6
Imperial	16.8	17.7	16.1	16.9	12.7	16.0	100	100	100	100	---	100
Jefferson	14.0	14.0	13.8	16.0	14.0	14.4	78	78	70	78	68	74.4
Klasic (W)	13.8	13.3	13.9	15.7	13.9	14.1	60	54	58	47	54	55
Klasic (W) 1.2	13.7	13.4	13.5	14.9	13.6	13.8	63	54	55	56	52	56
Klasic (W) 1.4	14.0	13.4	13.4	15.8	13.7	14.0	60	53	58	52	51	55
SY Coho	14.2	14.6	13.5	15.6	---	14.5	82	81	77	84	---	81.0
SY Gunsight	13.3	14.7	13.2	15.4	---	14.2	70	75	68	62	---	68.8
SY-Teton (W)	13.4	13.2	12.7	14.6	12.8	13.3	60	58	60	64	54	59
UI Platinum (W)	13.2	13.4	13.2	14.4	13.2	13.5	69	68	65	76	59	67
WA8280 CL+	14.0	15.7	14.0	16.5	15.1	15.1	80	76	84	75	64	75.8
WB7202CLP	13.4	13.0	12.7	15.0	12.6	13.4	76	76	74	81	66	75
WB7328 (W)	14.9	14.6	14.6	16.1	13.8	14.8	67	64	63	61	59	63
WB7589 (W)	15.3	14.6	13.0	15.0	13.7	14.3	80	75	71	71	70	73
WB7696	13.3	12.9	13.1	15.4	14.1	13.8	71	62	65	68	61	65
WB9411	14.8	15.8	13.4	16.1	14.0	14.8	79	80	75	74	70	75.6
WB9590	15.2	15.0	15.3	16.5	15.2	15.4	87	77	81	77	82	80.8
WB9668	15.9	16.8	14.9	16.4	15.4	15.9	81	85	77	72	75	78.0
WB9879CLP	15.0	15.3	14.4	16.1	---	15.2	84	77	79	77	73	78.0
MT1621	---	---	---	---	15.5	15.5	---	---	---	---	79	79
MT 1865	---	---	---	---	14.4	14.4	---	---	---	---	80	80
Choteau	---	---	---	---	15.0	15.0	---	---	---	---	73	73
DuClair	---	---	---	---	14.2	14.2	---	---	---	---	75	75
BZ902-413 (W)	---	---	---	---	15.4	15.4	---	---	---	---	76	76
MT1673	---	---	---	---	15.4	15.4	---	---	---	---	69	69
SY Selway	---	---	---	---	14.3	14.3	---	---	---	---	79	79
Imperial QC	17.5	17.1	16.5	---	---	17.0	100	100	100	---	---	100
Location Average	14.2	14.5	13.5	15.4	14.1	14.4	75	73	71	72	65	73

(W) = White
(D) = Durum

Table 75. Percent Flour Protein and Flour Yield for Hard Spring Wheat at Rupert, Aberdeen, Idaho Falls, Ashton, and Soda Springs, 2019.

Variety or Selection	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												
Alum	13.1	13.7	12.7	14.8	12.4	13.3	76.4	74.7	78.4	73.6	74.7	75.5
AP Octane	12	11.9	11.5	---	---	11.8	74.0	72.0	74.4	---	---	73.5
AP Renegade	12.4	11.9	10.9	12.9	12.2	12.1	76.1	75.1	76.9	72.2	74.1	74.9
AP Venom	12	12.6	11.6	---	---	12.1	72.3	71.5	73.4	---	---	72.4
Cabernet	12.7	12	11.9	14.2	---	12.7	77.5	76.9	77.9	73.5	---	76.4
CPX36619	12.4	13.2	12	13	---	12.7	76.6	76.0	77.5	72.8	---	75.7
Glee	12.7	12.6	12.4	13.7	11.8	12.6	76.3	75.5	77.3	73.3	74.7	75.4
IDO1603S	13.5	13.6	12.5	13.6	12.8	13.2	75.1	74.9	76.6	73.6	72.8	74.6
IDO1701S	13.3	12.8	12.5	14.3	13.4	13.3	75.4	75.1	75.9	71.6	72.0	74.0
IDO1702S	11.1	11.4	10	12.9	10	11.1	73.9	76.0	73.5	68.5	71.3	72.7
IDO1805S	12.5	12.3	11.9	14.4	12.1	12.6	75.6	75.2	75.3	71.2	73.1	74.1
Jefferson	12.1	11.8	12.2	14	12.4	12.5	76.2	73.9	76.6	73.3	73.8	74.8
SY Coho	12.8	13	12.5	14	---	13.1	75.2	73.7	75.0	72.7	---	74.1
SY Gunsight	10.8	13.2	11.7	13.4	---	12.3	75.6	73.8	76.2	72.4	---	74.5
WA8280 CL+	12.6	13.4	12.8	14.1	12.1	13.0	74.7	72.3	74.7	72.8	72.9	73.5
WB7202CLP	11.4	11.1	11.7	13	10.5	11.5	73.4	70.9	72.6	69.6	71.3	71.5
WB7696	11.7	11.5	11.9	13.2	12.4	12.1	74.3	72.5	75.9	71.9	73.8	73.7
WB9411	12.7	13	12	14.2	11.9	12.8	74.5	72.8	75.5	71.6	73.9	73.7
WB9590	13.8	12.3	13.5	14.5	12.6	13.3	74.5	73.3	74.5	71.0	71.6	73.0
WB9668	12	14.2	13.2	14.8	13.2	13.5	73.4	73.0	74.1	70.7	72.0	72.6
WB9879CLP	11.5	13	13.1	14.1	12.2	12.8	71.7	70.5	72.7	71.5	70.3	71.4
MT1621	---	---	---	---	14.2	14.2	---	---	---	---	71.8	71.8
MT 1865	---	---	---	---	12.5	12.5	---	---	---	---	72.9	72.9
Choteau	---	---	---	---	13	13.0	---	---	---	---	70.1	70.1
DuClair	---	---	---	---	11.5	11.5	---	---	---	---	71.8	71.8
MT1673	---	---	---	---	13.7	13.7	---	---	---	---	74.2	74.2
SY Selway	---	---	---	---	12.9	12.9	---	---	---	---	74.8	74.8
Location Average	12.3	12.6	12.1	13.8	12.4	12.7	12.7	12.7	12.9	12.7	12.7	12.7
Hard White Spring												
12SB0224 (W)	11.5	11.1	11.5	13.6	---	11.9	72.4	71.3	72.0	71.4	---	71.8
Dayn (W)	12.2	12.2	12.1	13.4	11.5	12.3	75.3	75.1	75.2	72.0	73.5	74.2
Klasic (W)	12.2	11.9	12.4	13.3	11.6	12.3	76.6	73.4	76.5	70.8	75.1	74.5
Klasic (W) 1.2	12	12	12.1	13.4	12.2	12.3	76.5	73.4	76.8	74.2	74.6	75.1
Klasic (W) 1.4	12.2	11.8	12.6	13.6	11.1	12.3	76.9	73.2	77.1	70.9	75.7	74.8
SY-Teton (W)	11.5	11.3	11.3	13.1	10.5	11.5	74.5	73.3	75.5	72.4	72.9	73.7
UI Platinum (W)	12.4	11.2	12.1	13	11.4	12.0	76.4	75.3	77.3	73.5	75.7	75.6
WB7328 (W)	13.5	13.2	13	13.9	12.4	13.2	74.0	72.6	75.6	70.4	72.4	73.0
WB7589 (W)	13.9	13.1	12.4	13.9	12.1	13.1	72.8	72.8	74.1	71.7	72.7	72.8
BZ902-413 (W)	---	---	---	---	13	13.0	---	---	---	---	68.2	68.2
Location Average	12.4	12.0	12.2	13.5	11.8	12.4	75.0	73.4	75.6	71.9	73.4	73.4

