

2017 Wheat, Barley, and Oats Variety Performance in Minnesota

- Preliminary Report

By Jochum Wiersma,
Small Grains Specialist,
Northwest Research and Outreach Center

Record soybean and corn yields in 2016 and a better price outlook in early spring for soybeans relative to other commodities caused spring wheat, oat, and barley to suffer another year of double digit acreage losses. Spring wheat, oat, and barley acreage declined by 11%, 19%, and 16% respectively. As with the disclaimer often found in financial investments that past performance is not necessarily a guide to future performance, Mother Nature gave a growing season that was in many aspects a repeat of 2013 and not 2016. The later planting tempered expectations initially but optimism returned as spring wheat enjoyed a price run-up in June. USDA's National Agricultural Statistics Service eventually estimated Minnesota's state average spring wheat yield to be 67 bushels per acre, shattering the previous record of 60 bu/acre set in 2015. The state's averages for barley and oats were 76 and 75 bu/acre, respectively.

April provided only a few good days of fieldwork and consequently planting started with fits and spurts. By the end of the month only about 10% of the barley, 20% of the spring wheat and less than half of the oats had been seeded. This equates to more than a two week delay compared to 2016 and nearly a week delay compared to the 5-year average. The first week of May finally allowed the pace of fieldwork to pick up and in one week producers seeded nearly half of the spring wheat acres and barley seeding reached the half-way mark. Small grains planting neared completion by the third week of May. The delayed start had many growers immediately worried about potential yields.

The cool and cloudy conditions in the second half of May that delayed soybean planting didn't hinder small grains' growth and development and by the end of the month half of the oats had jointed, a pace well ahead to the 5-year average. Likewise, spring wheat and barley emergence was 97% and 88%, respectively. This too was a pace already well ahead of the 5-year average and approaching the 2016 season's pace. The crops continued their accelerated pace of development and by the end of June 79%, 72%, and 69% of the oat, spring wheat, and barley had headed. Producers noted the overall shorter stature of the crop, fueling fears for some that the crops' yield potential was further reduced. Despite this, USDA-ARS estimated Minnesota's average spring wheat to be 61 bu/acre in both their July 1st and August 1st yield forecasts. This compared to 63 bu/acre on July 1st and 60 bushels

by August 1st the previous year and 62 bu/acre and 64 bu/acre in 2015. Thus, in each of the past 3 years USDA-NASS had predicted a new state record for spring wheat.

Daytime temperatures in the first half of July turned more seasonal while topsoil and subsoil moisture was starting to get in short supply in many parts of the northwest corner of state. The physiology of grain fill is researched and there is a good understanding how temperature and drought stress affect grain fill and grain quality. Bottom-line is that higher nighttime temperatures are more detrimental than the maximum daytime temperatures.

From June 22nd through July 14th, daily maximum temperatures across northwest Minnesota rarely exceeded 85°F while minimum temperatures were mostly in the fifties over the same period. Not only was the average daytime high temperature during that period 1 to 2 degrees below the climate normal of 78, 80, and 81 degrees at NDAWN's Humboldt, Ada, and Campbell weather stations, respectively, more importantly the daytime minimum temperatures were 4 to 6 degrees lower than the climate normals of 56, 57, and 58 degrees. In short, near ideal conditions for grain fill as yield losses due to higher rates of nighttime respiration (as a consequence of higher nighttime temperatures) were lower.

Disease and pest problems in 2017 were few due the dry conditions. Early season diseases again included the tan spot. Although stripe rust was observed in experimental plots in Southern Minnesota, the disease did not take hold because conditions became too warm. The lack of moisture led to a reduction in the rust disease as a whole as there were not prolonged periods of leaf surface moisture required to initiate infection. Higher humidity to prior grain filling saw many awn infections of Fusarium head blight (FHB), but as conditions dried up, these infections stalled out in many areas. The uncondusive conditions for disease were also conducive for growers being able to make fungicide applications at the critical early flowering time for FHB management. These factors combined led there to be no major issues at grain elevators with DON levels. The main disease again this year was bacterial leaf streak. This was most apparent during heading when symptoms were general more noticeable with necrotic lesions forming on leaves. The warmer temperatures saw early influxes of aphids and this led to transmission of Barley yellow dwarf in many areas. In some case infections occurred early enough to cause stunting of plants, but severe symptoms were not wide spread. Wheat stem saw fly was found in a few fields but the problem appears to be localized to just around Crookston.

The quality of the wheat, barley and oats is well above average. Preliminary reports from US Wheat Associates indicate that average grain protein is nearly a half point higher than the 2016 crop with slightly lower test weight and an average falling number just under 400 seconds, resulting in an overall grade of No. 1 DNS (Dark Northern Spring).

INTRODUCTION

Successful small grain production begins with selection of the best varieties for a particular farm or field. For that reason, varieties are compared in trial plots on the Minnesota Agricultural Experiment Station (MAES) sites at St. Paul, Rosemount, Waseca, Lamberton, Morris, and Crookston. In addition to the six MAES locations, trials are also planted with a number of farmer cooperators. The cooperator plots are handled so factors affecting yield and performance are as close to uniform for all entries at each location as possible.

The MAES 2017 Wheat, Barley, and Oat Variety Performance in Minnesota Preliminary Report 24 is presented under authority granted by the Hatch Act of 1887 to the Minnesota Agricultural Experiment Station to conduct performance trials on farm crops and interpret data for the public.

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VARIETY CLASSIFICATIONS

Varieties are listed in the tables alphabetically. Seed of tested varieties can be eligible for certification, and use of certified seed is encouraged. However, certification does not imply a recommendation. The intellectual property rights of the breeders or owners of the variety are listed as either PVP, PVP (pending), PVP (94), patent, or none. PVP protection means that the a variety is protected under the Plant Variety Protection Act for a period of 20 years, while PVP (94) means that the variety is protected for 20 years with the additional stipulation that seed of the variety can only be sold as registered and certified classes of seed. PVP (pending) indicates that the PVP application has been made and that you should consider the variety to have the same intellectual property rights as those provided by PVP (94). The designation of 'Patent' means that the variety is protected by a utility patent and that farm-saved seed may be prohibited by the patent holder. The designation 'None' means that the breeder or owner never requested any intellectual property protection or that legal protection has

expired. Registered and certified seed is available from seed dealers or from growers listed in the 'Minnesota Crop Improvement Association 2018 Directory', available through the Minnesota Crop Improvement Association office in St. Paul or online at <http://www.mncia.org>

INTERPRETATION OF THE DATA

The presented data are the preliminary variety trial information for single (2017) and multiple year (2015-2017) comparisons in Minnesota. The yields are reported as a percentage of the location mean, with the overall mean (bu/acre) listed below. Two-year and especially one-year data are less reliable and should be interpreted with caution. In contrast, averages across multiple environments, whether they are different years and/or locations, provide a more reliable estimate of mean performance and are more predictive of what you may expect from the variety the next growing season. The least significant difference or LSD is a statistical method to determine whether the observed yield difference between any two varieties is due to true, genetic differences between the varieties or due to experimental error. If the difference in yield between two varieties equals or exceeds the LSD value, the higher yielding one was indeed superior in yield. If the difference is less, the yield difference may have been due to chance rather than genetic differences, and we are unable to differentiate the two varieties. The 10% unit indicates that, with 90% confidence, the observed difference is indeed a true difference in performance. Lowering this confidence level will allow more varieties to appear different from each other, but also increases the chances that false conclusions are drawn.

