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Issue 178 November/December 2020

Prairie Grains

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PRAIRIE GRAINS

November / December 2020 | Issue 178

CONTENTS

- 4 Taming the Bulls and Bears
- 5 Comments from the MN Executive Director
- 6 2020 Prairie Grains Conference
- 12 The Spring Wheat Community Lost a Giant - Joe Smith
- 14 2020 U of M Wheat, Oats and Barley Variety Trials
- 36 MGGA Announces Chief Executive Transition
- 38 North Dakota Hard Red Spring Wheat Variety Trial Results for 2020 and Selection Guide
- 48 2020 NDSU Durum Variety Trials
- 56 MWC Seeking Candidates for Board of Directors
- 57 21st Century Genetics HRS Wheat Trials 2020
- 60 2020 South Dakota Spring Wheat Performance Trials
- 64 AgriPro Spring Wheat Performance Review & Outlook
- 66 CoAXium Wheat Production System for Annual Grassy Weed Control in Spring Wheat
- 68 Limagrain Cereal Seeds 2020 Spring Wheat Data
- 70 2021 Small Grains Update Meetings



In This Issue:

This year the Prairie Grains Conference will be delivered via a virtual format on Thursday, December 10, 2020. Details inside.

Also in this issue are the 2020 variety trials from different universities and companies.

Photo: Emma Dufault, MN Hockey Venture Group



Prepare Yourself for a Long, Frustrating Winter

It may be time to sit down and read *The Long Winter* by Laura Ingalls Wilder. It's one of my favorite books because of the wheat hidden in the walls. That's how valuable wheat was to someone at some point in history. Wheat is the brunt of many jokes and it's nice to be reminded of its historical significance.

I believe we are in for a long winter, not necessarily in cold weather but in continued COVID disruptions. I have been through one 14 day quarantine because of exposure, and I am assuming it will not be my last. I am preparing myself for more work disruptions, missed family events, and ultimately disruptions in the markets.

The late summer and fall rally in our commodity prices was a normal rally. I say normal because there are fundamentals to justify higher prices. We ended up with lower old crop stocks, export sales are strong, and there were some production problems that all added up to lower stocks for 2020/2021. If you look at the market fundamentals, you can nod your head and say "Yeah, that rally makes sense."

The bigger concern for this long winter is the price movements that don't make sense. We have futures markets, not current markets. The markets are trying to predict the future, and that crystal ball is exceptionally cloudy this year.

If we get continued COVID disruptions throughout the world, it affects the overall economy. If you look at commodity price charts at the beginning of the pandemic, there was panic. Check out price charts for oils, gold and cocoa. Not surprising, coffee held its own, but overall commodities suffered in the short run. Every buyer and seller was trying to predict the future, and the future did not look good.

I am anticipating a long winter of frustration. Frustration because I am stuck at home. Frustration because the commodity markets don't make sense. Frustration because my internet isn't working fast enough. Frustration because I love visiting my farmers face to face, and now I'm stuck behind a screen. Frustration because I can't get into Canada for a Tim Horton's cruller and Timbits.

We had a great fall rally, especially in soybeans. Corn and wheat came along for the ride, but soybeans were the most fun. I sold most of my soybeans way too early, but if you are lucky enough to own soybeans, do you have a plan? Is there a way to avoid frustration with soybean marketing this winter? Are you prepared for price movements that do not have an easy explanation?

I admit I sold soybeans too early. Next summer, you may admit to holding soybeans too long. I cannot predict commodity prices, but I do understand risk management. Every year I talk risk management, but this winter it seems more relevant than ever.

This winter, we need to focus on the things we can control. I can control my commodity marketing. If I see opportunities to sell 2020, or even 2021, I can take advantage of those prices. I cannot control prices and I have no idea where prices are headed, but I can eliminate some risk and some frustration.

Prepare yourself for a long, frustrating winter. On the positive side, perhaps I will get to see many more of you virtually, if not in person.

I miss seeing faces, but I hope in the future we can supplement our face-to-face visits with a few virtual ones as well. The world got a little smaller when we figured out how to connect virtually, and that is great news for the future.