mb = moisture basis

Table 76. Bake Volume for Hard Spring Wheat, 2019.

Variety or Selection	Bake Volume (cc)					Average
	Aberdeen	Ashton	Idaho Falls	Rupert	Soda Springs	
Hard Red Spring Wheat						
Alum	1200	1200	1025	1125	1050	1120
AP Octane	1150	---	975	1025	---	1050
AP Renegade	1000	1125	900	1025	---	1013
AP Venom	1175	---	1050	1125	---	1117
Cabernet	1200	1300	1075	1075	---	1163
CPX36619	1150	1150	1025	1000	1050	1075
Glee	1100	1250	1100	1175	1075	1140
IDO1603S	1250	1200	1150	1225	1175	1200
IDO1701S	1150	1225	1025	1150	1175	1145
IDO1702S	---	---	---	---	925	925
IDO1805S	1150	1225	1025	1200	1050	1130
Jefferson	1175	1250	1125	1125	1125	1160
SY Coho	1150	1200	1000	1100	---	1113
SY Gunsight	1125	1200	1025	1050	---	1100
WA8280 CL+	1100	1225	1075	1100	1100	1120
WB7202CLP	1125	1175	1050	1025	1050	1085
WB7696	1175	1225	1125	1125	1275	1185
WB9411	1150	1225	1000	1075	1075	1105
WB9590	1025	1250	1050	1000	1050	1075
WB9668	1200	1400	1100	1025	1125	1170
WB9879CLP	900	925	775	825	850	855
MT1621	---	---	---	---	1125	1125
MT 1865	---	---	---	---	1075	1075
Choteau	---	---	---	---	1050	1050
DuClair	---	---	---	---	1075	1075
MT1673	---	---	---	---	1075	1075
SY Selway	---	---	---	---	1075	1075
Location Average	1133	1208	1034	1079	1077	1093
Hard White Spring Wheat						
12SB0224	1025	1100	925	950	---	1000
Dayn	1100	1175	925	1025	1050	1055
Klasic	1100	1250	1200	1175	1125	1170
Klasic 1.2	1100	1250	1150	1175	1175	1170
Klasic 1.4	1200	1250	1150	1150	1075	1165
SY-Teton	1075	1250	1100	1075	1075	1115
UI Platinum	1075	1200	1075	1050	1050	1090
WB7328	1250	1250	1200	1125	1125	1190
WB7589	1225	1250	1125	1200	1150	1190
BZ902-413	---	---	---	---	1125	1125
Location Average	1128	1219	1094	1103	1106	1127

Table 77. Soft White Spring Wheat Grain Protein & Kernel Hardness, 2019.

Variety or Selection	-----Grain Protein %-----						-----Kernel Hardness 0-100-----					
	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average
Alturas	10.5	11.2	9.8	10.8	10.4	10.5	29	27	29	32	23	28.0
IDO1401S	10.9	10.2	10.2	12.2	11.4	11.0	37	29	27	31	25	29.8
UI Cookie	11.3	11.3	10.2	11.6	11.2	11.1	30	21	26	19	23	23.8
Louise	10.6	12.0	11.2	12.0	12.5	11.6	33	29	31	28	27	29.6
Melba*	10.4	11.4	9.8	11.8	11.3	10.9	38	34	32	33	28	33.0
Ryan	10.9	11.1	10.2	10.8	10.3	10.7	36	24	30	24	28	28.4
Seahawk	11.3	11.4	11.0	11.3	11.0	11.2	34	31	33	31	28	31.4
SY Saltese	11.0	12.3	10.8	11.8	11.0	11.4	34	28	28	24	24	27.6
Tekoa	10.5	12.4	10.7	11.9	11.3	11.3	34	35	32	29	30	32.0
UI Pettit	10.7	11.4	10.8	12.1	11.2	11.2	36	32	31	28	31	31.6
UI Stone	11.1	10.8	9.7	10.3	11.1	10.6	30	21	25	17	20	22.6
WA 8297 CL+	11.7	13.3	11.0	12.4	10.6	11.8	28	26	25	28	23	26.0
WA 8303	11.4	11.5	10.2	11.2	11.4	11.2	31	32	31	25	26	29.0
WB-1035CL+	12.7	12.2	11.2	12.4	11.1	11.9	38	29	34	25	30	31.2
WB6121	12.2	12.7	10.9	11.3	13.3	12.1	30	27	30	27	27	28.2
WB6430	10.3	11.4	9.9	10.8	12.2	10.9	32	27	28	27	29	28.6
Melba* (QC)	9.7	11.3	10.1	11.1	10.9	10.6	34	29	34	32	26	31.0
Alturas (QC)	10.7	11.6	10.1	10.4	11.7	10.9	23	29	33	27	---	28.0
Location Average	11.0	11.6	10.4	11.5	11.3	11.2	32.6	28.3	29.9	27.1	26.4	28.9

* Indicates club wheat

(QC) = Double entry for data quality analysis.

Table 78. Percent Flour Protein and Flour Yield for Soft White Spring Wheat at Rupert, Aberdeen, Idaho Falls, Ashton, and Soda Springs, 2019.