THE AUTHORS AND CONTRIBUTORS

This report is written, compiled, and edited by Dr. Jochum Wiersma, Small Grains Specialist. The contributing authors/principal investigators are:

Dr. James Anderson, Wheat Breeder, Department of Agronomy & Plant Genetics, St. Paul; Dr. Kevin Smith, Barley Breeder, Department of Agronomy & Plant Genetics, St. Paul; Dr. Austin Case, Post-doctoral fellow oat breeding, Department of Agronomy & Plant Genetics, St. Paul; Dr. Ruth Dill-Macky, Plant Pathologist, Department of Plant Pathology, St. Paul; Dr. James Kolmer, USDA-ARS, Cereal Disease Laboratory, St. Paul; Dr. Matt Rouse, USDA-ARS, Cereal Disease Laboratory, St. Paul; Dr. Madeleine Smith, Extension Plant Pathologist, Northwest Research & Outreach Center, Crookston; Dr. Brian Steffenson, Plant Pathologist, Department of Plant Pathology, St. Paul; Dr. Yue Jin, USDA-ARS, Cereal Disease Laboratory, St. Paul.

Matt Bickell, Robert Bouvette, Dave Grafstrom, Mark Hanson, Tom Hoverstad, Houston Lindell, Steve Quiring, Curt Reese, Susan Reynolds, Dimitri von Ruckert, Edward Schiefelbein, Nathan Stuart, Donn Vellekson, and Joe Wodarek supervised fieldwork at the various sites. Special thanks are also due to all cooperating producers.



SPRING WHEAT

James Anderson, Jochum Wiersma, Susan Reynolds, Nathan Stuart, Houston Lindell, Ruth Dill-Macky, James Kolmer, Matt Rouse, and Yue Jin.

This year marks the first time in probably three decades that University of Minnesota varieties accounted for more than 50% of the state's acreage. Linkert maintained its top ranking with about 28% of the acreage, while Bolles' acreage jumped to 14%, surpassing WB-Mayville's acreage. Fallor and Prosper's acreage declined further to just a few percentage points. Two public varieties, namely Lang-MN and ND Vitpro were released in 2017 and their single and multi-year data have been added to the tables. First-time entrants in the 2017 trials were Dyna-Gro Caliber, LCS Rebel, TCG-Climax, WB9479, and WB9590. Testing of Elgin-ND, Focus, Norden TCG-Wildfire, and WB9507 was discontinued.

The results of the variety performance evaluations for spring wheat are summarized in Tables 1 through 6. The varietal characteristics are presented in Tables 1 through 3. Tables 4, 5, and 6 present the relative grain yield of tested varieties in 1, 2, and 3-year comparisons. The average yield across the seven southern testing locations was 84 bu/acre in 2017. This compares to an average of 78 bu/acre in 2016 and a three-year average of 82 bu/acre. The seven northern locations averaged 99 bu/acre in 2017 compared to 86 bu/acre last year and 95 bu/acre for the three-year average. HRS 3419, HRS 3530, LCS Albany, SY Valda, and Shelly were the highest yielding varieties in both the south as well as the northern half of the state in both single year and multiyear comparisons. Higher yielding cultivars tend to be lower in grain protein. Variety selection is one approach to avoid discounts for low protein, but N fertility management remains paramount to maximize grain yield and grain protein.

Varieties that are rated 4 or lower are considered the best defense against a particular disease. Varieties that are rated 7 or higher are likely to suffer significant economic losses under even moderate disease pressure. The foliar disease rating represents the total complex of leaf diseases other than the rusts, and includes the Septoria complex and tan spot. Although varieties may differ from their response to each of those diseases, the rating does not differentiate among them. Therefore, the rating should be used as a general indication and only for varietal selection in areas where these diseases historically have been a problem or if the previous crop is wheat or barley. Control of leaf diseases with fungicides may be warranted, even for those varieties with an above average rating.

Bacterial leaf streak (BLS) cannot be controlled with fungicides. Variety selection of more resistant varieties is the only recommended practice at this time if you have a history of problems with this disease. Boost, HRS 3504, Lang-MN, Prevail, Surpass, SY Ingmar, SY Rowyn, SY

Valda, and WB9653 provide the best resistance against BLS. Forefront, Lang-MN, ND-VitPro, and Rollag provide the best resistance against FHB while another fifteen varieties have a rating of 4 for FHB. Combined, this group of varieties includes some of the top yielders and varieties with higher grain protein content such as Bolles and Rollag.

BARLEY

Kevin Smith, Ruth Dill-Macky, Jochum Wiersma, Madeleine Smith, Brian Steffenson, and Ed Schiefelbein

The results of the variety performance evaluations for spring barley are summarized in Tables 7 through 10. The varietal characteristics are presented in Tables 7 and 8. Tables 9 and 10 present the relative grain yield of the tested varieties in 1, 2 and 3-year comparisons. The average yield across the five testing locations was 111 bu/acre in 2017. This is 16 bushels higher than the trial average in 2016. The highest yields were recorded in Crookston while the lowest grain yields were recorded in Morris.

Rasmusson, Innovation, Lacey and ND-Genesis were the highest yielding varieties followed by ABI Balster and Tradition based on the 3 year averages. Conlon is the most lodging resistant variety while Celebration and Robust are the most prone to lodging. The two-row varieties Conlon, ND-Genesis and Pinnacle have the plumpest grain while Innovation has the lowest percentage plump grain. Grain protein content for the six-rowed varieties varied between 12.7% and 14.3%. Two-rowed varieties have, on average, lower grain protein content. ND-Genesis averaged 11.5% grain protein, more than a percentage point lower than Rasmusson, the six-row variety with the lowest grain protein content.

Table 8 describes the reaction of the currently grown varieties to the six major diseases in the region. Disease reaction is based on at least two years of data and scored from 1–9 where 1 is most resistant and 9 is most susceptible. Conlon and Celebration have the best net blotch resistance while Quest and Conlon have the best FHB resistance among the varieties tested. Bacterial Leaf Streak (BLS) cannot be controlled by fungicides and there are only minimal differences in resistance among the current varieties.

