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**Preliminary Report 24**

**2015 Wheat, Barley, and Oats Variety Performance in Minnesota  
Preliminary Report**

**Preface**

Jochum Wiersma

Both the cash prices and futures for all commodities continued their decline that started in second half of 2013. Consequently, producers weighed their options. The relatively dry and early spring may have helped contribute to an increase of spring wheat acreage by 25% to 1.6 million acres. Barley and oats also enjoyed a renaissance as acreage increased by nearly 40% for both. As a whole, the 2015 growing season was probably one of the most ideal for the cool season grasses that are wheat, barley, oats, and rye. Consequently, the state has new record averages of 78, 77 and 60 bushels per acre for oats, barley, and spring wheat, respectively. Winter wheat did not break a record but ended up with a 58 bushels per acre average across the state, the second highest ever recorded.

Planting progress followed a pace much like the 2012 season. Already a fifth of the spring wheat, oats, and barley acreage had been seeded by the middle of April. Very cool and dry conditions, however, delayed emergence. Planting had progressed to over 90% for spring wheat, barley and oats by the end of April. Over half of the acreage had emerged by that time; three weeks ahead of the five-year average and nearly a month ahead of the 2014 growing season. Cooler than average conditions prevailed once again for much of the month of May and June across many parts of Minnesota. But unlike the 2012 and 2013 seasons, the topsoil and subsoil moistures were rated adequate for nearly 90% of the state and only a few percentage points were rated as being short. USDA's July 1 yield forecast had the state average spring wheat yield pegged as 62 bushel per acre. By August 1, USDA had even adjusted the estimate upwards to 64 bushel per acre, a more that 10% increase over the previous record set in 2003.

Disease problems centered around tan spot and stripe rust. The first reports of stripe rust in spring wheat came in mid-June followed quickly by crown rust in oats. Later in the season bacterial leaf streak and infections of barley yellow dwarf were quite common. The use of fungicides at the five leaf stage and at anthesis, a common practice for much of the spring wheat acres and being adopted by oat producers, reduced both incidence and severity of the fungal pathogens and reduced economic losses substantially, especially when compared to the losses caused by crown rust in 2014. Damages due to Fusarium head blight were generally light across the state and only in the southeastern part of the state was testing for DON at the time of delivery common.

By August 9, about half of the state's barley and oats and about one-third of the state's spring wheat acreage had been harvested. A pace nearly equal to the 5-year average and again a testament to the excellent growing conditions for small grains. Growers' expectations for yield were generally exceeded in the southern one-third of the state, about met in the central one-third of the state and only in the northern one-third of the state were growers disappointed. Much of this disappointment can be explained by the observed abortion of developing kernels in the lower and upper quarters of heads. The likely cause of these abortions were not disease or insect problems but rather the interplay of a relatively shallow rooted crop and a sudden increase in day time temperatures during the grain fill period that was one to two weeks later. The overall quality of the wheat, barley and oats is excellent. Preliminary reports from US Wheat Associates indicate that grain protein is approximately a half point higher than the 2014 crop with high falling numbers, excellent test weight and vitreous kernel count, 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 2015 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. No other distinction or classification is used to group varieties. Seed of tested varieties can be eligible for certification, and use of certified seed is encouraged. However, certification does not imply a recommendation. Registered and certified seed is available from seed dealers or from growers listed in the 'Minnesota Crop Improvement Association 2016 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 (2015) and multiple years (2013-2015) 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.

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## SPRING WHEAT

James Anderson, Jochum Wiersma, Susan Reynolds, Lance Miller, Chris Olson, Ruth Dill-Macky, James Kolmer, Matt Rouse, and Yue Jin.

The lower grain protein and higher incidence of FHB in the 2014 crop combined with steep discounts over the course of the marketing year made producers re-evaluate their variety selection. Consequently acreages of two varieties in particular - LCS Albany and WB Mayville - decreased in favor of Linkert, the 2013 release of the University of Minnesota. Faller and Prosper's combined acreage declined to 29% of the total acreage, representing over 460,000 acres. Two public varieties, namely Bolles and Focus, and LCS Nitro were released in 2015 and their single and multi-year data has been added to the tables. First-time entrants in the 2015 trials were SY Valda (Syngenta), WB9653 (WestBred), while Croplan Genetics added HRS 3504 and HRS 3530 to their line-up. Meridian Seed of Casselton, ND, entered MS Stingray and Chevelle for the first time. Testing of Advance, Breaker, HRS 3378, Jenna, LCS Powerplay, Vantage and WB-Digger was discontinued.

The results of the variety performance evaluations are summarized in Tables 1 through 7. The average yield across the six southern testing locations was 81 bu/acre in 2015. This compares to an average of 75 bu/acre in 2014 and a three-year average of 74 bu/acre. The eight northern locations averaged 91 bu/acre in 2015 compared to 84 bu/acre last year and 88 bu/acre for the three-year average. Four of the fourteen locations exceeded 100 bu/acre averages, further evidence of the favorable growing conditions across the state this past growing season.

Tables 4, 5, and 6 present the relative grain yield of tested varieties in 1, 2, and 3-year comparisons. LCS Albany no longer had the monopoly on the highest grain yield. SY Valda, MS Stingray, HRS 3530, and HRS 3419 all yielded as much if not more in the single year comparison across locations. Faller, Prosper, LCS Albany, and LCS Iguacu maintained - at least for now - their high yield rankings in both the south as well as the northern half of the state in multiyear comparisons. Higher yielding cultivars tend to be lower in grain protein as is the case with these three varieties. Variety selection is one approach to avoid discounts for low protein, but N fertility management remains paramount to maximize grain yield and grain protein. Ultimately, however, Mother Nature has the final word as she eloquently demonstrated this past season with high grain yield and high to very high grain protein percentages.

The varietal characteristics are presented in Tables 1, 2, and 3. Table 3 summarizes all the disease reactions for individual varieties. 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. Table 7 provides insight of how varieties respond to the use of fungicides. In Lamberton, Morris, Crookston, and Roseau the State Variety Trials are grown in duplicate. The duplicate trial is treated with fungicides at Feekes 5, 9, and 10.51 to eliminate, to the extent possible, any fungal pathogens that potentially can reduce grain yield and quality. Averaged across varieties, the use of fungicide increased grain yield by 13 bu/acre in the northern locations and 5 bu/acre in southern locations in 2015. Much of the losses in the north can be attributed to tan spot and Septoria species, while in the southern locations stripe rust was slightly more prevalent in 2015. Overall losses due to either leaf rust or FHB were minimal. Individual varieties may have very different responses to fungicide, depending on their level of susceptibility to and intensity of fungal diseases. Use the information in Tables 3 and 7 to gain an understanding of how individual varieties should be managed to reduce the yield losses caused by fungal pathogens such as tan spot, leaf and stripe rust, and FHB. For example, WB9507 yielded 32% more with fungicide protection, largely due to its high susceptibility to stripe rust.