Stay healthy and safe this winter.

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Comments from the MN Wheat Executive Director

2020 – Leaping into the Unknown?

By Charlie Vogel,
Minnesota Association of
Wheat Growers/Minnesota
Wheat Research and
Promotion Council

No matter your walk of life, 2020 has been a ride. Agriculture, and specifically MN Wheat, has faced numerous challenges, changes, and opportunities as the year has progressed. Transitioning from Harvest '19 to Plant '20 was challenging, then the whole world has been dealt disruption as a result of COVID19, and top that off with an election year that is being decided by in-person voting as I type this – 2020 has been one leap into the unknown after another.

The impact of Covid19: This worldwide pandemic has impacted many aspects of our daily lives. From mask wearing to conferences and meeting cancellations, no one has been unaffected from a business or personal aspect. Summer meetings were cancelled and replaced with Zoom's. On one hand, the loss of face-to-face meetings reduces effectiveness of those meetings when side bar and hallway conversations are not possible. On the other, from a logistical perspective, it is possible to be more involved without the time and financial constraints of travel.

The Marketing Seminar was the first major event impacting the delivery of traditional content to our membership. In September

MN Wheat, in conjunction with the NDGGA, we held the annual Marketing Seminar virtually from the Northern Crop Institution's auditorium in Fargo, ND. Online attendance was slightly down from our in-person delivery from previous years. However, when we look at the number of views the seminar has received from our YouTube channel, our numbers are significantly greater than average. What is fascinating is this; there is very little cross over from the traditional audience when compared with those who registered and watched the online version. While most of our traditional attendees choose not to participate virtually, we reached a new audience. Going forward, what opportunity is there to have our cake and eat it too?

Legislatively, we have been busy on the state and national level. In MN, successfully getting Section 179 conformity across the finish line is a massive accomplishment for the good of production agriculture that could not have been accomplished without the cooperation of many commodity groups and Ag organizations. I believe it's this unified front that made this possible. The same cooperative spirit is seen on the national level with CFAP, MFP, and so many other initiatives. As rural America and agriculture continue to be a crucial minority by our very nature, it

will be crucial for commodity groups and Ag organizations to remain united and cooperative. Your membership and support of these organizations are appreciated and critical to advance policy that is conducive to production Ag, sustainability, profitability, and our ability to continue to feed the world. Thank you.

As we move into winter more changes are on the horizon. The 2020 Prairie Grains Conference (PGC) has been moved to a virtual event. This was a difficult decision for the PGC team to make. In the end, the decision was made to go virtual due to the inability to secure speakers, sponsors, venues, etc. due to the inability to know what the environment will be the day of the conference.

How do we develop a trade show and valued educational content that has become a premier event in the region in the year of Covid? By ag organizations working collaboratively and sharing resources, always keeping the grower in mind. We continually strive to give you the best information.

I am genuinely excited about the content and delivery that our team has put together to continue this great event in a difficult year. Key vendors and sponsors have stepped up to participate on a new delivery of this quality traditional content in a new way.

Within this issue is publicity for the conference. I hope you will register and participate; your involvement is what makes this premier conference a success!

What else does 2020 and 2021 have in store? I do not know. As you read this, we should know the outcome of the 2020 election. I do know this, regardless of what changes or stays the same, your participation in your commodity groups and ag organizations will continue to be crucial. The rural agriculture economy is in a tough time and money is tight. This reality is not taken for granted when you support commodity groups like MN Wheat. I do not know what the future holds, but I know there will be challenges and opportunities. We will be there to mitigate the challenges and grow the opportunities. Whether you are reading this in MN, ND, SD, or MT, I hope you join us in the journey by joining your state Wheat Association.

Thank you.



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MN Wheat Growers on Facebook
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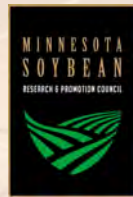
Our Conference Partners Welcome You to the

virtual 2020 Prairie Grains conference



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PROGRAM

PRE-REGISTRATION
is required to gain
access to sessions.