OATS

Austin Case, Ruth Dill-Macky, Jo Heuschele, Howard Rines, Dimitri von Ruckert, Jochum Wiersma, Kevin Smith

The results of the variety performance evaluations for oats are summarized in Tables 11 through 13. Locations included Waseca, Rochester, Le Center, Lamberton, St. Paul, Kimball, and Morris in Southern Minnesota. In Northern Minnesota trials were conducted near Fergus Falls, Crookston, Stephen, and Roseau. In addition, entries were evaluated for disease resistance to crown rust, barley

yellow dwarf virus (BYDV), and loose smut in inoculated nurseries. The varieties CS Camden, Antigo, and Sumo were tested for the first time this year.

The greatest challenges in oat production and performance evaluations are lodging and crown rust. Crown rust continues to be a major limiting factor to oat production in Minnesota that must be managed to maintain yield potential. Buckthorn, the alternate host of crown rust, is widespread in Minnesota, allowing the pathogen population to be present annually and rapidly evolve virulence. Therefore, all yield trials were treated with a propiconazole based fungicide when the flag leaf was fully extended (Feekes 9) to reduce the incidence and severity of fungal diseases, in particular crown rust. However, in some locations in Southern Minnesota crown rust infections was still present later in the season. In addition, lodging and bird damage caused yield trials at Kimball and Rochester to be lost.

The origin and agronomic characteristics of oat varieties tested are listed in Table 11. Maturity measured as days to heading, plant height, and test weight data are presented as state-wide averages from 2015-2017 except where noted. Straw strength data is also a state-wide average from the same time period but only from locations where lodging was present. Groat percent is from 2016 crop year only whereas the others are from the 2017 crop year. Maturity, plant height, and lodging are an important consideration for variety selection based on the intended location of the crop and the expected end-use. In general earlier maturing varieties perform better in southern Minnesota as flowering and grain fill can occur during cooler weather. Especially test weight will suffer if the variety matures too late. If the intended use is food, high grain protein content, high groat percentage, and low oil content are important considerations. Hull color may also be a consideration. Growers should contact their local buyer regarding preferred varieties.

Crown rust and other disease resistance ratings are listed in Table 12. All disease scores were converted to a '1-9' scale. Where '1' is very resistant and '9' is very susceptible. Crown rust resistance was evaluated in the Buckthorn Nursery in St. Paul by the USDA-ARS, and represents an exceptionally aggressive crown rust population. Deon continues to be one of the best varieties for crown rust resistance. In addition, the new variety Antigo has very good resistance. As crown rust is a rapidly evolving population the rust ratings are taken only from this year's data. Application of fungicide to a variety with rating of 4 or greater is prudent if crown rust is present in the lower canopy at Feekes 9. Other important diseases include BYDV and loose smut which were evaluated in inoculated nurseries at the University of Illinois and the University of Minnesota, respectively. Varieties susceptible to BYDV (>3) should be chosen with caution particularly in the Southern Minnesota, where infected aphids are more

common early in the season. A seed treatment and certified seed should be used to manage loose smut.

Table 13 presents the relative grain yield of tested varieties in 1, 2, and 3-year comparisons. The average yield across the trials dropped this year to 138 bushels per acre from 142 in 2016 and 148 in 2015. Deon remains among the top yielding varieties in both the 2017 and in multi-year comparisons. However, Hayden and CS Camden may have surpassed Deon in yield this year. CS Camden appears to mostly derive the yield advantage from locations in southern Minnesota whereas Hayden may be more adapted to northern Minnesota. CS Camden looks to be a promising variety given the good yield potential and good crown rust resistance. Antigo has very good crown rust resistance and good yield potential in southern Minnesota. Although Sumo may lack the yield potential of other varieties the moderate crown rust resistance, early maturity, and lodging resistance suggest it may be well adapted for both grain production or an alfalfa nurse crop in an organic setting. If the intended end use of the variety is forage or alfalfa nurse crop a taller variety with lodging resistance such as Goliath may be a good choice. ■>■>

Table 1. Origin and agronomic characteristics of hard red spring wheat varieties in Minnesota in single-year (2017) and multiple-year comparisons.

Variety	Origin ¹	Year of Release	Legal Status	Days to Heading ²	Plant Height ²	Straw Strength ³
				(days)	(inches)	(1-9)
Bolles	MN	2015	PVP(pending)	63.9	32.9	4
Boost	SD	2016	PVP(94)	63.9	33.8	5
Chevelle	Meridian Seeds	2014	PVP(94)	60.1	29.9	4
Dyna-Gro Ambush	Dyna-Gro	2016	PVP(pending)	59.9	30.5	5
Dyna-Gro Caliber	Dyna-Gro	2017	PVP(pending)	62.2	27.1	2
Faller	ND	2007	PV(94)	62.3	34.1	5
Forefront	SD	2012	PVP(94)	58.7	34.8	7
HRS 3361	CROPLAN by WinField	2013	PVP 94)	62.5	30.6	3
HRS 3419	CROPLAN by WinField	2014	PVP(94)	64.9	31.9	3
HRS 3504	CROPLAN by WinField	2015	Patent	63.7	30.2	3
HRS 3530	CROPLAN by WinField	2015	Patent	62.7	34.3	5
HRS 3616	CROPLAN by WinField	2016	PVP(pending)	61.9	31.3	4
Lang-MN	MN	2017	PVP(pending)	61.3	31.7	5
LCS Albany	Limagrain Cereal Seeds	2009	PVP(94)	64.1	30.1	5
LCS Anchor	Limagrain Cereal Seeds	2016	PVP(pending)	59.3	28.5	5
LCS Breakaway	Limagrain Cereal Seeds	2012	PVP(94)	59.7	29.8	4
LCS Iguacu	Limagrain Cereal Seeds	2014	PVP(94)	63.6	31.7	4
LCS Nitro	Limagrain Cereal Seeds	2015	PVP(94)	63.4	29.3	5
LCS Prime	Limagrain Cereal Seeds	2016	PVP(pending)	59.7	33.1	5
LCS Rebel	Limagrain Cereal Seeds	2017	PVP(pending)	60.2	33.5	6
Linkert	MN	2013	PVP(94)	60.8	29.4	2
ND-VitPro	ND	2017	PVP(pending)	60.2	31.9	5
Prevail	SD	2014	PVP(pending)	58.7	32.1	4
Prosper	ND	2011	PVP(94)	62.8	33.3	6
RB07	MN	2007	PVP(94)	59.7	31.1	5
Rollag	MN	2011	PVP(94)	60.2	30.4	3
Shelly	MN	2016	PVP(pending)	62.3	30.2	5
Surpass	SD	2016	PVP(pending)	58.9	32.5	7
SY Ingmar	AgriPro/Syngenta	2014	PVP(94)	62.3	30.8	4
SY Rowyn	AgriPro/Syngenta	2013	PVP(94)	60.3	29.8	6
SY Soren	AgriPro/Syngenta	2011	PVP(94)	60.4	28.6	4
SY Valda	AgriPro/Syngenta	2015	PVP(94)	61.1	30.9	4
TCG-Climax	21 st Century Genetics	2017	PVP(pending)	66.6	31.2	2
TCG-Cornerstone	21 st Century Genetics	2016	PVP(94)	61.7	29.6	3
TCG-Spitfire	21 st Century Genetics	2016	PVP(94)	64.3	32.1	3
WB-Mayville	WestBred	2011	PVP(94)	60.2	28.4	3
WB9479	Westbred	2017	PVP(pending) patent	59.9	28.4	4
WB9590	Westbred	2017	PVP(pending) patent	60.1	27.3	4
WB9653	Westbred	2015	PVP(94)	62.5	30.1	4
Mean				61.5	31.2	