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. Tan spot was again widespread in 2015 and likely caused significant yield reduction in susceptible varieties. Control of leaf diseases with fungicides may be warranted, even for those varieties with an above average rating. Leaf rust was not a problem in 2015. However, growers should consider a variety's rating for leaf rust, and plan to use a fungicide if a variety is rated 5 or higher for leaf, stem, or stripe rust and disease levels warrant treatment.

Bacterial Leaf Streak 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. Focus, Forefront, LCS Breakaway, Prevail, SY Ingmar, and SY Rowyn offer the best resistance while varieties like HRS 3419, LCS Albany, RB07, Samson, WB-Mayville, WB9507 have a rating of 6, indicating that they are the most consistently affected by the disease.

Variety selection for 2016 continues to be a balance between yield potential, disease responses, and grain quality. Vigilance against FHB remains paramount as economic losses can quickly add up with varieties rated 6 or higher. Forefront, and Rollag provide the best resistance against FHB. Forefront has good adaptation to southern locations and both Forefront and Rollag are competitive varieties for the northern locations. Barlow, Bolles, Faller, LCS Albany, LCS Iguacu, Norden, Prevail, RB07, and SY Rowyn are all varieties with a rating of 4 for FHB. Combined, this group of varieties includes some of the top yielders (LCS Albany, Faller) and varieties with higher grain protein content such as Bolles, Rollag, and Barlow. The extensive lodging encountered in some parts of the state will put more emphasis on straw strength in the variety selection process for next year. The University of Minnesota's releases Linkert, Norden, and Rollag together with the Croplan Genetics line-up provide some of the best straw strength ever available in adapted HRSW cultivars. Use of growth regulators, a common practice in winter wheat production across much of Europe, is another way to reduce lodging and allows for other varieties to be considered if straw strength is paramount for next years' variety selection.

## **BARLEY**

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The results of the state yield trials are summarized in Table 8. The average yield across the four testing locations (Crookston, Morris, Stephen, and Roseau) was 116 bu/acre in 2015. This is 13 bushels higher than the state average in 2014. The highest yields were in Roseau and the lowest in Morris.

The yield data in Table 8 were collected from advanced yield trials that contain the important varieties for the region planted in five locations in the state. Yield data is presented as percent of the mean of the varieties listed in the table. The mean of the varieties is presented in bushels per acre. Rasmusson was the highest yielding variety followed by Innovation and Pinnacle based on the 3 year state averages (Table 8). Innovation and Pinnacle are the most lodging resistant lines and Robust and Quest are the least (Table 9). The two-rowed varieties Conlon and Pinnacle had the plumpest grain while Celebration

was thinner than the other varieties. Grain protein for the six-rowed varieties ran from 13.0% (Innovation and Rasmusson) to 13.9% (Robust). While the two-rowed varieties had 12.0% (Pinnacle) and 13.1% (Conlon) protein.

Table 10 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. Bacterial Leaf Streak (BLS) cannot be controlled by fungicides and there are only minimal differences in resistance among the current varieties. Conlon and Celebration have the best net blotch resistance while Quest and Conlon have the best FHB resistance among the varieties presented. The two rowed varieties are more susceptible to spot blotch.

## OATS

Jochum Wiersma, Ruth Dill-Macky, Chris Olson

The results of the variety performance evaluations are summarized in Tables 11 through 14. The oat performance evaluations were grown in seven Minnesota locations, including Waseca, Lamberton, Kimball, Morris, Crookston, Stephen, and Roseau in 2015. The greatest challenge during this past growing season in both the oat performance evaluations and commercial production was lodging. Consequently, the trials in Waseca, Kimball, and Roseau are not included in the final results. Due to logistical constraints only the performance evaluations in Lamberton and Crookston were treated with a fungicide when the flag leaf was fully extended (Feekes 9). The average yield across the testing locations was 151 bushels per acre in 2015. This compares to an average of 170 bushels per acre in 2014 and a three-year average of 144 bushels per acre. Deon, the latest University of Minnesota release, was the top yielding variety across the state in both the single and three year comparisons followed by BetaGene, Natty, and Ron in the single year comparison and Newburg, the 2011 release from North Dakota State University, in the 3 year comparison (Table 14).

Relative maturity, measured as the number of days to heading, plant height, and resistance to lodging have been converted to a 1-9 scale to allow for easier interpretation of the data (Table 11). Differences among varieties for all three characteristics are generally much less in the southern half of the state or when seeding is delayed. In the northern half of the state the differences among varieties widen as is also the case when seeding is early. Presenting averages of the actual data therefore can be misleading. Earlier varieties tend to perform relatively better in the southern parts of the state, while later maturing varieties usually have a yield advantage in the north. Varieties with lodging scores greater than 4 should be chosen with caution as lodging problems reduce yield, quality, and harvestability. This is especially important if your soils are highly fertile. The extensive lodging encountered across the state will put more emphasis on straw strength in the variety selection process for next year. Deon provides some of the best straw strength available in oats, but as this past year proved, when conditions are favorable even Deon will encounter substantial lodging.

Quality traits are also presented on a 1-9 scale (Table 12). Groat percentage is an important consideration for grain production (perhaps as important as grain yield) regardless whether the crop is intended for food or feed. It is defined as the percentage of germ, bran, and endosperm in proportion to the whole seed on a weight basis. In addition to groat percentage, test weight, and the grain protein percentage is reported (Table 12).

The disease ratings are based on inoculated screening nurseries for crown rust and smut on the University of Minnesota's St. Paul campus and for Barley yellow dwarf (or red leaf of oats) on the University of Illinois' Champaign Urbana campus (Table 13). Consider most oat varieties to be moderately to very susceptible to crown rust. Other fungal pathogens that commonly cause yield losses in oats in Minnesota are stem rust of oats and Septoria leaf blotch. No ratings are presented on these disease due to insufficient data at this time. The use of a fungicide at Feekes 9 is warranted if crown rust is present in the lower canopy and the variety has a crown rust rating of 4 or higher. A fungicide application at Feekes 9 will also provide excellent protection against Septoria leaf blotch but will likely be too early to protect against stem rust. Expect some yield losses due to crown rust with the most susceptible cultivars even when a fungicide application is made at Feekes 9 if conditions for crown rust remain favorable during the grain fill period. Therefore selecting a less susceptible cultivars like Deon and Ron is still prudent. Seed treatment should be used for smut-susceptible varieties. Varieties susceptible to Barley yellow dwarf (a rating of 6 or higher) should be avoided in the southern half of the state or when planting is delayed as viruliferous aphids are more likely to arrive early enough in the crops development to cause economic damages.