Variety or Selection	Flour Protein (14% mb)						Flour Yield (%)					
	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average
Alturas	10.9	11.7	10.2	11.4	10.6	11.0	77	76	77	76	78	76.5
IDO1401S	10.7	10.4	10.3	11.5	10.8	10.7	78	76	76	75	76	76.2
UI Cookie	11.1	11.9	10.1	11.9	12	11.4	75	75	75	73	73	74.3
Louise	10.7	11.9	10.2	11.8	11	11.1	77	75	76	74	75	75.2
Melba*	10.6	11.1	9.2	11.7	10	10.5	78	78	79	74	75	76.9
Ryan	11.5	11.7	10.1	11.2	10.8	11.1	78	77	77	75	75	76.4
Seahawk	11.7	11.8	10.3	10.9	10.6	11.1	78	76	76	75	75	76.0
SY Saltese	11.1	11.8	10.5	11.5	10.8	11.1	76	75	76	74	75	75.1
Tekoa	11.1	12	10.5	11.5	10.6	11.1	78	76	77	75	77	76.7
UI Pettit	11.1	11.5	10.2	11.7	10.8	11.1	78	74	77	75	76	75.9
UI Stone	11.4	11.2	9.6	10.5	10.4	10.6	77	76	78	77	76	76.7
WA 8297 CL+	11.9	12.6	11	10.9	11.2	11.5	76	73	75	76	75	74.9
WA 8303	11.4	11.2	10.5	10.8	10.5	10.9	74	74	75	75	74	74.2
WB-1035CL+	13.2	12.7	11.4	12.2	12.7	12.4	74	72	74	73	73	73.3
WB6121	12.3	12.6	11	11.2	12	11.8	76	75	76	75	73	74.9
WB6430	11	11.6	9.6	10	10.7	10.6	77	76	77	75	75	76.1
Melba* (QC)	10	11.1	10	10.1	10.7	10.4	78	76	78	76	74	76.6
Alturas (QC)	11.4	12	10.4	9.9	---	10.9	77	75	77	77	---	76.3
Location Average	11.3	11.7	10.3	11.2	11.0	11.1	76.7	75.4	76.4	74.9	74.9	75.7

mb = Moisture basis

* = Indicates club wheat

(QC) = Double entry for data quality analysis.

Table 79. Percent Break Flour and Cookie Diameter for Soft White Spring Wheat at Rupert, Aberdeen, Idaho Falls, Ashton, and Soda Springs, 2019.

Variety or Selection	Break Flour (%)						Cookie Diameter (cm)					
	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average	Rupert	Aberdeen	Idaho Falls	Ashton	Soda Springs	Average
Alturas	48	51	49	50	50	49.8	9.0	9.0	8.8	9.0	9.0	9.0
IDO1401S	53	56	49	54	55	53.4	9.1	9.5	9.2	9.2	9.4	9.3
UI Cookie	49	52	50	50	49	50.0	8.9	9.3	9.3	8.9	8.8	9.1
Louise	51	52	50	50	50	50.5	9.1	9.0	9.1	9.1	9.3	9.1
Melba*	55	54	53	51	52	53.0	9.1	9.4	9.2	9.3	9.4	9.3
Ryan	52	52	50	50	50	50.9	8.7	9.1	8.8	8.8	9.0	8.9
Seahawk	53	51	49	51	50	50.8	8.8	9.0	9.1	8.9	8.8	8.9
SY Saltese	52	52	50	51	49	50.8	9.0	8.8	9.1	9.1	8.9	9.0
Tekoa	54	53	51	53	52	52.6	9.2	9.1	9.0	9.2	9.0	9.1
UI Pettit	51	50	51	50	49	50.3	8.9	9.3	9.1	8.9	9.0	9.0
UI Stone	54	53	54	53	52	53.2	9.0	9.4	9.4	9.2	9.0	9.2
WA 8297 CL+	53	52	52	55	52	53.0	8.9	9.0	9.1	9.0	9.0	9.0
WA 8303	50	51	50	53	51	51.2	9.0	9.0	9.2	9.2	9.2	9.1
WB-1035CL+	45	45	43	46	43	44.5	8.5	8.7	8.9	8.6	8.4	8.6
WB6121	47	47	46	51	45	47.3	8.8	9.0	9.1	8.8	8.6	8.9
WB6430	52	51	52	53	50	51.5	9.1	8.9	9.2	9.4	9.4	9.2
Melba (QC)	52	53	52	55	50	52.5	9.2	9.3	9.1	9.3	9.3	9.3
Alturas (QC)	48	50	49	52	---	49.7	9.0	8.9	9.0	9.3	---	9.0
Location Average	51.2	51.3	50.2	51.5	49.9	50.8	9.0	9.1	9.1	9.1	9.0	9.1

*= Indicates club wheat

(QC) = Double entry for data quality analysis.

Table 80. SRC (Solvent Retention Capacity) data for Soft White Spring Wheat at Rupert, Aberdeen, Idaho Falls, 2019.

Variety or Selection	Rupert				Aberdeen				Idaho Falls			
	Water	Sucrose	Na2CO3	LacticAcid	Water	Sucrose	Na2CO3	LacticAcid	Water	Sucrose	Na2CO3	LacticAcid
Alturas	51.1	92.4	68.6	94.0	52.3	97.0	78.1	87.3	51.8	90.8	70.7	77.8
IDO1401S	48.1	88.6	66.3	83.0	49.6	92.2	72.6	74.1	49.6	88.8	69.2	69.0
IDO1405S	50.0	91.5	68.7	92.6	50.1	97.5	74.6	92.7	50.9	89.0	67.5	71.6
Louise	50.2	89.7	68.6	93.6	50.7	95.7	71.9	94.7	51.9	88.7	71.6	85.1
Melba*	50.9	85.5	70.2	73.7	50.2	85.3	71.3	67.1	51.5	80.4	71.6	58.3
Ryan	52.0	89.8	69.0	74.8	51.4	91.6	70.1	77.4	52.4	87.6	69.2	66.1
Seahawk	50.8	95.0	74.9	72.1	52.4	96.7	76.2	77.0	51.6	92.5	69.7	64.0
SY Saltese	50.6	95.1	71.0	85.6	49.7	96.7	71.4	93.8	50.5	90.8	66.3	82.4
Tekoa	49.2	93.3	68.6	85.5	48.6	93.3	68.3	96.2	48.9	90.1	66.3	81.2
UI Pettit	50.5	92.2	67.8	80.0	50.7	92.1	74.6	82.6	50.8	88.8	68.3	68.7
UI Stone	50.0	93.6	70.1	94.7	50.1	91.5	71.8	86.4	49.9	89.4	67.5	81.4
WA 8297 CL+	51.4	99.0	79.1	99.9	52.5	103.0	77.5	109.2	51.6	94.9	76.8	93.0
WA 8303	53.3	99.1	74.3	87.4	50.3	99.7	77.1	92.9	51.9	94.5	75.0	75.0
WB-1035CL+	56.1	107.7	75.0	88.8	55.3	108.1	79.9	82.3	57.1	101.5	72.8	64.5
WB6121	52.2	96.0	67.7	84.8	50.9	97.6	68.3	86.0	51.6	93.7	65.7	67.1
WB6430	51.0	90.5	71.1	63.3	50.5	89.1	71.1	63.1	50.7	85.6	65.9	54.8
Melba (QC)	51.2	85.9	69.1	63.0	50.2	84.2	67.8	67.8	52.1	84.7	66.2	62.3
Alturas (QC)	51.4	94.9	68.5	90.9	51.8	94.2	74.1	90.1	52.6	91.2	69.9	79.2
Location average	51.1	93.3	70.5	83.8	51.0	94.7	73.1	84.5	51.5	90.2	69.5	72.3