¹ Abbreviations: MN = Minnesota Agricultural Experiment Station; ND = North Dakota State University Research Foundation; SD = South Dakota State Experiment Station. ² 2017 data ³ 1-9 scale in which 1=strongest straw, 9=weakest straw. Based on 2014-2017 data. The rating of newer entries may change by as much as one rating point as more data are collected.

Table 2. Grain quality of hard red spring wheat varieties in Minnesota in single-year (2017) and multiple-year comparisons.

Variety	Test Weight		Grain Protein ¹		Baking Quality ²	Preharvest Sprouting ³
	2017	2 yr	2017	2 yr		
	---(lbs/bu)---		-----%-----			
Bolles	60.3	59.3	15.5	15.6	1	1
Boost	60.5	59.6	14.8	14.7	3	5
Chevelle	60.5	59.8	13.3	13.1	-	3
Dyna-Gro Ambush	61.8	61.0	14.6	14.6	-	3
Dyna-Gro Caliber	60.3	-	15.0	-	-	2
Faller	60.5	59.6	13.2	13.2	5	1
Forefront	61.0	60.4	14.5	14.6	5	3
HRS 3361	59.8	59.2	14.2	14.0	3	2
HRS 3419	60.1	59.3	13.3	13.1	6	4
HRS 3504	59.7	59.3	13.7	13.5	6	1
HRS 3530	60.7	60.1	14.3	14.3	-	2
HRS 3616	60.1	59.4	15.1	15.0	-	3
Lang-MN	61.7	60.9	14.7	14.7	3	1
LCS Albany	60.6	59.9	13.4	13.3	6	4
LCS Anchor	60.9	59.7	14.9	14.9	-	2
LCS Breakaway	62.4	60.9	14.4	14.7	4	2
LCS Iguacu	61.1	60.6	13.1	12.8	7	3
LCS Nitro	60.0	59.3	13.2	13.1	4	4
LCS Prime	61.2	59.6	13.2	13.0	6	1
LCS Rebel	61.5	-	14.3	-	-	4
Linkert	60.9	60.2	15.4	15.1	1	2
ND-VitPro	62.1	61.4	15.0	15.1	-	1
Prevail	60.3	59.9	14.0	14.0	5	4
Prosper	60.9	59.9	13.1	13.3	5	2
RB07	60.3	59.5	14.5	14.5	3	2
Rollag	61.3	60.6	15.1	14.9	6	1
Shelly	61.4	60.4	13.6	13.5	5	1
Surpass	60.4	59.6	14.4	14.5	3	1
SY Ingmar	61.3	60.6	14.8	14.5	2	2
SY Rowyn	60.7	60.2	13.8	13.7	3	3
SY Soren	61.3	60.2	14.7	14.6	4	1
SY Valda	60.5	60.0	14.0	13.8	6	3
TCG-Climax	62.4	-	15.4	-	-	2
TCG-Cornerstone	60.4	59.6	14.5	14.5	-	3
TCG-Spitfire	60.2	59.0	13.8	13.7	-	3
WB-Mayville	61.3	60.1	14.7	14.7	3	3
WB9479	61.3	-	15.0	-	-	3
WB9590	60.8	-	14.5	-	-	2
WB9653	60.0	59.5	13.6	13.4	5	1
Mean	59.3	60.7	14.1	14.2		
No. Environments	14	23	14	23		

¹ 12% moisture basis ² 2014 -2016 crop years ³ 1-9 scale in which 1 is best and 9 is worst. Values of 1-3 should be considered as resistant.

Table 3. Disease reactions¹ of hard red spring wheat varieties in Minnesota in multiple-year comparisons (2012 - 2017).

Variety	Leaf Rust	Stripe Rust ²	Stem Rust ³	Bacterial Leaf Streak ⁴	Other Leaf Diseases ⁵	Fusarium Head Blight
	----- (1-9) -----					
Bolles	1	1	2	5	4	4
Boost	2	2	4	2	5	4
Chevelle	3	1	1	5	6	5
Dyna-Gro Ambush	2	-	2	-	4	4
Dyna-Gro Caliber	3	-	2	-	4	-
Faller	5	5	2	4	4	4
Forefront	2	2	5	4	6	3
HRS 3361	3	3	3	4	4	5
HRS 3419	4	1	1	5	3	5
HRS 3504	2	2	3	3	4	6
HRS 3530	3	3	1	4	4	4
HRS 3616	2	-	3	-	5	5
Lang-MN	1	1	2	3	5	3
LCS Albany	2	3	3	7	5	4
LCS Anchor	2	-	1	-	7	6
LCS Breakaway	3	2	2	4	5	5
LCS Iguacu	5	5	3	5	4	4
LCS Nitro	3	2	5	5	4	5
LCS Prime	3	4	2	5	6	4
LCS Rebel	5	-	2	-	4	-
Linkert	3	1	1	4	4	5
ND-VitPro	3	-	1	-	5	3
Prevail	2	1	5	2	7	4
Prosper	5	5	2	5	4	5
RB07	2	2	2	6	6	4
Rollag	4	1	2	4	5	3
Shelly	3	1	2	5	4	4
Surpass	3	2	5	3	6	4
SY Ingmar	2	2	2	3	5	4
SY Rowyn	3	1	1	2	6	4
SY Soren	2	2	1	5	4	5
SY Valda	1	2	1	3	4	4
TCG-Climax	4	-	5	-	4	-
TCG-Cornerstone	3	-	1	-	5	7
TCG-Spitfire	5	-	3	-	4	5
WB-Mayville	3	3	3	6	7	7
WB9479	3	-	3	-	5	-
WB9590	3	-	3	-	7	-
WB9653	1	2	2	3	4	5

¹ 1-9 scale where 1=most resistant, 9=most susceptible

² Based on natural infections in 2015 at Kimball, Lamberton, and Waseca

³ Stem rust levels have been very low in production fields in recent years, even on susceptible varieties

⁴ Bacterial leaf streak symptoms are highly variable from one environment to the next. The rating of newer entries may change by as much as one rating point as more data is collected

⁵ Combined rating of tan spot and Septoria spp

Table 4. Relative grain yield of hard red spring wheat varieties in northern Minnesota locations in single-year (2017) and multiple-year comparisons (2015-2017).