Descriptions of oat varieties covered by the U.S. Plant Variety Protection Act include a PVP designation. When PVP is followed by the notation (94), seed of that variety may not be sold by a grower, not even to a relative or neighbor, without the express permission of the variety's developer/owner. If the PVP application is pending, consider the variety as having PVP (94) protection. Using oats for cover crop does not exempt the buyer from the legal obligation to purchase only certified or registered classes of seed. Proper selection of oat varieties requires consideration of the anticipated growing conditions, the pests that might be encountered in a specific production situation, the purpose for growing the crop and its eventual usage. Specific growing situations will dictate the priority and emphasis given to each trait included in the tables.

**Table 1. Origin and agronomic characteristics of hard red spring wheat varieties in Minnesota in single-year (2015) and multiple-year comparisons.**

Variety	Origin <sup>1</sup>	PVP Status	Days to Heading <sup>2</sup> ( # days)	Plant Height <sup>2</sup> (inches)	Straw Strength <sup>3</sup> (1-9)
Barlow	2009 NDSU	PVP (94)	64.8	35.3	7
Bolles	2015 MN	PVP (pending)	68.9	33.0	4
Chevelle	2014 Meridian Seeds	PVP (94)	64.9	31.2	4
Elgin-ND	2013 NDSU	PVP (94)	65.7	37.4	6
Faller	2007 NDSU	PVP (94)	67.6	34.2	5
Focus	2015 SDSU	PVP (pending)	62.8	36.9	7
Forefront	2012 SDSU	PVP (94)	63.6	38.9	6
Glenn	2005 NDSU	PVP (94)	63.8	36.5	5
HRS 3361	2013 CROPLAN by WinField	PVP (94)	66.8	32.2	3
HRS 3419	2014 CROPLAN by WinField	PVP (pending)	69.5	32.2	3
HRS 3504	2015 CROPLAN by WinField	PVP (pending)	67.4	30.5	3
HRS 3530	2015 CROPLAN by WinField	PVP (pending)	67.7	35.8	5
Knudson	2001 Syngenta	PVP (94)	66.3	31.6	5
LCS Albany	2009 Limagrain Cereal Seeds	PVP (94)	69.2	32.6	5
LCS Breakaway	2012 Limagrain Cereal Seeds	PVP (94)	64.3	31.0	4
LCS Iguacu	2014 Limagrain Cereal Seeds	PVP (94)	68.8	32.7	4
LCS Nitro	2015 Limagrain Cereal Seeds	PVP (pending)	68.9	31.8	5
Linkert	2013 MN	PVP (94)	65.4	29.2	2
Linkert 1.3X	30% higher seeding rate of Linkert	PVP (94)	65.5	30.1	2
Marshall	1982 MN	None	70.8	32.4	4
MS Stingray	2013 Meridian Seeds	PVP (94)	71.6	34.0	4
Norden	2012 MN	PVP (94)	67.0	32.7	3
Prevail	2014 SDSU	PVP (pending)	64.2	33.0	4
Prosper	2011 NDSU	PVP (94)	67.0	35.2	6
RB07	2007 MN	PVP (94)	65.0	32.2	5
Rollag	2011 MN	PVP (94)	65.4	30.6	3
Samson	2007 WestBred	PVP (94)	65.8	30.9	3
SY Ingmar	2014 Syngenta	PVP (94)	68.1	31.9	4
SY Rowyn	2013 Syngenta	PVP (94)	65.4	30.7	5
SY Soren	2011 Syngenta	PVP (94)	65.6	30.3	4
SY Valda	2015 Syngenta	PVP (pending)	66.2	31.4	4
WB-Mayville	2011 WestBred	PVP (94)	65.2	29.9	3
WB9507	2013 Westbred	PVP (pending)	65.3	34.1	6
WB9653	2015 Westbred	PVP (pending)	67.3	30.9	4
<b>Mean</b>			<b>66.5</b>	<b>32.7</b>	

<sup>1</sup> Abbreviations: MN = Minnesota Agricultural Experiment Station; NDSU = North Dakota State University Research Foundation; SDSU = South Dakota Agricultural Experiment Station

<sup>2</sup> 2015 data.

<sup>3</sup> 1-9 scale in which 1 is the strongest straw and 9 is the weakest. Based on 2009-2015 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 (2015) and multiple-year comparisons.**

Variety	Test Weight		Protein <sup>1</sup>		Baking Quality	Preharvest Sprouting <sup>3</sup>
	2015	2 yr.	2015	2 yr. <sup>2</sup>		
	--(lbs/bu) --		-----(%) -----		(1-9)	(1-9)
Barlow	61.7	61.1	14.9	14.7	3	2
Bolles	60.3	60.1	15.9	15.8	1	1
Chevelle	61.0	–	13.4	–	–	–
Elgin-ND	60.0	60.0	14.7	14.6	3	2
Faller	60.4	60.3	13.6	13.5	4	2
Focus	62.2	61.9	14.9	14.9	–	–
Forefront	61.3	61.1	14.6	14.6	4	4
Glenn	62.8	62.3	15.1	14.9	1	1
HRS 3361	60.2	59.8	14.0	13.9	–	–
HRS 3419	59.1	59.5	13.4	13.1	–	–
HRS 3504	59.0	–	14.0	–	–	–
HRS 3530	60.8	–	14.4	–	–	–
Knudson	60.5	60.1	13.6	13.5	3	2
LCS Albany	60.5	60.5	13.4	13.2	6	5
LCS Breakaway	61.5	61.5	14.7	14.5	4	3
LCS Iguacu	61.3	61.2	13.2	12.9	7	2
LCS Nitro	60.5	60.3	13.3	13.0	–	–
Linkert	61.1	60.7	15.0	15.0	1	2
Linkert 1.3X	61.0	–	14.9	–	1	–
Marshall	58.8	59.1	13.7	13.5	7	2
MS Stingray	58.7	–	12.2	–	–	–
Norden	62.1	61.8	14.2	14.0	4	1
Prevail	60.9	60.7	14.1	13.9	4	5
Prosper	60.7	60.5	13.8	13.6	4	2
RB07	60.8	60.5	14.5	14.3	3	2
Rollag	61.6	61.4	15.0	14.9	6	1
Samson	59.9	59.0	13.9	14.1	4	5
SY Ingmar	61.3	61.1	14.9	14.7	–	–
SY Rowyn	60.7	60.9	13.8	13.8	4	4
SY Soren	59.8	60.2	14.7	14.6	4	1
SY Valda	60.7	–	13.9	–	–	–
WB-Mayville	60.4	59.6	14.6	14.6	3	4
WB9507	59.4	59.1	13.6	13.7	–	–
WB9653	60.2	–	13.7	–	–	–
<b>Mean</b>	<b>60.6</b>	<b>60.5</b>	<b>14.2</b>	<b>14.1</b>		
No. Environments	11	23	11	23	3	2

<sup>1</sup> 12% moisture basis.

<sup>2</sup> 2012 -2014 crop years.

<sup>3</sup> 1-9 scale in which 1 is best and 9 is worst. Values of 1-3 should be considered as resistant.