Variety or Selection	Ashton				Soda Springs			
	Water	Sucrose	Na2CO3	LacticAcid	Water	Sucrose	Na2CO3	LacticAcid
Alturas	51.6	92.7	75.4	101.3	53.8	93.5	73.1	103.4
IDO1401S	50.3	93.0	80.0	94.0	50.2	94.1	73.8	103.9
IDO1405S	51.2	97.3	80.1	109.5	51.1	99.1	71.0	115.8
Louise	52.0	93.3	71.7	108.0	52.0	90.1	71.4	105.9
Melba*	51.0	84.2	73.6	77.0	51.0	84.6	66.7	73.5
Ryan	52.1	89.0	73.1	80.2	51.9	89.2	70.7	91.1
Seahawk	51.0	92.0	76.5	78.6	52.1	91.7	72.4	92.7
SY Saltese	51.4	96.5	75.0	101.4	50.9	92.1	68.1	106.0
Tekoa	50.4	91.7	73.4	98.6	51.0	88.8	68.3	107.6
UI Pettit	52.5	91.1	74.8	91.2	51.4	91.4	67.8	91.0
UI Stone	49.7	87.3	74.3	94.3	50.6	91.4	69.4	105.7
WA 8297 CL+	55.3	94.1	82.3	97.8	52.0	98.1	75.8	113.8
WA 8303	52.6	93.7	81.2	81.2	50.6	100.4	74.7	102.1
WB-1035CL+	57.4	105.4	78.9	90.5	56.2	106.6	76.3	103.5
WB6121	52.0	95.4	73.2	84.8	51.6	96.3	67.2	97.0
WB6430	51.2	87.4	72.3	62.5	51.6	88.7	66.7	68.6
Melba (QC)	50.8	83.3	68.7	67.9	50.9	87.7	66.0	71.7
Alturas (QC)	51.9	90.2	75.2	85.8	---	---	---	---
Location average	51.3	87.0	72.1	72.0	51.2	88.2	66.3	70.2

* = Indicates club wheat

(QC) = Double entry for data quality analysis.

Addendum 1. Stripe rust (*Puccinia striiformis* f. sp. *tritici*) ratings for 2019 winter wheat. Stripe rust was not severe in 2020 in Southeast Idaho. 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 or Selection	Stripe Rust Infection Type (IT)	Percent Leaf Area Infected (PLAI)	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

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

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 applications in severe years

2019 Disease Ratings in Aberdeen

Soft white winter wheat under naturally occurring infection

Variety or Selection	Stripe Rust Infection Type (IT)	Percent Leaf Area Infected (PLAI)	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
Rosalyn	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 17-6333 (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
VI Bulldog	0.0	0	0.00	R
VI Shock	0.0	0	0.00	R
VI Voodoo CL+	6.0	1	0.06	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. Stripe rust was not severe in 2020 in Southeast Idaho. 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 or Selection	Stripe Rust Infection Type (IT)	Percent Leaf Area Infected (PLAI)	IT x PLAI (%)	Stripe Rust Rating
12SB0224 (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 or Selection	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 Saltese	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 2019 FHB Spring Wheat Screening nursery, Aberdeen, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*, and sprayed with *F. graminearum* conidia. 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 in a column are not significantly different.

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

Variety or Selection	Resistance Rating	FHB Index* (%)	FDK (%)	DON (ppm)
Rollag	MR	3.8 F	3.8 F	1.7 E
Alum	S	36.7 A-E	36.7 A-E	9.7 A-E
AP Renegade	S	18.4 EF	18.4 EF	4.3 CDE
Choteau	S	21.8 C-F	21.8 C-F	5.2 CDE
DuClair	S	28.0 B-F	28.0 B-F	2.3 E
HRS3419	S	35.8 A-E	35.8 A-E	1.8 E
IDO1702S	S	25.8 B-F	25.8 B-F	7.5 CDE
IDO1805S	S	41.9 A-E	41.9 A-E	3.7 DE
Jefferson	S	25.8 B-F	25.8 B-F	17.2 ABC
LCS Iron	S	34.3 A-E	34.3 A-E	8.7 A-E
MT1621	S	35.5 A-E	35.5 A-E	9.7 A-E
SY Selway	S	40.8 A-E	40.8 A-E	6.4 CDE
USW11200024-1-4	S	34.5 A-E	34.5 A-E	9.5 A-E
WA 8280 CL+	S	28.0 B-F	28.0 B-F	8.4 B-E
WB9411	S	33.1 A-F	33.1 A-F	8.5 A-E
WB9590	S	25.2 B-F	25.2 B-F	4.1 CDE
WB9879CLP	S	21.3 DEF	21.3 DEF	5.0 CDE
Cabernet	VS	39.8 A-E	39.8 A-E	14.7 A-D
CPX36619	VS	31.1 A-F	31.1 A-F	24.8 A
Glee	VS	35.5 A-E	35.5 A-E	13.7 A-E
IDO1603S	VS	43.6 A-D	43.6 A-D	9.9 A-E
IDO1701S	VS	59.4 A	59.4 A	9.4 A-E
Kelse	VS	45.1 A-D	45.1 A-D	15.1 A-D
MT1673	VS	37.1 A-E	37.1 A-E	12.9 A-E
SY Basalt	VS	56.8 AB	56.8 AB	19.2 ABC
SY Coho	VS	61.2 A	61.2 A	16.3 ABC
SY Gunsight	VS	52.9 AB	52.9 AB	7.8 B-E
USW11200083-1-3	VS	52.1 ABC	52.1 ABC	11.3 A-E
WB936	VS	54.8 AB	54.8 AB	20.0 AB
WB9518	VS	33.3 A-E	33.3 A-E	16.6 ABC
WB9668	VS	55.9 AB	55.9 AB	9.8 A-E
MT1865		17.7 EF	17.7 EF	NA
<i>P</i> ($\alpha=0.05$)		0.0261 *	0.0261 *	0.1424 ns

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 3b. Results from the 2019 FHB Spring Wheat Screening nursery, Aberdeen, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*, and sprayed with *F. graminearum* conidia. 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 in a column are not significantly different.