<https://bit.ly/2JmHT7T>

- 7:00 a.m. Wheat & Soybean Research Reporting Sessions (see next page)
8:00 a.m. Virtual Exhibits open
8:50 a.m. **BREAK** - be sure to visit the Virtual Exhibit Hall

8:55 a.m. **WELCOME** from Doug Goerhing, Commissioner, ND Department of Agriculture

9:05 a.m. **Projected Weather Patterns in 2021**



DARYL RITCHISON

Meteorologist & Director of the ND Agricultural Weather Network (NDAWN)

Ritchison will share his insight on weather patterns and cycles and how they will impact the 2021 growing season.

10:05 a.m. **BREAKOUT SESSIONS** - see next page for session details

10:40 a.m. **BREAK** - visit the Virtual Exhibit Hall

11:00 a.m. **The Agricultural Trade Agenda of the Trump Administration**



AMBASSADOR GREGG DOUD

Chief Agricultural Negotiator at the Office of the U.S. Trade Representative Ambassador Doud will discuss the Trump Administration's agricultural trade agenda, covering the USMCA, the U.S.-Japan Trade Agreement, and the U.S.-China Phase One Agreement, among others.

11:45 a.m. **BREAK** - visit the Virtual Exhibit Hall

12:30 p.m. **BREAKOUT SESSIONS** - see next page for session details

1:05 p.m. **REMARKS** from THOM PETERSON, Commissioner, MN Department of Agriculture

1:15 p.m. **Economic Impacts**



DR. JOHN NEWTON

Chief Economist, American Farm Bureau Federation

Dr. Newton will provide an agricultural economic outlook, including current marketing conditions, an overview of the economic impact and federal support efforts related to COVID-19, and the current status of agricultural trade and the Phase One agreement with China.

2:00 p.m. **BREAK** - visit the Virtual Exhibit Hall

2:30 p.m. **BREAKOUT SESSIONS** - see next page for session details

3:30 p.m. **Conference Closing**

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Thursday, December 10th

RESEARCH REPORTING SESSIONS

WHEAT

Sponsored by MN Wheat Check-off

6:50 a.m. Log in to session via conference registration email

7:00 a.m. How Much Does Protein Content Vary Within a Field? - *Melissa Carlson, VP of Research, Minnesota Wheat Research & Promotion Council*

A look through three years of data from a combine mounted protein sensor.

7:20 a.m. Nitrogen Balance in Spring Wheat Production System - *Dr. Amitava Chatterjee, Associate Professor of Soil Science, NDSU*

Nitrogen fertilizer application rate, uptake, and losses were measured for twenty-six spring wheat fields across western Minnesota from 2018 to 2020 growing seasons. Nitrogen losses (denitrification, volatilization, and leaching (below root zone) were determined throughout the growing season. This project evaluated the nitrogen use efficiency of growers' fields under different management practices.

7:40 a.m. Nitrogen Loss in Tile-drained Fields During the 2020 Growing Season - *Dr. Lindsay Pease, Assistant Professor and Extension Specialist, U of MN*

Pease will reflect back on the 2020 growing season and consider how this year's heavy rainfall might have affected loss of nitrogen fertilizer from subsurface-drained fields.

8:00 a.m. Tackling Wheat Digestibility: FODMAP Levels in Wheat Lines - *Dr. Jim Anderson, Spring Wheat Breeder, U of MN and Dr. George Annor, General Mills Endowed Professor in Cereal Chemistry and Technology, U of MN*

For individuals with wheat sensitivity, less reactive wheat products can increase quality of life while allowing them to enjoy the health benefits of wheat products. This University of Minnesota research, funded through the Minnesota Department of Agriculture's Agricultural Growth, Research, and Innovation (AGRI) Grant and in collaboration with the Minnesota Wheat Research and Promotion Council, the Agricultural Utilization Research Institute and Back When Foods, could make a meaningful impact on the industry overall—from the farmer to the bread processor to the consumer.

8:20 a.m. Understanding Bacterial Leaf Streak of Wheat - *Dr. Ruth Dill-Macky, Professor, Dept of Plant Pathology, U of MN*
Bacterial Leaf Streak can have a big impact on fields. Learn about research and some trends to consider.