Variety	Crookston			Fergus Falls			Hallock			Oklee			Perley ¹		Roseau			Stephen ¹	
	2017	2 yr	3 yr	2017	2 yr	3 yr	2017	2 yr	3 yr	2017	2 yr	3 yr	2017	2 yr	2017	2 yr	3 yr	2017	2 yr
	-----(% of mean)-----																		
Bolles	99	97	95	86	92	94	92	91	92	103	100	100	102	98	101	100	99	98	95
Boost	109	103	98	95	97	94	100	94	95	101	97	98	97	93	103	95	97	97	94
Chevelle	107	105	104	108	107	103	107	104	100	107	105	104	109	102	99	93	89	108	104
Dyna-Gro Ambush	98	102	-	94	97	-	103	105	-	104	103	-	100	-	92	96	-	98	-
Dyna-Gro Caliber	100	-	-	91	-	-	95	-	-	88	-	-	87	-	89	-	-	93	-
Faller	117	107	103	110	103	107	114	109	109	107	105	103	112	107	113	111	108	107	105
Forefront	97	95	97	82	86	88	90	94	96	102	98	95	99	100	100	101	98	97	93
HRS 3361	110	108	105	91	96	99	95	96	96	87	95	96	98	96	96	99	96	100	95
HRS 3419	111	109	110	106	100	102	99	104	107	121	114	112	108	106	118	122	118	111	110
HRS 3504	116	109	106	107	109	107	111	110	105	105	102	101	105	102	110	103	99	101	103
HRS 3530	104	103	103	105	100	104	104	108	109	93	100	100	107	110	108	110	106	117	114
HRS 3616	95	97	-	99	102	-	100	99	-	97	96	-	100	-	98	92	-	97	-
Lang-MN	94	94	96	96	97	98	105	100	100	96	100	101	90	93	98	102	103	92	96
LCS Albany	131	121	115	107	106	107	99	101	103	115	112	109	102	103	112	114	110	105	103
LCS Anchor	84	90	-	89	92	-	90	92	-	91	93	-	91	-	72	72	-	92	-
LCS Break-away	83	94	96	109	104	102	98	100	96	96	95	95	102	104	89	89	93	94	97
LCS Iguacu	119	113	109	93	93	93	103	107	105	114	106	104	103	106	107	108	108	107	108
LCS Nitro	107	106	105	96	99	100	99	101	100	96	99	100	108	103	106	108	104	103	101
LCS Prime	87	92	90	115	109	112	115	105	105	114	111	109	112	109	108	106	106	102	103
LCS Rebel	105	-	-	97	-	-	106	-	-	104	-	-	95	-	99	-	-	99	-
Linkert	95	96	99	94	95	94	102	100	100	94	95	95	96	95	95	90	93	88	95
ND-VitPro	91	91	-	86	91	-	96	98	-	86	94	-	93	-	93	95	-	90	-
Prevail	88	92	94	98	98	98	101	104	102	100	99	98	94	98	99	100	102	95	95
Prosper	112	106	104	108	103	105	115	110	109	110	106	103	108	106	111	113	110	110	107
RB07	101	103	101	106	102	99	101	97	95	93	96	97	101	97	89	86	87	107	101
Rollag	96	99	101	96	97	98	94	100	100	95	95	94	97	99	87	84	85	98	92
Shelly	109	106	106	118	112	105	103	103	102	104	106	106	108	108	110	113	109	112	103
Surpass	96	99	99	102	100	100	109	106	103	98	101	100	100	100	100	100	102	102	106
SY Ingmar	89	94	94	96	101	100	95	100	99	103	103	100	97	98	89	92	95	97	99
SY Rowyn	105	103	102	108	104	105	100	101	101	112	105	104	109	102	103	102	98	104	102
SY Soren	102	102	102	97	102	97	99	101	97	96	98	98	93	93	97	92	98	98	97
SY Valda	117	113	111	115	111	110	110	115	115	116	113	111	108	109	105	111	106	113	111

Table 4 continued

Variety	Crookston			Fergus Falls			Hallock			Oklee			Perley ¹		Roseau			Stephen ¹	
	2017	2 yr	3 yr	2017	2 yr	3 yr	2017	2 yr	3 yr	2017	2 yr	3 yr	2017	2 yr	2017	2 yr	3 yr	2017	2 yr
-----(% of mean)-----																			
TCG-Climax	108	-	-	96	-	-	87	-	-	108	-	-	89	-	96	-	-	95	-
TCG-Cornerstone	88	92	-	98	99	-	89	89	-	85	89	-	93	-	89	89	-	89	-
TCG-Spitfire	103	103	-	111	111	-	98	100	-	114	108	-	102	-	102	104	-	103	-
WB-Mayville	85	90	92	97	102	99	97	95	95	92	95	95	95	95	91	88	90	100	96
WB9479	103	-	-	92	-	-	93	-	-	102	-	-	99	-	95	-	-	105	-
WB9590	101	-	-	102	-	-	101	-	-	99	-	-	103	-	88	-	-	113	-
WB9653	101	102	100	108	109	108	114	111	102	102	99	100	103	97	112	105	101	101	106
Mean (bu/acre)	108	105	98	90	89	96	95	87	89	80	90	94	115	113	101	83	84	107	97
LSD (0.10)	12.3	6.3	5.1	8.1	5.1	4.1	12.7	6.6	4.5	10.5	4.9	3.0	6.2	6.3	9.9	6.4	5.6	6.9	6.8

¹ Data from 2016 sites at Perley (hail), Stephen and Strathcona (excessive water) were excluded from analyses. 2-year data for these locations is from 2015 and 2017

Table 5. Relative grain yield of hard red spring wheat varieties in southern Minnesota locations in single-year (2017) and multiple-year comparisons (2015-2017).