Table 2. Screening (13) hard white spring wheat and (2) durum varieties for FHB resistance

Variety or Selection	Resistance Rating	FHB Index* (%)	FDK (%)	DON (ppm)
12SB0224	S	19.1 A	19.1 A	10.7 CDE
BZ902-413W	S	36.0 AB	36.0 AB	8.7 DE
Dayn	S	21.0 B	21.0 B	3.5 E
LCS Star	S	38.6 AB	38.6 AB	10.4 CDE
Snow Crest	S	35.2 AB	35.2 AB	7.2 DE
WB-Paloma	S	50.2 AB	50.2 AB	22.4 B
Alzada (D)	VS	63.7 A	63.7 A	19.0 BC
Imperial (D)	VS	33.9 AB	33.9 AB	63.9 A
Klasic	VS	50.7 AB	50.7 AB	15.1 BCD
SY Teton	VS	46.9 AB	46.9 AB	9.0 CDE
UI Platinum	VS	60.0 AB	60.0 AB	10.7 CDE
WB7202CLP	VS	49.1 AB	49.1 AB	15.6 BCD
WB7328	VS	60.7 AB	60.7 AB	21.9 B
WB7589	VS	42.4 AB	42.4 AB	9.7 CDE
WB7696	VS	30.6 AB	30.6 AB	11.0 CDE
<i>P</i> ($\alpha=0.05$)		0.3687 ns	0.3687 ns	<.0001 **

(D)=durum wheat

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 2019 FHB Spring Wheat Screening nursery, Aberdeen, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*, and sprayed with *F. graminearum* conidia. 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 in a column are not significantly different.

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

Variety or Selection	Resistance Reating	FHB Index* (%)	FDK (%)	DON (ppm)
Alturas	S	25.3 ^{CD}	25.3 ^{CD}	2.5 ^E
IDO1401S	S	18.2 ^D	18.2 ^D	7.6 ^{CDE}
IDO1405S	S	18.3 ^D	18.3 ^D	6.2 ^{CDE}
SY Saltese	S	25.2 ^{CD}	25.2 ^{CD}	5.8 ^{CDE}
Tekoa	S	32.1 ^{BCD}	32.1 ^{BCD}	10.9 ^{B-E}
UI Pettit	S	27.7 ^{CD}	27.7 ^{CD}	15.6 ^{ABC}
UI Stone	S	31.0 ^{BCD}	31.0 ^{BCD}	4.7 ^{DE}
WA 8297 CL+	S	34.7 ^{BCD}	34.7 ^{BCD}	12.6 ^{A-E}
WB6121	S	22.0 ^{CD}	22.0 ^{CD}	10.9 ^{B-E}
AP Coachman	VS	43.5 ^{A-D}	43.5 ^{A-D}	12.1 ^{A-E}
Louise	VS	47.9 ^{ABC}	47.9 ^{ABC}	12.3 ^{A-E}
Melba	VS	36.7 ^{A-D}	36.7 ^{A-D}	15.9 ^{ABC}
Ryan	VS	51.0 ^{AB}	51.0 ^{AB}	21.4 ^A
Seahawk	VS	50.6 ^{ABC}	50.6 ^{ABC}	3.9 ^{DE}
WA 8303	VS	41.7 ^{A-D}	41.7 ^{A-D}	14.0 ^{A-D}
WB-1035CL+	VS	32.1 ^{BCD}	32.1 ^{BCD}	20.1 ^{AB}
WB6430	VS	65.3 ^A	65.3 ^A	8.6 ^{CDE}
<i>P</i> ($\alpha=0.05$)		0.0695 ^{ns}	0.1 ^{ns}	0.0 [*]

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 4. Results from the 2019 FHB Spring Wheat Screening nursery, Kimbrly, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*, and sprayed with *F. graminearum* conidia. 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 in a column are not significantly different.

Variety or Selection	Resistance Rating	FHB Index* (%)	FDK (%)	DON (ppm)
HRS3419	MR	5.6 BC	3.0 F	11.2 G
Rollag	MR	2.5 C	1.4 F	6.6 G
Alturas	MS	11.7 BC	3.4 F	22.3 FG
LCS Iron	S	9.7 BC	16.8 EF	21.9 FG
UI Stone	S	40.0 BC	13.0 EF	33.5 EF
Alzada	VS	104.8 A	67.0 A	45.1 DE
Cabernet	VS	47.8 B	57.5 AB	62.6 ABC
Jefferson	VS	29.7 BC	41.5 BC	48.2 CDE
Kelse	VS	21.4 BC	29.5 CDE	40.3 E
Klasic (W)	VS	112.2 A	45.5 BC	57.7 BCD
Louise	VS	32.8 BC	23.5 DE	61.0 A-D
Melba (club)	VS	17.0 BC	36.0 CD	74.2 A
Snow Crest	VS	35.6 BC	18.3 DEF	40.6 E
WB7589	VS	27.2 BC	71.0 A	65.0 AB
WB-Paloma	VS	42.2 BC	44.0 BC	64.1 ABC
<i>P</i> ($\alpha=0.05$)		0.0019 **	<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

Addendum 5a. Results from the 2019 FHB winter wheat screening nursery, Kimberly, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*, and sprayed with *F. graminearum* conidia. 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 in a column are not significantly different.