**Table 3. Disease reactions<sup>1</sup> of hard red spring wheat varieties in Minnesota in multiple-year comparisons (2011 - 2015).**

Variety	Leaf Rust	Stripe Rust <sup>2</sup>	Stem Rust <sup>3</sup>	Bacterial Leaf Streak <sup>4</sup>	Other Leaf Diseases <sup>5</sup>	Scab
	----- (1-9) -----					
Barlow	4	1	1	4	4	4
Bolles	1	1	2	4	4	4
Chevelle	–	1	1	–	–	–
Elgin-ND	2	2	2	5	5	5
Faller	5	5	2	4	4	4
Focus	3	3	3	3	7	–
Forefront	2	2	4	3	4	3
Glenn	5	1	1	4	5	3
HRS 3361	3	3	3	4	4	–
HRS 3419	4	1	1	6	3	–
HRS 3504	–	2	1	–	–	–
HRS 3530	–	3	1	–	–	–
Knudson	2	4	3	4	3	6
LCS Albany	2	3	3	6	5	4
LCS Breakaway	3	2	2	3	5	5
LCS Iguacu	4	5	2	4	4	4
LCS Nitro	4	2	2	5	7	–
Linkert	4	1	1	4	4	5
Linkert 1.3X	4	1	1	4	4	5
Marshall	8	–	1	6	7	7
MS Stingray	–	7	2	–	–	–
Norden	2	1	1	4	4	4
Prevail	2	1	5	2	6	4
Prosper	5	5	2	4	4	5
RB07	2	2	2	6	6	4
Rollag	4	1	2	4	5	3
Samson	5	2	1	6	6	8
SY Ingmar	3	2	1	3	6	–
SY Rowyn	3	1	1	2	6	4
SY Soren	2	2	1	4	4	5
SY Valda	–	2	1	–	–	–
WB-Mayville	3	3	2	6	7	7
WB9507	8	8	3	6	3	–
WB9653	–	2	2	–	–	–

<sup>1</sup> 1-9 scale where 1=most resistant, 9=most susceptible.

<sup>2</sup> Based on natural infections in 2015 at Kimball, Lamberton, and Waseca.

<sup>3</sup> Stem rust levels have been very low in production fields in recent years, even on susceptible varieties.

<sup>4</sup> 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.

<sup>5</sup> 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 (2015) and multiple-year comparisons (2013-2015).**

Variety	Crookston			Fergus Falls			Hallock			Oklee			Perley			Roseau			Stephen			Strathcona	
	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr.
	-----(% of mean)-----																						
Barlow	94	89	89	97	89	91	96	98	102	100	100	97	93	93	96	98	100	97	97	98	108	99	99
Bolles	93	98	99	99	100	104	95	94	100	97	99	96	95	97	99	101	102	94	94	94	104	108	104
Chevelle	102	-	-	100	-	-	94	-	-	110	-	-	96	-	-	84	-	-	102	-	-	94	-
Elgin-ND	100	100	99	99	99	100	86	95	101	95	95	95	89	93	97	83	90	92	89	95	108	95	94
Faller	93	109	109	115	115	116	110	112	116	97	103	102	102	104	105	104	104	104	105	107	117	101	105
Focus	101	97	-	94	94	-	95	97	-	109	99	-	97	97	-	109	109	-	97	95	-	102	95
Forefront	102	103	101	93	101	102	102	103	102	101	100	98	104	103	103	94	98	92	91	98	105	103	101
Glenn	90	87	86	93	88	91	89	94	95	103	100	96	91	92	94	106	102	95	99	98	105	101	101
HRS 3361	100	100	-	105	106	-	96	97	-	104	103	-	96	97	-	92	99	-	91	93	-	105	99
HRS 3419	115	111	-	107	118	-	115	111	-	99	105	-	105	106	-	112	111	-	113	108	-	110	111
HRS 3504	102	-	-	106	-	-	97	-	-	100	-	-	100	-	-	94	-	-	109	-	-	98	-
HRS 3530	108	-	-	112	-	-	114	-	-	103	-	-	113	-	-	102	-	-	113	-	-	114	-
Knudson	96	101	100	100	100	103	98	102	106	102	100	98	94	96	99	88	92	91	97	99	107	109	100
LCS Albany	103	110	108	111	113	119	109	108	115	103	109	106	105	104	103	103	104	105	102	106	115	101	106
LCS Breakaway	104	94	93	102	91	94	91	95	101	99	101	96	107	103	104	103	100	93	104	101	105	105	101
LCS Iguacu	101	106	105	94	105	110	103	101	106	100	107	103	111	107	110	111	110	106	111	109	112	104	106
LCS Nitro	105	104	-	104	114	-	99	99	-	102	104	-	99	101	-	98	103	-	100	100	-	114	106
Linkert	108	101	99	95	90	92	101	99	104	103	99	95	95	95	98	100	102	96	105	101	106	107	103
Linkert 1.3X	104	-	-	91	-	-	91	-	-	95	-	-	95	-	-	111	-	-	103	-	-	94	-
Marshall	88	90	92	92	91	96	92	95	101	103	93	93	85	91	95	71	81	84	95	95	106	87	89
MS Stingray	103	-	-	110	-	-	120	-	-	99	-	-	115	-	-	131	-	-	109	-	-	126	-
Norden	98	97	97	100	98	99	97	98	102	99	100	98	96	97	99	114	102	99	97	98	107	84	93
Prevail	103	100	99	100	108	107	102	101	107	108	104	98	103	101	102	108	106	100	97	99	104	99	101
Prosper	100	108	107	110	113	114	109	110	114	105	108	107	104	106	108	105	106	103	105	105	119	106	107
RB07	100	101	99	97	97	99	93	95	103	106	102	98	95	98	100	91	96	92	96	99	106	97	98
Rollag	108	105	99	101	99	101	101	100	104	109	103	98	103	100	101	87	90	87	88	92	100	100	97
Samson	110	98	97	100	93	98	109	105	110	104	105	102	111	107	108	104	108	101	102	103	110	123	113
SY Ingmar	95	100	-	100	100	-	99	98	-	100	97	-	100	100	-	102	98	-	104	101	-	100	101
SY Rowyn	102	107	103	108	110	109	104	103	107	95	99	96	97	98	98	90	95	90	102	100	104	110	102
SY Soren	104	103	99	91	96	98	92	95	99	101	100	98	95	95	99	110	108	100	99	99	104	105	103
SY Valda	107	-	-	110	-	-	118	-	-	98	-	-	110	-	-	98	-	-	110	-	-	105	-
WB-Mayville	97	91	93	97	91	92	98	98	103	97	99	96	96	97	96	95	101	93	94	94	100	89	95
WB9507	94	103	-	112	113	-	110	111	-	92	100	-	106	106	-	92	98	-	98	104	-	110	104
WB9653	97	-	-	110	-	-	87	-	-	100	-	-	92	-	-	95	-	-	114	-	-	106	-
<b>Mean (bu/acre)</b>	<b>82.3</b>	<b>88.5</b>	<b>89.4</b>	<b>108.2</b>	<b>93.3</b>	<b>89.7</b>	<b>90.9</b>	<b>89.4</b>	<b>93.2</b>	<b>103.1</b>	<b>98.3</b>	<b>94.2</b>	<b>108.8</b>	<b>95.5</b>	<b>92.6</b>	<b>84.5</b>	<b>86.1</b>	<b>83.9</b>	<b>85.4</b>	<b>72.9</b>	<b>74.9</b>	<b>64.7</b>	<b>77.3</b>
<b>LSD (0.10)</b>	<b>6.6</b>	<b>11.4</b>	<b>7.9</b>	<b>7.5</b>	<b>11.3</b>	<b>7.8</b>	<b>11.4</b>	<b>6.3</b>	<b>5.3</b>	<b>11.2</b>	<b>8.7</b>	<b>6.7</b>	<b>7.4</b>	<b>5.9</b>	<b>5.3</b>	<b>12.2</b>	<b>8.5</b>	<b>8.7</b>	<b>10.7</b>	<b>8.4</b>	<b>7.6</b>	<b>14.1</b>	<b>9.4</b>