Variety	Benson			Kimball			Le Center			Lamberton		
	2017	2 yr	3 yr	2017	2 yr	3 yr	2017	2 yr	3 yr	2017	2 yr	3 yr
	-----(% of mean)-----											
Bolles	78	85	90	102	100	99	89	95	92	88	94	93
Boost	86	90	91	103	97	96	95	95	93	90	97	94
Chevelle	82	96	102	96	93	100	109	102	102	113	106	104
Dyna-Gro Ambush	105	99	-	98	98	-	101	100	-	100	100	-
Dyna-Gro Caliber	101	-	-	94	-	-	90	-	-	88	-	-
Faller	105	103	102	98	96	92	92	95	98	111	110	109
Forefront	109	98	96	102	103	102	99	96	99	89	93	97
HRS 3361	97	100	95	99	97	97	106	106	105	99	103	101
HRS 3419	118	114	108	99	111	116	112	122	120	96	105	107
HRS 3504	114	114	111	94	97	98	106	102	105	109	108	108
HRS 3530	106	111	111	100	103	100	116	111	109	106	105	105
HRS 3616	79	90	-	103	102	-	98	104	-	93	93	-
Lang-MN	96	97	97	105	102	99	89	90	97	103	104	100
LCS Albany	103	105	107	108	110	112	102	110	108	102	107	105
LCS Anchor	88	91	-	96	101	-	103	90	-	89	82	-
LCS Breakaway	102	97	96	103	106	100	92	90	92	99	94	93
LCS Iguacu	99	99	99	99	106	105	107	112	107	97	99	100
LCS Nitro	102	105	104	99	106	109	107	117	114	94	101	102
LCS Prime	114	112	110	98	96	100	110	102	102	116	107	107
LCS Rebel	93	-	-	95	-	-	92	-	-	100	-	-
Linkert	99	96	94	93	101	99	99	93	96	100	93	92
ND-VitPro	86	88	-	101	100	-	85	85	-	89	88	-
Prevail	104	103	98	106	109	111	101	100	102	90	97	99
Prosper	114	109	110	107	100	98	104	101	100	110	110	106
RB07	87	94	95	100	98	99	97	92	91	91	90	92
Rollag	98	96	97	98	97	97	100	96	94	95	90	91
Shelly	94	100	103	106	100	104	106	107	101	109	111	109
Surpass	108	102	102	108	96	93	90	83	88	101	101	100
SY Ingmar	96	103	102	90	103	105	104	109	108	100	104	103
SY Rowyn	109	109	105	96	99	102	97	103	101	94	101	103
SY Soren	87	95	94	110	109	105	105	106	99	99	94	93
SY Valda	117	115	112	100	98	100	119	116	115	114	113	111
TCG-Climax	91	-	-	95	-	-	81	-	-	98	-	-
TCG-Cornerstone	97	96	-	96	96	-	102	102	-	102	97	-
TCG-Spitfire	101	98	-	102	102	-	110	105	-	117	108	-
WB-Mayville	120	109	102	108	108	102	106	104	104	103	101	98
WB9479	110	-	-	102	-	-	93	-	-	97	-	-
WB9590	119	-	-	103	-	-	93	-	-	97	-	-
WB9653	111	109	109	97	94	100	110	105	106	109	107	107
Mean (bu/acre)	94	104	104	95	80	86	90	85	86	83	78	84
LSD (0.1)	15.0	6.4	5.3	13.4	7.9	6.4	11.4	7.6	6.0	11.3	6.8	4.8

Table 5 continued

Variety	Morris			St. Paul			Waseca		
	2017	2 yr	3 yr	2017	2 yr	3 yr	2017	2 yr	3 yr
	-----(% of mean)-----								
Bolles	101	99	98	100	101	103	96	97	97
Boost	92	97	95	91	97	96	99	101	103
Chevelle	112	110	110	95	100	102	107	107	103
Dyna-Gro Ambush	108	108	-	96	97	-	109	102	-
Dyna-Gro Caliber	87	-	-	101	-	-	78	-	-
Faller	97	92	93	108	93	95	87	89	93
Forefront	99	94	98	113	104	97	103	100	100
HRS 3361	102	99	101	104	100	100	103	107	108
HRS 3419	109	112	113	104	109	112	109	112	112
HRS 3504	116	116	115	105	103	103	115	114	110
HRS 3530	92	99	95	101	105	105	110	114	119
HRS 3616	95	100	-	91	98	-	91	93	-
Lang-MN	110	109	105	106	106	104	103	107	108
LCS Albany	101	104	103	99	103	108	92	96	99
LCS Anchor	84	85	-	91	91	-	84	84	-
LCS Breakaway	102	101	96	97	101	101	106	99	99
LCS Iguacu	104	101	100	84	98	106	92	97	92
LCS Nitro	117	112	112	88	106	112	104	107	104
LCS Prime	110	104	99	98	92	90	101	95	90
LCS Rebel	96	-	-	100	-	-	91	-	-
Linkert	100	96	97	107	108	106	97	95	96
ND-VitPro	83	90	-	101	93	-	96	95	-
Prevail	89	90	93	99	99	102	100	108	110
Prosper	92	94	92	107	98	98	95	96	97
RB07	94	95	95	90	93	95	98	91	93
Rollag	92	96	98	93	94	93	90	83	84
Shelly	109	115	113	108	111	113	104	109	108
Surpass	92	99	99	108	94	88	113	113	110
SY Ingmar	88	99	97	94	103	98	100	103	97
SY Rowyn	104	107	108	94	103	102	95	103	102
SY Soren	98	100	94	98	106	103	93	102	96
SY Valda	107	110	111	102	103	105	112	109	106
TCG-Climax	110	-	-	91	-	-	94	-	-
TCG-Cornerstone	101	98	-	99	102	-	91	92	-
TCG-Spitfire	110	106	-	110	107	-	101	96	-
WB-Mayville	110	104	107	98	102	104	96	95	98
WB9479	108	-	-	98	-	-	102	-	-
WB9590	114	-	-	96	-	-	107	-	-
WB9653	100	105	110	109	106	107	119	116	114
Mean (bu/acre)	60	69	68	72	69	75	95	84	73
LSD (0.1)	17.7	5.5	5.0	12.9	9.4	6.8	11.1	6.6	6.5

Table 6. Relative grain yield of hard red spring wheat varieties in Minnesota in single-year (2017) and multiple-year comparisons (2015-2017).