Table 1. Screening (41) hard winter wheat varieties for FHB resistance

Variety or Selection	Resistance Rating	FHB Index* (%)	FDK (%)	DON (ppm)	
Bobcat	MR	1.24	1.9	5.20	I-M
Curlew	MR	1.90	1.5	4.20	KLM
Deloris	MR	0.92	0.7	0.79	M
Golden Spike (W)	MR	0.57	8.7	8.20	H-L
IDO1506 (W)	MR	0.70	12.8	9.10	H-L
IDO1607	MR	1.19	5.6	8.50	H-L
Juniper	MR	0.73	4.2	5.60	I-M
Keldin	MR	1.17	3.0	4.20	KLM
Millie (W)	MR	0.09	3.4	4.40	KLM
MT1491 (HWW)	MR	0.52	2.5	11.65	F-I
Promontory	MR	0.34	9.9	9.00	H-L
UI SRG	MR	1.20	2.2	3.85	KLM
UICF Grace (HW)	MR	1.10	1.3	4.25	KLM
WA8252 (W)	MR	2.04	2.2	5.45	I-M
WB4623CLP	MR	0.00	4.0	3.05	LM
Whetstone	MR	0.90	6.1	6.45	H-M
FourOsix	MS	1.67	13.1	7.40	H-M
Greenville	MS	2.42	16.0	13.00	E-H
IDO1608	MS	0.25	33.1	4.65	I-M
IDO1806 (W)	MS	3.54	5.8	19.90	B-E
Irv (W)	MS	1.54	14.3	10.95	G-J
Ray	MS	5.34	9.5	8.85	H-L
AP Nugrain (W)	MS	3.79	2.6	7.45	H-M
Sequoia	MS	5.34	10.0	3.45	LM
SY Clearstone 2CL (W)	MS	2.95	24.0	11.25	F-J
UI Silver	MS	2.99	3.5	13.55	E-H
Utah 100	MS	2.92	17.0	8.40	H-L
WB4311	MS	3.15	7.2	8.10	H-L
LCS Jet	S	1.94	39.0	6.70	H-M
LCS Rocket	S	1.40	47.0	10.95	G-J
LCS Yeti	S	32.70	1.0	7.30	H-M
Norwest 553/Yellowstone (50/50)	S	1.09	79.5	20.00	B-E
SY Touchstone	S	2.44	50.0	25.00	ABC
Scorpio	S	0.40	50.8	11.60	F-I
WB4792	S	10.95	20.3	21.00	BCD
Yellowstone	S	3.37	36.8	18.30	C-F
AP Redeye	VS	9.78	46.5	16.65	D-G
UI Bronze Jade (W)	VS	3.62	76.0	31.50	A
LCS Zoom	VS	10.95	69.0	9.00	H-L
Norwest 553	VS	2.65	33.5	25.75	AB
WA8289	VS	5.33	69.8	21.80	BCD
<i>P</i> ($\alpha=0.05$)		0.0745ns	<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

Addendum 5b. Results from the 2019 FHB winter wheat screening nursery, Kimberly, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*, and sprayed with *F. graminearum* conidia. 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 in a column are not significantly different.

Table 2. Screening (46) soft winter wheat varieties for FHB resistance

Variety or Selection	Resistance Reating	FHB Index* (%)		FDK (%)		DON (ppm)	
Jasper	MR	0.67	GH	10.4	HL	6.40	JK
Norwest Duet	MR	2.62	FGH	3.4	JKL	6.90	JK
OR2X2CL+	MR	0.50	GH	9.3	HL	3.80	K
VI Presto CL+	MR	0.00	GH	0.5	L	5.60	JK
Stingray CL+	MR	0.37	GH	3.2	JKL	8.25	G-K
WB1376CLP	MR	1.75	GH	2.1	KL	8.65	F-K
Brundage	MS	7.68	C-H	1.8	L	7.00	JK
Eltan	MS	4.00	FGH	3.9	JKL	9.90	F-K
IDO1810	MS	5.17	D-H	1.6	L	7.85	H-K
LCS Hulk	MS	0.62	GH	18	H-L	10.90	F-K
Norwest Tandem	MS	0.85	GH	35	D-I	18.20	D-J
Appleby CL+	MS	0.92	GH	13.8	HL	8.80	F-K
Otto	MS	2.84	FGH	3	JKL	6.90	JK
Purl	MS	1.09	GH	21.4	F-L	15.95	D-K
SY Assure	MS	1.15	GH	16	H-L	11.00	F-K
SY Dayton	MS	4.37	E-H	3	JKL	15.80	D-K
SY Raptor	MS	1.14	GH	13	HL	15.20	D-K
UI Magic	MS	0.70	GH	11.3	HL	12.05	E-K
VI Bulldog	MS	2.35	FGH	15.3	H-L	9.95	F-K
VI Shock	MS	2.00	GH	7.5	HL	13.55	D-K
VI Voodoo CL+	MS	1.85	GH	20.3	F-L	10.00	F-K
WB456	MS	2.57	FGH	2.2	KL	11.65	F-K
Caledonia	S	30.92	B	0.9	L	5.40	K
IDO1708	S	3.92	FGH	32.8	D-K	21.40	C-F
LCS Shine	S	10.72	C-F	27.6	E-L	13.50	D-K
LCS Artdeco	S	1.22	GH	50.5	B-F	11.40	F-K
LCS Sonic	S	1.20	GH	27	E-L	30.80	ABC
Nixon	S	2.69	FGH	55.5	A-E	12.90	D-K
Stephens	S	2.32	FGH	49.5	B-G	20.55	D-H
SY Ovation	S	2.57	FGH	18.8	G-L	18.85	D-I
UI Castle	S	13.67	CD	12.5	HL	10.30	F-K
UI Sparrow	S	7.42	C-H	11.9	HL	12.90	D-K
UIL 17-6333 (CL+)	S	2.20	FGH	21.6	F-L	20.95	D-G
UIL 17-6834 (CL+)	S	1.17	GH	45	C-H	20.65	D-G
WA8271	S	6.50	D-H	4.3	HL	15.70	D-K
Bruneau	VS	9.59	C-G	33.3	D-J	34.60	AB
IDO1808	VS	5.92	D-H	67.5	ABC	20.15	D-H
LCS Ghost	VS	15.32	C	68	ABC	25.50	BCD
LCS Drive	VS	2.10	FGH	81.5	A	11.95	E-K
LCS Shark	VS	3.67	FGH	71.5	ABC	34.75	AB
LCS Blackjack	VS	7.10	C-H	76	AB	24.50	B-E
Rosalyn	VS	12.75	CDE	61.5	A-D	14.60	D-K
UIL 11-456031A	VS	5.03	D-H	73	ABC	37.15	AB
UIL 17-6546 (CL+)	VS	56.39	A	12	HL	11.55	F-K
WB1529	VS	10.75	C-F	54.5	A-E	39.40	A
WB1783	VS	5.42	D-H	68.5	ABC	30.95	ABC
<i>P</i> ($\alpha=0.05$)		<0.0001	**	<.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

Addendum 6a. Results from the 2019 FHB Spring Barley Screening nursery, Aberdeen, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*, and sprayed with *F. 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 in a column are not significantly different.