**Table 5. Relative grain yield of hard red spring wheat varieties in southern Minnesota locations in single-year (2015) and multiple-year comparisons (2013-2015).**

Entry	Benson			LeCenter <sup>1</sup>		Lamberton			Morris			St. Paul			Waseca		
	2015	2 yr.	3 yr.	2015	2 yr.	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.
	----- (% of mean) -----																
Barlow	94	91	90	100	84	97	98	89	99	98	95	93	92	100	94	89	93
Bolles	101	98	93	88	77	92	97	91	98	101	92	103	105	106	100	109	113
Chevelle	117	–	–	104	–	105	–	–	110	–	–	103	–	–	93	–	–
Elgin-ND	105	97	94	93	79	97	99	91	101	101	96	99	99	101	81	79	89
Faller	105	106	103	106	104	111	108	99	96	102	97	98	103	106	109	104	106
Focus	96	99	–	94	91	110	106	–	93	105	–	95	98	–	96	94	–
Forefront	95	95	94	108	100	108	103	95	106	108	99	86	96	100	102	107	116
Glenn	87	92	87	84	80	102	97	89	87	95	90	75	78	85	103	92	94
HRS 3361	88	94	–	106	97	101	100	–	105	101	–	99	101	–	116	113	–
HRS 3419	99	100	–	119	117	114	115	–	114	108	–	116	113	–	117	116	–
HRS 3504	108	–	–	111	–	112	–	–	116	–	–	102	–	–	101	–	–
HRS3530	115	–	–	108	–	106	–	–	88	–	–	104	–	–	141	–	–
Knudson	100	96	94	102	93	102	103	94	100	99	94	101	98	102	82	88	97
LCS Albany	113	110	106	107	96	104	110	105	101	107	102	115	117	118	112	121	131
LCS Breakaway	98	99	96	98	91	93	93	86	85	92	89	99	93	101	100	93	100
LCS Iguacu	101	103	101	98	99	103	102	97	98	100	97	118	118	120	77	89	110
LCS Nitro	107	110	–	110	110	106	107	–	113	109	–	120	117	–	98	110	–
Linkert	93	93	89	104	94	93	92	86	99	93	88	102	96	97	103	102	102
Linkert 1.3X	92	–	–	99	–	93	–	–	96	–	–	105	–	–	109	–	–
Marshall	101	102	95	70	67	75	82	77	97	92	86	75	80	82	40	56	70
MS Stingray	103	–	–	101	–	89	–	–	98	–	–	122	–	–	88	–	–
Norden	95	98	94	96	87	100	100	90	102	96	91	101	99	100	103	107	109
Prevail	93	100	97	106	103	105	101	94	101	108	102	105	109	111	122	124	136
Prosper	116	114	106	100	96	104	105	95	90	103	100	98	103	109	106	112	117
RB07	102	98	94	89	85	99	101	92	95	94	93	99	94	96	104	94	98
Rollag	101	100	93	91	83	94	94	84	104	98	92	92	94	92	88	85	89
Samson	96	94	93	109	94	106	99	93	106	96	92	114	105	104	105	103	110
SY Ingmar	103	108	–	110	109	103	103	–	94	101	–	90	95	–	80	86	–
SY Rowyn	102	105	100	98	99	109	106	96	112	116	108	100	101	106	101	109	109
SY Soren	95	97	93	86	83	93	100	92	83	95	90	99	99	100	78	85	93
SY Valda	110	–	–	116	–	113	–	–	112	–	–	107	–	–	98	–	–
WB-Mayville	92	96	95	107	99	95	91	85	114	96	89	106	103	103	110	97	101
WB9507	110	107	–	113	108	97	101	–	86	97	–	114	114	–	87	102	–
WB9653	112	–	–	109	–	109	–	–	123	–	–	108	–	–	111	–	–
<b>Mean (bu/acre)</b>	<b>102.6</b>	<b>107.8</b>	<b>105.1</b>	<b>86.3</b>	<b>75.6</b>	<b>94.5</b>	<b>88.0</b>	<b>81.9</b>	<b>64.9</b>	<b>72.7</b>	<b>71.6</b>	<b>88.7</b>	<b>77.9</b>	<b>76.4</b>	<b>47.7</b>	<b>42.7</b>	<b>43.1</b>
<b>LSD (0.10)</b>	<b>10.2</b>	<b>8.2</b>	<b>5.9</b>	<b>10.8</b>	<b>11.0</b>	<b>7.1</b>	<b>8.1</b>	<b>7.2</b>	<b>9.4</b>	<b>14.2</b>	<b>9.4</b>	<b>7.2</b>	<b>11.4</b>	<b>10.1</b>	<b>16.8</b>	<b>23.9</b>	<b>17.9</b>

**Table 6. Relative grain yield of hard red spring wheat varieties in Minnesota in single-year (2015) and multiple-year comparisons (2013-2015).**