Variety	State			North			South				
	2017	2 yr	3 yr	2017	2 yr	3 yr	2017	2 yr	3 yr		
	-----(% of mean)-----										
Bolles	95	96	96	97	97	96	93	95	95		
Boost	98	97	96	100	97	96	94	96	95		
Chevelle	104	103	102	107	104	101	101	102	103		
Dyna-Gro Ambush	100	100	-	98	100	-	102	101	-		
Dyna-Gro Caliber	92	-	-	92	-	-	91	-	-		
Faller	106	102	102	112	107	106	99	97	98		
Forefront	98	97	97	95	95	95	102	98	98		
HRS 3361	99	100	99	97	99	98	101	102	101		
HRS 3419	109	111	111	110	110	109	107	113	113		
HRS 3504	108	107	105	108	106	104	108	108	107		
HRS 3530	106	106	106	106	105	106	105	107	107		
HRS 3616	95	97	-	98	97	-	93	97	-		
Lang-MN	98	99	100	96	97	99	101	102	101		
LCS Albany	106	107	107	110	110	108	101	105	106		
LCS Anchor	89	89	-	87	89	-	91	89	-		
LCS Breakaway	98	97	97	96	97	98	100	98	96		
LCS Iguacu	102	104	103	107	106	104	98	102	101		
LCS Nitro	102	105	105	103	103	102	101	107	108		
LCS Prime	107	103	103	107	105	105	107	102	100		
LCS Rebel	98	-	-	101	-	-	95	-	-		
Linkert	97	96	96	95	95	96	99	97	97		
ND-VitPro	91	92	-	91	93	-	92	91	-		
Prevail	98	99	100	96	97	98	99	101	102		
Prosper	108	105	103	111	108	106	105	101	101		
RB07	97	96	96	100	98	97	94	93	94		
Rollag	95	94	95	95	96	96	95	93	94		
Shelly	107	108	106	109	108	106	105	107	107		
Surpass	102	100	99	101	101	101	103	98	97		
SY Ingmar	96	101	100	95	98	98	96	104	102		
SY Rowyn	102	104	103	106	104	102	98	104	103		
SY Soren	98	100	98	97	98	98	99	101	98		
SY Valda	111	111	109	112	112	110	110	110	109		
TCG-Climax	95	-	-	97	-	-	94	-	-		
TCG-Cornerstone	94	94	-	90	91	-	98	98	-		
TCG-Spitfire	106	104	-	105	105	-	107	103	-		
WB-Mayville	99	99	98	94	95	95	106	103	102		
WB9479	100	-	-	99	-	-	101	-	-		
WB9590	102	-	-	101	-	-	104	-	-		
WB9653	107	105	105	106	105	102	108	106	107		
Mean (bu/acre)	92	87	88	99	94	95	84	81	82		
LSD (0.1)	4.1	3.2	2.6	4.9	3.9	3.2	6.4	4.9	4.0		
No. Environments	14	26	40	7	12	19	7	14	21		

Table 7. Origin and agronomic characteristics of barley varieties in multiple-year comparisons (2015-2017).

Variety	Origin ¹	Year of Release	Legal Status	Use	Days to Heading (days)	Plant Height (inches)	Straw Strength ² (1-9)	Plump (%)	Protein (%)
2-row									
ABI Balster	ABI	2015	PVP	Malt	63	33	5.1	90	13.5
ABI Growler	ABI	2014	PVP	Malt	63	33	4.9	93	13.2
Conlon	ND	1996	None	Malt	57	33	2.2	97	13.5
ND Genesis	ND	2015	PVP(94)	Malt	61	35	3.5	97	11.5
Pinnacle	ND	2007	PVP(94)	Malt	61	34	4.6	94	12.1
6-row									
Celebration	ABI	2008	PVP	Malt	60	37	6.1	90	14.2
Innovation	ABI	2010	PVP	Malt	59	34	3.5	89	14.1
Lacey	MN	2000	PVP 94)	Malt	59	34	4.4	92	13.9
Quest	MN	2010	PVP(94)	Malt	59	36	4.6	90	13.7
Rasmusson	MN	2008	PVP(94)	Malt	59	33	3.8	92	12.7
Robust	MN	1983	None	Malt	60	37	5.6	90	13.8
Tradition	MN	2003	PVP	Malt	60	36	3.4	93	14.3
No. Environments					11	10	5	6	6
¹ Abbreviations: ABI= Busch Agricultural Resources, MN = Minnesota Agricultural Experiment Station; ND = North Dakota State University Research Foundation. ² 1-9 scale in which 1=strongest straw, 9=weakest straw.									

Table 8. Disease reactions of barley varieties in multiple year comparisons (2015-2017).

Variety	Fusarium Head Blight ¹	Net Blotch ¹	Spot Blotch ¹	Stem Rust ^{1,2}	Bacterial Leaf Streak ¹
----- (1-9) -----					
2-row					
ABI Balster	6	-	5	1	4
ABI Growler	6	-	5	1	4
Conlon	6	3	5	1	4
ND Genesis	8	5	2	1	3
Pinnacle	9	6	4	1	4
6-row					
Celebration	7	3	4	1	4
Innovation	8	4	2	1	5
Lacey	8	6	2	1	5
Quest	5	5	3	1	5
Rasmusson	9	5	2	1	5
Robust	8	5	2	1	5
Tradition	8	4	2	1	5
¹ 1-9 scale where 1=most resistant, 9=most susceptible ² Reaction to the dominant strain of the stem rust pathogen					

Table 9. Relative grain yield of barley varieties at several locations in Minnesota in single-year (2017) and multiple-year comparisons (2015-2017).

Variety	Crookston		Morris		Stephen		St. Paul		Roseau		State	
	2017	3 yr	2017	3 yr	2017	2 yr ¹	2017	2 yr ²	2017	3 yr	2017	3 yr
-----(% of mean)-----												
2-row												
ABI Balster	87	91	114	106	87	96	101	113	105	108	99	103
ABI Growler	85	94	99	89	82	88	98	110	107	106	94	97
Conlon	94	98	79	92	98	93	77	85	83	92	86	92
ND Genesis	99	100	103	104	95	103	120	126	82	100	100	105
Pinnacle	81	86	101	102	75	89	102	102	111	93	94	94
6-row												
Celebration	101	98	89	93	99	96	94	86	105	94	98	94
Innovation	112	109	121	110	109	110	99	101	102	109	109	108
Lacey	110	107	103	111	119	115	113	98	96	96	108	105
Quest	110	106	92	96	106	100	90	91	97	95	99	98
Rasmusson	114	110	119	105	110	116	110	106	120	112	115	110
Robust	99	99	90	93	113	92	97	86	96	97	99	94
Tradition	106	101	96	100	109	103	98	95	102	100	102	100
Mean (bu/acre)	154	131	73	80	108	117	96	97	123	112	111	108
LSD (0.05)	12	6	18	9	11	12	19	10	20	10	7	4

¹ Only two years of data, 2015 and 2017 ² Only two years of data, 2016 and 2017

Table 10. Relative grain yield of barley varieties in on-farm trials near Fergus Falls, Hallock, Oklee, Perley, Kimball and Strathcona, Minnesota in single-year (2017) and multiple-year comparisons (2015-2017).

Variety	2017	3 yr ¹
-----(% of mean)-----		
2-row		
ABI Balster ²	105	100
ABI Growler ²	103	95
ND Genesis	101	100
Conlon	84	91
Pinnacle	108	103
6-row		
Celebration	99	99
Innovation	97	102
Lacey	103	105
Quest	96	98
Rasmusson	108	109
Robust	97	93
Tradition	101	101
Mean (bu/acre)	98	119
LSD (0.05)	8	4

¹ Missing data from Hallock and Kimball (2015); Fergus Falls, Perley, and Strathcona (2016): Fergus Falls, Perley and Kimball (2017) ² 2016 and 2017 data only

Table 11. Origin and agronomic characteristics of oat varieties in Minnesota in multiple-year comparisons (2015-2017).