Table 1. Screening (44) two-rowed malt barley varieties for FHB resistance

Variety or Selection	Resistance rating	FHB Index (%)	DON (ppm)
Clho 4196	R	0.2	2.1
2IK14-8413	MR	3.8	3.6
AAC Connect	MR	1.7	2.8
AAC Synergy	MR	1.5	5.8
CDC Fraser	MR	2.3	4.7
Conlon	MR	0.8	1.7
Conrad	MR	2.6	3.8
Merem	MR	2.1	2.8
Moravian 179	MR	1.4	4.5
ND Genesis	MR	0.4	4.8
10ARS191-3	MS	4.3	5.8
2Ab08-X05M010-82	MS	2.9	3.1
95SR316A	MS	3.6	3.5
AC Metcalfe	MS	3.1	4.7
AD120341	MS	3.1	4.2
Bente	MS	8.3	8.6
CDC Bow	MS	3.6	5.8
CDC Copeland	MS	4.0	2.8
CDC Meredith	MS	4.8	3.7
Fandaga	MS	6.2	6.6
Fangio	MS	5.3	8.8
Far15-52A	MS	5.6	4.5
Gemcraft	MS	8.3	4.7
Golden Promise	MS	4.4	5.9
Harrington	MS	8.7	5.4
Hockett	MS	6.6	2.4
Klages	MS	5.8	5.1
Manta	MS	5.7	9.4
Merit 57	MS	5.3	6.3
Sangria	MS	7.0	7.4
2Ab07-X031098-31	S	8.8	5.9
2IM14-8212	S	6.8	8.8
ABI Eagle	S	10.6	5.6
ABI Growler	S	6.1	10.4
ABI Voyager	S	7.8	6.9
DH120058	S	10.9	14.3
DH120285	S	21.5	5.5
Esmā	S	11.9	9.5
Explorer	S	11.9	19.2
Full Pint	S	9.1	9.7
ICB 111809	S	10.5	10.8
LCS Genie	S	12.3	7.5
LCS Odyssey	S	8.4	10.8
Moravian 69	S	7.7	14.7
<i>P</i> ($\alpha=0.05$)		0.1654ns	0.0754ns

ns = non-significant

* 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	5 - 10
MS	10.1 - 20
S	20.1 - 30
VS	> 30

Addendum 6b. Results from the 2019 FHB Spring Barley Screening nursery, Aberdeen, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*, and sprayed with *F. 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 in a column are not significantly different.

Table 2. Screening (17+2) two-rowed feed barley varieties for FHB resistance

Variety or Selection	Resistance rating	Index		DON (ppm)
Clho 4196	R	0.2	c	2.1
08ARS208-11	MS	3.0	BC	3.3
Altorado	MS	2.0	BC	6.8
BZ512-319	MS	7.7	BC	6.0
Champion	MS	2.0	BC	7.6
Claymore	MS	5.7	BC	2.7
Goldenhart	MS	5.2	BC	1.9
Golf	MS	5.9	BC	5.3
Idagold II	MS	2.8	BC	5.8
Julie	MS	3.2	BC	2.4
Kardia	MS	2.8	BC	3.6
Lenetah	MS	3.2	BC	2.9
Oreana	MS	4.1	BC	10.6
Transit	MS	4.9	BC	4.7
Xena	MS	3.2	BC	5.1
ICB 111809	S	10.5	B	10.8
Otis	VS	41.7	A	8.6
<i>P</i> ($\alpha=0.05$)		0.0019	*	0.0642ns

* 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	5 - 10
MS	10.1 - 20
S	20.1 - 30
VS	> 30

Addendum 6c. Results from the 2019 FHB Spring Barley Screening nursery, Aberdeen, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum* , and sprayed with *F. 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 in a column are not significantly different.

Table 2. Screening (10) six-rowed barley varieties for FHB resistance

Variety or Selection	Resistance rating	Index	DON (ppm)	
Chevron	R	0.5	1.6	E
Quest	MR	0.8	3.7	DE
Stander	MS	1.2	10.5	B-D
Tradition	MS	4.3	8.7	CDE
Goldeneye	S	8.6	17.7	ABC
Millennium	S	8.6	14.2	BCD
UT11302-11	S	11.6	12.9	BCD
UTSB10905-72	S	11.5	12.7	BCD
PI383933	VS	37.4	20.4	AB
YU510-510	VS	12.8	28.4	A
<i>P</i> ($\alpha=0.05$)		0.1382ns	0.0244	*

* 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	5 - 10
MS	10.1 - 20
S	20.1 - 30
VS	> 30

Addendum 7a. Results from the 2019 FHB Spring Barley Screening nursery, Kimberly, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*, and sprayed with *F. 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 in a column are not significantly different.

Table 1. Screening (39 + 2) two-rowed malt barley varieties for FHB resistance

Variety or Selection	Resistance rating	FHB Index (%)	DON (ppm)	
CDC Copeland	MR	0.8	MNO	3.6 N
Clho 4196	MR	0.0	o	14.3 F-N
Far15-52A	MR	0.4	MN	5.5 RS
Golden Promise	MR	1.1	L-O	6.5 LMN
AAC Connect	MS	4.7	J-O	8.0 K-N
ABI Voyager	MS	4.0	J-O	6.5 LMN
CDC Meredith	MS	1.6	L-O	17.4 F-M
Conlon	MS	1.2	L-O	10.1 I-N
Harrington	MS	1.6	L-O	14.2 F-N
Merem	MS	3.9	J-O	7.4 K-N
ND Genesis	MS	1.0	L-O	10.3 I-N
10ARS191-3	S	6.0	H-O	8.6 K-N
2IM14-8212	S	7.5	GL	9.7 J-N
AAC Synergy	S	5.2	J-O	15.5 F-N
ABI Eagle	S	6.4	H-O	10.4 I-N
ABI Growler	S	7.1	G-M	12.2 G-N
AC Metcalfe	S	8.3	G-K	14.0 F-N
CDC Bow	S	4.1	J-O	14.0 F-N
CDC Fraser	S	4.3	J-N	11.0 L-S
Conrad	S	6.8	G-N	17.4 F-M
Explorer	S	5.3	I-O	10.2 I-N
Hockett	S	5.9	H-O	17.9 F-M
Klages	S	2.6	K-O	18.7 F-L
Manta	S	10.6	E-J	11.8 H-N
Merit 57	S	9.0	G-K	16.0 F-N
Moravian 179	S	13.5	D-F	15.4 F-N
Sangria	S	8.4	G-K	11.4 H-N
ICB 111809	VS	8.8	G-K	24.8 D-G
2IK14-8413	VS	6.9	G-N	23.7 D-H
AD120341	VS	18.0	BCD	32.7 B-E
Bente	VS	10.5	F-J	23.0 E-I
DH120058	VS	17.2	B-E	33.3 B-E
DH120285	VS	21.7	BC	58.3 A
Esma	VS	15.7	B-G	21.5 F-K
Fandaga	VS	16.9	B-F	19.7 F-N
Fangio	VS	39.8	A	38.2 BC
Full Pint	VS	11.9	D-J	21.7 F-K
Gemcraft	VS	12.2	D-H	18.8 F-L
LCS Genie	VS	23.7	B	36.0 BCD
LCS Odyssey	VS	18.1	BCD	44.9 B
Moravian 69	VS	7.5	GL	26.6 C-F
<i>P</i> ($\alpha=0.05$)		<.0001	**	<.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	5 - 10
MS	10.1 - 20
S	20.1 - 30
VS	> 30

Addendum 7b. Results from the 2019 FHB Spring Barley Screening nursery, Kimberly, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum* , and sprayed with *F. 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 in a column are not significantly different.