Variety	State			North			South		
	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.
	-----(% of mean)-----								
Barlow	96	94	96	96	95	96	96	93	96
Bolles	97	98	99	97	98	99	97	97	100
Chevelle	101	–	–	98	–	–	106	–	–
Elgin-ND	94	94	97	92	95	97	97	94	97
Faller	104	106	107	103	107	108	104	105	105
Focus	99	98	–	100	97	–	97	100	–
Forefront	99	101	100	98	100	99	100	101	102
Glenn	93	92	93	96	95	94	89	89	91
HRS 3361	99	99	–	98	99	–	101	100	–
HRS 3419	110	110	–	109	110	–	112	111	–
HRS 3504	103	–	–	100	–	–	108	–	–
HRS3530	109	–	–	109	–	–	109	–	–
Knudson	98	98	99	97	98	99	99	97	98
LCS Albany	106	108	111	105	107	109	109	110	113
LCS Breakaway	99	96	97	101	98	97	95	94	97
LCS Iguacu	103	105	106	104	106	106	101	103	107
LCS Nitro	105	106	–	102	103	–	109	111	–
Linkert	100	97	96	101	98	97	98	94	94
Linkert 1.3X	98	–	–	97	–	–	98	–	–
Marshall	85	87	91	89	90	94	79	83	86
MS Stingray	108	–	–	113	–	–	101	–	–
Norden	98	98	98	98	98	98	99	98	98
Prevail	103	104	104	102	102	101	103	106	108
Prosper	104	107	108	105	107	109	103	106	107
RB07	97	97	98	97	98	98	97	95	97
Rollag	98	96	95	99	98	97	95	94	93
Samson	106	101	102	107	103	103	105	98	99
SY Ingmar	99	100	–	100	99	–	98	102	–
SY Rowyn	101	103	102	100	101	100	103	106	106
SY Soren	95	97	98	99	99	98	90	94	96
SY Valda	108	–	–	107	–	–	110	–	–
WB-Mayville	98	96	96	95	95	95	102	97	97
WB9507	102	105	–	101	104	–	103	106	–
WB9653	104	–	–	99	–	–	111	–	–
<b>Mean (Bu/A)</b>	<b>86.9</b>	<b>83.2</b>	<b>81.7</b>	<b>91.4</b>	<b>88.1</b>	<b>88.4</b>	<b>81.0</b>	<b>77.2</b>	<b>73.6</b>
<b>LSD (0.10)</b>	<b>4.0</b>	<b>2.7</b>	<b>2.2</b>	<b>4.7</b>	<b>3.2</b>	<b>2.5</b>	<b>7.0</b>	<b>4.7</b>	<b>3.8</b>
No. Environments	14	29	42	8	16	23	6	13	19

**Table 7. Grain yield (bushels per acre) of hard red spring wheat varieties grown under conventional and intensive management.**

Variety	North						South						State					
	2015		2 Year		3 Year		2015		2 Year		3 Year		2015		2-Year		3-Year	
	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int
	----- (bu/acre) -----																	
Barlow	80.2	91.7	82.3	96.5	80.7	93.6	77.9	82.5	78.7	82.7	73.1	72.5	79.1	87.1	80.5	89.6	76.9	83.0
Bolles	81.0	92.4	87.5	97.0	83.7	93.3	75.3	79.7	79.2	83.4	70.1	71.8	78.2	86.0	83.3	90.2	76.9	82.5
Chevelle	77.5	100.5	-	-	-	-	85.1	89.4	-	-	-	-	81.3	94.9	-	-	-	-
Elgin-ND	76.2	90.5	82.9	96.5	82.8	94.7	78.4	82.3	80.4	84.3	73.3	73.1	77.3	86.4	81.7	90.4	78.1	83.9
Faller	82.4	105.1	92.8	111.1	92.2	106.3	83.6	92.5	85.0	91.4	76.6	78.1	83.0	98.8	88.9	101.3	84.4	92.2
Focus	87.6	96.5	89.6	100.2			86.5	78.6	86.9	83.0			87.1	88.4	88.3	92.0		
Forefront	82.1	83.1	87.9	94.6	83.9	90.9	93.4	85.8	88.9	85.3	77.8	74.1	86.6	84.5	87.8	89.9	80.5	82.5
Glenn	81.9	88.9	82.5	94.2	78.6	90.1	86.5	75.6	82.5	80.5	73.2	69.8	83.7	82.2	82.3	87.4	75.8	80.0
HRS 3361	79.9	91.8	86.5	100.9	-	-	88.9	79.4	84.1	81.7	-	-	83.5	85.6	84.8	91.3	-	-
HRS 3419	94.6	98.3	96.9	108.2	-	-	91.0	98.8	89.9	96.4	-	-	92.8	98.5	93.4	102.3	-	-
HRS 3504	81.6	102.5	-	-	-	-	93.6	91.0	-	-	-	-	87.1	96.7	-	-	-	-
HRS3530	87.5	99.3	-	-	-	-	78.7	88.0	-	-	-	-	83.1	93.6	-	-	-	-
Knudson	76.7	95.4	84.6	100.6	83.0	96.6	83.6	90.1	82.9	86.3	74.1	75.2	79.8	93.0	83.6	93.6	78.4	86.0
LCS Albany	85.9	101.2	93.3	106.1	92.5	104.2	85.2	95.4	89.0	91.2	80.9	79.9	85.6	98.3	91.2	98.7	86.7	92.1
LCS																		
Breakaway	86.2	100.4	84.7	102.4	80.5	95.5	79.8	86.3	78.3	87.1	71.6	75.3	83.6	94.0	81.8	95.1	76.3	85.6
LCS Iguacu	88.8	92.8	94.2	102.4	91.5	99.3	80.4	90.2	81.4	89.3	74.9	77.4	84.6	91.5	87.8	95.9	83.2	88.4
LCS Nitro	84.6	91.1	90.2	101.9			86.7	85.6	86.6	90.9			85.6	88.4	88.4	96.4		
Linkert	86.7	98.0	88.6	100.8	84.3	94.6	75.8	81.2	74.5	79.9	67.7	69.3	81.3	89.6	81.6	90.4	76.0	81.9
Linkert 1.3X	89.9	93.5	-	-	-	-	75.0	85.8	-	-	-	-	82.4	90.0	-	-	-	-
Marshall	66.5	89.6	74.8	97.6	76.4	94.3	67.4	80.4	69.8	81.3	63.6	69.7	66.9	85.0	72.3	89.5	70.0	82.0
MS Stingray	97.9	107.9	-	-	-	-	74.1	91.5	-	-	-	-	86.0	99.7	-	-	-	-
Norden	88.5	94.2	87.1	98.6	85.0	96.0	83.1	82.9	80.1	83.4	72.4	72.1	86.1	88.5	83.7	91.0	78.8	84.0
Prevail	87.7	101.6	90.0	102.4	86.1	97.1	82.4	91.7	83.6	87.2	76.6	75.6	85.1	97.1	86.8	95.0	81.3	86.5
Prosper	85.3	98.2	93.5	106.8	90.8	102.6	78.0	91.3	83.4	90.6	77.4	78.8	81.6	94.7	88.5	98.7	84.1	90.7
RB07	79.9	100.5	86.1	104.7	83.1	98.9	77.5	87.3	78.9	85.7	73.5	74.2	78.7	93.9	82.5	95.2	78.3	86.6
Rollag	81.2	98.7	85.2	101.2	80.8	95.4	78.5	80.8	77.4	80.2	69.4	68.4	79.8	89.7	81.3	90.7	75.1	81.9
Samson	89.4	105.9	90.0	104.9	85.9	98.2	84.5	88.3	78.5	87.2	71.9	77.0	86.9	97.9	84.2	96.5	78.9	87.9
SY Ingmar	82.1	100.2	86.4	101.6	-	-	75.5	83.6	80.0	86.1	-	-	79.1	91.9	83.3	93.9	-	-
SY Rowyn	80.1	100.1	88.0	103.5	83.8	97.3	95.1	86.9	92.4	89.4	83.1	76.7	86.1	93.5	89.5	96.5	82.9	87.0
SY Soren	89.4	97.1	91.9	102.1	86.7	95.9	71.0	83.7	78.5	85.0	70.4	73.7	80.2	90.4	85.2	93.6	78.5	84.8
SY Valda	85.6	99.5	-	-	-	-	89.5	93.0	-	-	-	-	87.5	96.3	-	-	-	-
WB-Mayville	80.4	102.5	83.8	103.8	80.4	97.2	83.7	90.4	76.1	85.5	67.9	73.7	81.9	96.5	79.9	94.7	74.1	85.5
WB9507	77.8	104.0	87.7	107.2	-	-	73.5	96.3	79.8	94.6	-	-	75.6	100.2	83.8	100.9	-	-
WB9653	79.9	101.6	-	-	-	-	91.3	80.4	-	-	-	-	86.1	91.0	-	-	-	-
Mean bu/acre	<b>83.8</b>	<b>97.2</b>	<b>87.7</b>	<b>101.8</b>	<b>84.7</b>	<b>96.9</b>	<b>81.4</b>	<b>86.5</b>	<b>81.8</b>	<b>86.2</b>	<b>73.5</b>	<b>74.3</b>	<b>82.5</b>	<b>91.9</b>	<b>84.7</b>	<b>94.0</b>	<b>79.1</b>	<b>85.6</b>
LSD (0.10)	<b>7.1</b>	<b>6.3</b>	<b>3.7</b>	<b>3.4</b>	<b>3.0</b>	<b>2.8</b>	<b>5.4</b>	<b>5.9</b>	<b>3.4</b>	<b>3.2</b>	<b>2.4</b>	<b>2.2</b>	<b>4.7</b>	<b>4.4</b>	<b>4.6</b>	<b>4.4</b>	<b>1.9</b>	<b>1.8</b>