Variety	Origin ¹	Year of Release	Legal Status	Seed Color	Days to Heading (days)	Plant Height (inches)	Straw Strength ² (1-9)	Test Weight (lbs/bu)	Groat ³ (%)	Grain Protein (%)	Oil ⁴ (%)
Antigo ⁵	WI	2017	PVP(pending)	Yellow	59	37	2	38	-	14.2	5.2
Badger	WI	2010	PVP	Yellow	58	35	3	36	68	13.1	4.5
Betagene	WI	2015	PVP(pending)	Yellow	62	38	4	35	72	12.9	4.8
Colt	SD	2010	PVP(94)	White	58	37	4	38	70	13.8	4.6
CS Camden ⁶	Meridian Seeds	2013	PVP(pending)	White	64	39	2	35	67	13.0	5.0
Deon	MN	2014	PVP(94)	Yellow	64	42	4	37	68	12.6	5.1
Esker	WI	2006	PVP	Yellow	61	38	3	36	69	13.8	4.4
Goliath	SD	2013	PVP(94)	White	64	47	6	37	69	12.9	4.9
Hayden	SD	2015	PVP(94)	White	63	41	5	38	69	12.5	5.7
Horsepower	SD	2012	PVP(94)	White	61	35	5	36	70	12.7	4.8
Jury	ND	2012	None	White	64	43	5	37	70	12.4	5.6
Natty	SD	2015	PVP(94)	White	61	42	4	38	72	13.8	4.1
Newburg	ND	2011	PVP	White	64	44	6	35	67	12.0	5.4
Reins ⁶	IL	2016	PVP(pending)	White	60	33	2	38	69	14.1	4.4
Rockford	ND	2008	PVP	White	65	41	4	37	68	13.0	6.0
Ron	WI	2014	PVP(94)	Yellow	63	40	4	36	69	13.9	5.1
Saber	IL	2010	PVP(94)	Yellow	59	36	4	37	72	14.1	4.6
Shelby 427	SD	2011	PVP(94)	White	60	40	4	38	69	13.2	5.5
Souris	ND	2008	PVP	White	63	38	5	36	69	12.6	4.6
Streaker ⁷	SD	2016	PVP(94)	Hulless	61	40	5	-	-	-	-
Sumo ⁵	SD	2017	PVP(pending)	White	58	38	1	37	-	14.8	4.2

¹ Abbreviations: IL = University of Illinois; MN = Minnesota Agricultural Experiment Station; ND = North Dakota State University Research Foundation; SD = South Dakota State Experiment Station, WI = University of Wisconsin ² 1-9 scale in which 1=strongest straw, 9=weakest straw. ³ 2016 data ⁴ 2017 data ⁵ 1 year data (2017) ⁶ 2 year data (2016-2017) ⁷ Hulless oat

Table 12. Disease characteristics of oat varieties.

Variety	Crown Rust ¹	BYDV ¹	Loose Smut ¹
	----- (1-9) -----		
Antigo	2	7	3
Badger	6	5	1
Betagene	4	6	1
Colt	6	7	1
CS Camden	4	-	2
Deon	3	4	1
Esker	5	5	1
Goliath	5	2	3
Hayden	5	3	1
Horsepower	6	7	3
Jury	5	5	3
Natty	6	4	1
Newburg	5	3	4

Variety	Crown Rust ¹	BYDV ¹	Loose Smut ¹
	----- (1-9) -----		
Reins	6	-	1
Rockford	6	3	2
Ron	4	6	1
Saber	6	6	6
Shelby 427	6	6	1
Souris	6	5	1
Streaker	5	-	1
Sumo	5	-	1

¹ 1 = most resistant and 9 = most susceptible

Table 13. Relative grain yield of oat varieties in Minnesota in single-year (2017) and multiple-year comparisons (2015-2017).

Variety	Waseca		Le Center		Lamberton			Morris	Fergus Falls
	2017	2 yr	2017	2 yr	2017	2 yr	3 yr	2017	2017
-----% mean-----									
Antigo ¹	98	-	106	-	88	-	-	95	82
Badger	110	104	125	112	90	89	82	105	90
Betagene	105	105	113	103	107	103	111	132	87
Colt	99	90	94	93	82	78	77	57	99
CS Camden ²	115	100	133	113	119	110	-	117	117
Deon	94	101	116	107	126	119	125	110	100
Esker	111	111	38	81	105	101	104	100	104
Goliath	112	104	98	97	101	99	95	64	112
Hayden	105	100	94	105	109	104	95	114	116
Horsepower	72	78	73	93	93	85	80	87	115
Jury	76	88	97	95	99	100	99	96	110
Natty	111	113	101	102	97	101	101	88	101
Newburg	77	83	106	104	98	100	96	107	117
Reins ²	108	110	135	116	88	91	-	98	76
Rockford	69	68	60	83	100	91	85	108	119
Ron	115	112	123	113	99	107	111	119	114
Saber	113	116	120	114	108	111	102	119	80
Shelby 427	81	92	95	99	85	88	86	103	100
Souris	80	74	53	83	96	90	79	97	120
Streaker ³	66	67	37	51	80	80	-	89	28
Sumo ¹	88	-	62	-	81	-	-	99	80
Mean (bu/acre)	106	111	109	137	149	142	149	122	134
LSD (0.1)	12	18	44	37	17	18	26	45	20

¹ 1 year data (2017) ² 2 year data (2016-2017) ³ Hullless oat

Crookston			Stephen			Roseau		State		
2017	2 yr	3 yr	2017	2 yr	3 yr	2017	2 yr	2017	2 yr	3 yr
-----% mean-----										
97	-	-	90	-	-	84	-	91	-	-
105	97	93	97	100	95	103	94	102	99	92
109	104	103	106	102	101	111	97	108	102	104
98	84	88	83	80	77	93	93	88	85	82
99	93	-	100	94	-	103	114	112	105	-
105	101	95	109	116	113	119	114	110	111	111
103	101	99	103	102	98	93	97	96	101	99
93	99	97	110	111	104	91	82	98	98	95
104	110	122	117	108	94	121	120	111	111	105
101	99	101	106	100	102	110	105	97	94	93
90	98	100	103	105	101	98	96	97	100	98
91	99	96	101	100	103	96	104	98	103	102
106	104	104	107	107	101	105	88	104	99	98
91	99	-	87	84	-	94	101	95	98	-
101	101	96	103	100	93	106	99	98	93	90
107	101	100	111	107	101	104	96	110	107	106
100	109	104	104	98	97	102	97	105	108	104
107	97	97	90	89	92	94	94	94	94	94
105	103	102	107	102	101	100	108	97	93	90
94	92	-	81	76	-	73	68	70	70	-
96	-	-	71	-	-	77	-	81	-	-
109	146	164	184	149	151	193	174	138	142	147
12	21	18	14	16	16	30	38	15	10	11