Table 2. Screening (14+2) two-rowed feed barley varieties for FHB resistance

Variety or Selection	Resistance Rating	FHB Index (%)	DON (ppm)	
Clho 4196	MR	0.0	14.3	BCD
Altorado	MS	4.1	10.1	DE
BZ512-319	MS	5.4	11.9	DE
Champion	MS	3.1	12.9	CDE
Claymore	MS	2.9	10.1	DE
Kardia	MS	3.7	8.7	DE
Xena	MS	4.0	6.2	E
Goldenhart	S	8.9	10.7	DE
Golf	S	10.4	12.1	DE
Idagold II	S	9.0	13.3	B-E
Julie	S	5.2	13.8	BCD
Lenetah	S	6.0	12.3	DE
Otis	S	8.9	19.9	ABC
Transit	S	7.0	13.7	B-E
ICB 111809	VS	8.8	24.8	A
Oreana	VS	9.6	20.6	AB
<i>P</i> ($\alpha=0.05$)		0.168ns	0.01	**

* 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	5 - 10
MS	10.1 - 20
S	20.1 - 30
VS	> 30

Addendum 7c. Results from the 2019 FHB Spring Barley Screening nursery, Kimberly, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*, and sprayed with *F. 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 in a column are not significantly different.

Table 3. Screening (10) six-rowed barley varieties for FHB resistance

Variety or Selection	Resistance Rating	FHB Index (%)	DON (ppm)	
Tradition	MR	0.5	5.4	D
UT11302-11	MR	0.8	7.0	CD
Chevron	MS	5.0	10.6	BCD
Quest	MS	1.0	8.9	BCD
Stander	MS	2.4	12.3	BC
UTSB10905-72	MS	2.9	12.4	BC
Goldeneye	S	2.1	23.1	A
Millennium	S	1.8	14.8	BCD
PI383933	S	14.8	11.7	BC
YU510-510	VS	16.5	25.4	A
$P(\alpha=0.05)$		0.4305ns	0.0004	**

* 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	5 - 10
MS	10.1 - 20
S	20.1 - 30
VS	> 30

Addendum 8. Results from the 2019 FHB winter barley screening nursery, Kimberly, ID, where plots were inoculated with corn spawn colonized with *Fusarium graminearum*, and sprayed with *F. graminearum* conidia. 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 in a column are not significantly different.

Table 1. Screening (24) winter barley varieties for FHB resistance

Variety or Selection	Resistance Rating	FHB Index (%)	DON (ppm)	
05ARS561-208	R	0.2	2.45	C-H
05ARS849-15	R	0.0	1.2	D-H
06ARS617-25	R	0.3	0.905	E-H
07ARS518-13	R	0.1	2.8	C-H
2WI14-7577	R	0.1	0.805	GH
2WI15-8747	R	0.1	3.95	C
2WI15-8784	R	0.0	4.6	C
Buck	R	0.2	3.9	CD
Charles	R	0.0	4.35	C
Lightning	R	0.1	3.2	C-H
DH140963	R	0.2	3.15	C-H
Endeavor	R	0.1	0.865	FGH
FR124/12	R	0.2	2.5	C-H
KWS Donau	R	0.5	2.4	C-H
KWS Scala	R	0.1	3.25	C-H
KWS Somerset	R	0.5	3.6	CDE
LCS Calypso	R	0.0	3.5	C-G
Thunder	R	0.1	2.55	C-H
WintMalt	R	0.3	2.75	C-H
05ARS748-270	MR	1.6	0.64	H
2WI15-8688	MR	0.9	4.15	C
Eight-Twelve	MR	0.8	3.55	C-F
UT10201	MR	0.0	13.45	A
Sunstar Pride	S	7.8	8.9	B
<i>P</i> ($\alpha=0.05$)		<.0001	**	<.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

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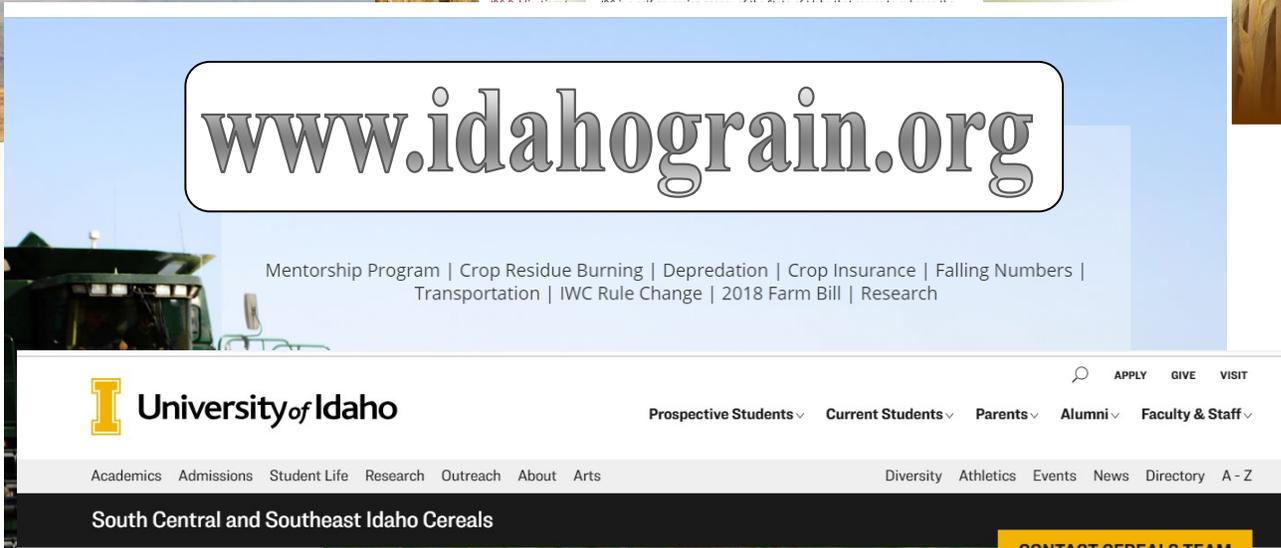


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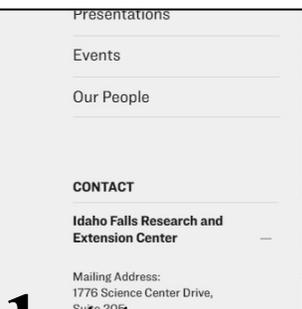


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