**Table 8. Relative grain yield of barley varieties in Minnesota single-year(2015) & multiple year comparisons (2013-2015)**

Variety	Crookston		Morris		Stephen		St. Paul	Roseau		State	
	2015	2 yr. <sup>1</sup>	2015	2 yr. <sup>2</sup>	2015	3 yr.	2 yr <sup>2</sup>	2015	3 yr.	2015	3 yr.
	-----(% of mean)-----										
Celebration	96	103	87	95	94	101	103	85	96	99	99
Conlon	91	93	87	92	88	98	91	96	89	90	93
Innovation	108	105	105	105	112	103	119	108	104	108	106
Lacey	106	100	108	104	113	104	96	97	101	105	101
Pinnacle	97	105	105	103	103	103	100	112	113	104	105
Quest	103	99	107	105	94	95	111	95	102	99	102
Rasmusson	110	104	106	112	123	114	109	109	104	111	109
Robust	97	99	93	89	73	88	91	99	100	90	93
Stellar-ND	99	99	99	93	101	98	89	105	95	101	95
Tradition	94	92	103	99	98	97	90	94	95	97	95
<b>Mean (bu/acre)</b>	<b>103</b>	<b>95</b>	<b>90</b>	<b>88</b>	<b>124</b>	<b>113</b>	<b>126</b>	<b>145</b>	<b>126</b>	<b>116</b>	<b>110</b>
<b>LSD (0.05)</b>	<b>7</b>	<b>6</b>	<b>16</b>	<b>9</b>	<b>19</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>8</b>	<b>7</b>	<b>4</b>

<sup>1</sup> Only two years of data, 2013 and 2015.

<sup>2</sup> Only two years of data, 2013 and 2014.

**Table 9. Origin and agronomic characteristics of barley varieties, 2008-2015.**

Variety	Origin	Year of Release	Type	Use	Days to Heading (# days)	Plant Height (inches)	Lodging (1-9)	Plump (%)	Grain Protein (%)
Celebration	BAR <sup>1</sup>	2008	6-row	Malt	59	34	4.8	85	13.6
Conlon	NDSU	1996	2-row	Malt	57	31	4.3	95	13.1
Innovation	BAR <sup>1</sup>	2011	6-row	Malt	59	31	3.4	94	13.0
Lacey	U of Minnesota	2000	6-row	Malt	59	32	3.8	94	13.3
Pinnacle	NDSU	2008	2-row	Malt	60	32	3.0	97	12.0
Quest	U of Minnesota	2010	6-row	Malt	59	33	5.4	91	13.2
Rasmusson	U of Minnesota	2008	6-row	Malt	59	30	3.8	91	13.0
Robust	U of Minnesota	1983	6-row	Malt	59	34	5.4	92	13.9
Stellar-ND	NDSU	2005	6-row	Malt	59	32	3.9	94	13.4
Tradition	BAR <sup>1</sup>	2003	6-row	Malt	59	32	3.9	92	13.5
No. Environments					24	20	10	17	17

<sup>1</sup> Busch Agricultural Resources, LLC.

**Table 10. Disease reactions of barley varieties in multiple year comparisons<sup>1</sup>.**

Variety	Fusarium Head Blight	Net Blotch	Speckled Leaf Blotch	Spot Blotch	Stem Rust <sup>2</sup>	Bacterial Leaf Streak
	----- (1-9) -----					
Celebration	7	3	9	4	1	5
Conlon	6	3	9	5	1	5
Innovation	8	4	9	2	1	6
Lacey	8	6	9	2	1	6
Pinnacle	9	6	9	4	1	6
Quest	5	5	9	3	1	6
Rasmusson	9	5	9	2	1	6
Robust	8	5	9	2	1	6
Stellar-ND	9	6	9	2	1	7
Tradition	8	4	9	2	1	7

<sup>1</sup> 1-9 scale where 1=most resistant, 9=most susceptible.

<sup>2</sup> Reaction to the dominant strain of the stem rust pathogen.

**Table 11. Origin and agronomic characteristics of oat varieties in single-year (2015) and multiple-year comparisons (2013-2015).**

Variety	Origin	Year of Release	PVP Status	Seed Color	Maturity <sup>1</sup>			Plant Height <sup>2</sup>			Lodging <sup>3</sup>		
					2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.
					----- (1-9) -----			----- (1-9) -----			----- (1-9) -----		
AAC Justice	AAC <sup>4</sup>	2015	Pending	White	9	9	-	6	4	-	8	6	-
Badger	U of Wisconsin	2010	PVP(94)	Yellow	1	1	1	2	1	1	8	5	4
BetaGene	U of Wisconsin	2015	Pending	Yellow	4	-	-	3	-	-	7	-	-
Colt	SDSU	2010	PVP(94)	White	1	1	1	4	2	3	8	6	6
Deon	U of Minnesota	2014	PVP(94)	Yellow	7	8	8	7	6	7	4	3	2
Esker	U of Wisconsin	2006	PVP(94)	Yellow	3	3	3	4	3	4	8	5	4
GMI 423	General Mills	2015	Pending	White	8	-	-	7	-	-	9	-	-
Goliath	SDSU	2013	Pending	White	7	8	-	9	9	-	8	6	-
Hayden	SDSU	2015	Pending	White	5	6	-	5	5	-	8	5	-
Horsepower	SDSU	2012	PVP(94)	White	3	3	3	3	2	2	8	6	5
Jury	NDSU	2012	Pending	White	5	7	-	7	7	-	9	7	-
Natty	SDSU	2015	Pending	White	3	3	-	8	5	-	7	5	-
Newburg	NDSU	2011	PVP(94)	White	5	6	6	7	7	9	9	7	6
Rockford	NDSU	2008	PVP(94)	White	7	8	8	7	6	8	8	5	5
Ron	U of Wisconsin	2014	PVP(94)	White	4	6	-	4	4	-	7	4	-
Saber	SDSU	2010	PVP(94)	White	2	2	2	3	2	3	8	4	4
Shelby 427	SDSU	2011	PVP(94)	White	2	3	2	6	5	6	8	5	5
Souris	NDSU	2008	PVP(94)	White	7	7	7	5	4	5	8	6	6
Tack	U of Illinois	2006	PVP(94)	White	2	3	4	1	2	2	8	5	4
<b>LS(0.01)</b>					<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>

<sup>1</sup> 1=earliest and 9=latest

<sup>2</sup> 1=shortest and 9=tallest

<sup>3</sup> 1=least prone and 9=most prone

<sup>4</sup> Agriculture and Agri-Food Canada



**Table 12. Quality characteristics of oat varieties in single-year (2015) and multiple-year comparisons (2013-2015).**

Variety	Test Weight <sup>1</sup>			Grain Protein Content <sup>1</sup>		Groat Percentage <sup>1</sup>
	2015	2 yr.	3 yr.	2015	2 yr.	2 yr. <sup>2</sup>
	----- (1-9) -----			----- (1-9) -----		(1 - 9)
AAC Justice	6	4	10	8	8	-
Badger	5	7	7	4	5	8
BetaGene	6	-	-	5	-	-
Colt	2	2	3	3	2	2
Deon	5	5	5	3	3	3
Esker	6	8	8	3	3	5
GMI 423	9	-	-	4	-	-
Goliath	6	3	-	4	3	-
Hayden	3	1	-	5	5	-
Horsepower	4	3	5	5	6	5
Jury	5	4	-	5	5	-
Natty	3	3	-	3	2	-
Newburg	6	6	6	5	6	3
Rockford	4	2	4	4	3	5
Ron	5	5	-	1	1	-
Saber	3	3	4	4	4	1
Shelby 427	1	1	1	3	3	3
Souris	6	5	7	6	5	4
Tack	1	2	3	4	3	3
<b>LSD(0.01)</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>

<sup>1</sup> 1=highest and 9=lowest

<sup>2</sup> 2012 and 2013 data

**Table 13. Disease characteristics of oat varieties in single-year (2015) comparisons.**

Cultivar	Barley		
	Crown Rust	Smut	Yellow Dwarf
	----- (1-9) -----		
AAC Justice	5	2	5
Badger	9	1	9
BetaGene	5	1	5
Colt	9	1	9
Deon	4	1	4
Esker	7	1	7
GMI 423	5	2	6
Goliath	6	4	6
Hayden	6	1	7
Horsepower	9	5	9
Jury	6	3	6
Natty	6	2	6
Newburg	5	6	6
Rockford	6	4	6
Ron	4	2	4
Saber	9	8	9
Shelby 427	9	2	9
Souris	6	2	7
Tack	9	8	9

<sup>1</sup> 1=most resistant and 9 most susceptible

**Table 14. Relative grain yield of oat varieties in Minnesota in single-year (2015) and multiple-year comparisons (2013-2015).**

Cultivar	Lamberton			Morris			Crookston			Stephen		State <sup>2</sup>		
	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr.	3 yr.	2015	2 yr. <sup>1</sup>	2015	2 yr.	3 yr.
	----- (% of mean) -----													
AAC Justice	75	81	-	99	95	-	109	110	-	98	107	94	100	-
Badger	71	89	93	76	77	77	92	92	91	92	82	82	87	89
BetaGene	127	-	-	101	-	-	109	-	-	105	--	107	-	-
Colt	74	83	84	56	60	62	93	76	75	69	67	74	74	75
Deon	136	129	121	125	123	120	92	103	109	103	110	116	115	114
Esker	109	114	111	86	95	94	95	96	103	89	95	97	99	102
GMI 423	84	-	-	109	-	-	106	-	-	91	-	94	-	-
Goliath	87	96	-	88	89	-	92	101	-	117	111	97	98	-
Hayden	95	102	-	104	120	-	114	114	-	101	108	99	109	-
Horsepower	72	74	83	87	96	98	108	107	107	117	119	98	102	101
Jury	97	101	-	98	98	-	112	111	-	94	101	97	103	-
Natty	103	104	-	100	97	-	104	101	-	107	110	106	102	-
Newburg	90	96	100	97	103	107	109	111	110	104	105	95	106	106
Rockford	72	76	81	87	101	100	91	96	98	82	86	83	90	91
Ron	118	119	-	116	106	-	101	100	-	100	95	105	103	-
Saber	86	93	99	114	111	106	93	92	97	95	96	99	97	100
Shelby 427	80	87	96	100	101	100	100	96	95	91	93	98	94	96
Souris	59	71	78	81	90	93	106	101	101	102	105	90	92	92
Tack	98	91	93	70	78	81	94	90	94	87	87	83	91	91
<b>Mean (bu/a)</b>	<b>163</b>	<b>152</b>	<b>142</b>	<b>117</b>	<b>137</b>	<b>120</b>	<b>218</b>	<b>185</b>	<b>172</b>	<b>149</b>	<b>122</b>	<b>151</b>	<b>154</b>	<b>144</b>
<b>LSD(0.1)</b>	<b>16</b>	<b>9</b>	<b>11</b>	<b>14</b>	<b>7</b>	<b>11</b>	<b>10</b>	<b>6</b>	<b>7</b>	<b>14</b>	<b>6</b>	<b>13</b>	<b>6</b>	<b>5</b>

<sup>1</sup> 2014 and 2015 data

<sup>2</sup> Includes 2013 data from Waseca and St. Paul and 2014 data from Roseau.