8:45 a.m. Concluding Remarks



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SOYBEANS

Sponsored by MN Soybean Check-off

6:50 a.m. Log in to session via conference registration email

7:00 a.m. Soybean Aphid Update - *Dr. Bob Koch, Extension Entomologist, U of MN*

Dr. Koch will provide an update from his check-off supported soybean aphid research project and current soybean aphid management recommendations.

7:20 a.m. New Disease Challenges and Management Options - *Dr. Dean Malvick, Professor & Extension Specialist, Dept. of Plant Pathology, U of MN*

New diseases of soybean continue to spread and add to already existing challenges for soybean crop management. This session will focus on new soybean disease issues in the region and research updates on disease management options.

7:40 a.m. Soybean Cyst Nematode Update - *Dr. Angie Peltier, Assistant Extension Professor, U of MN*

The soybean cyst nematode (SCN) is the number one yield limiting-pathogen of soybean as soon it moves into an area. This session will discuss results of some of the most recent MSRPC-sponsored SCN research.

8:00 a.m. The influence of Phosphorus and Potassium Rates in a Multi-Year Spring Wheat-Soybean Rotation - *Dr. Dave Grafstrom, Research Agronomist, U of MN*

Updates on small plot replicated research and large on-farm research trials to determine the influence of elevated levels of P&K in a wheat-soybean rotation over a four-year timeline.

8:20 a.m. Green-seeding Soybeans Into Cover Crops in Northwestern MN: Lessons from Small and Large Plots - *Melissa Carlson, VP of Research, Minnesota Wheat Research & Promotion Council and Dr. Joel Ransom, Extension Agronomist, NDSU*

Results from small plot research and field-scale on-farm trials demonstrate how a variety of management and environmental scenarios can affect the impact of fall cover crops on next year's soybean crop.

8:45 a.m. Concluding Remarks



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- Red River Valley Sugarbeet Growers • Rivard's Turf & Forage
- West Central Ag Services

BREAKOUT SESSIONS

10:05 - 10:40 A.M.

MN Legislative Update - Bruce Kleven, Legislative Strategist, MN Association of Wheat Growers and Amber Glaeser, Director of Public Policy, MN Farm Bureau
Kleven and Glaeser will provide an update on election results and its impact on agriculture, along with state and federal policy issues as affect you and your farm operation.

NDGGA Ag and Legislative Update - Moderator: Tom Bernhardt; Panelists: Michael Howe, State Representative and NDGGA Director; Terry Wanzek, State Senator and former NDGGA President; and Craig Headland, State Representative and NDGGA member
NDGGA President Tom Bernhardt will moderate a panel of agricultural and legislative leaders from North Dakota to discuss agricultural and legislative issues impacting North Dakota agriculture.

Barley, Beer and Pet Food - Lester Jones, Chief Economist, National Beer Wholesalers Association will give details on the Beverage Trends During Covid; Randy Brag, Valley Grain Milling will speak about Barley and the Pet Food Demand; and Mark Black, North American Barley Procurement Manager, Malteurop will tell you about Malting Barley Demand in Commercial and Craft Beer Market.

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- Minnesota Corn Growers Association
- Small Grains Institute
- North Dakota Barley Council
- WestBred - Bayer

12:30 - 1:05 P.M.

Primary and Alternative Crop Budgets and Markets for 2021 Planning - Josh Tjosaas and Betsy Jensen, Farm Business Management Instructors, Northland Community & Technical College
It's not too early to start planning crop mix and marketing for the 2021 season. Presenters will discuss likely break-even costs for our region's major and alternative crops and some potential 2021 marketing strategies.

Utilizing Sunlight After the Main Crop; Cover Crops After Wheat and Interseeded Into Soybean - Dr. Hans Kandel, Extension Agronomist Broadleaf Crops, NDSU
Kandel is conducting research that involves best management practices for soybean, rotational effect of wheat on the following crop, cover crops after spring wheat, cover crops planted into soybean, and soybean following cover crops.

Prepare for a Battle 'Cause Pigweed Don't Play Dead - Dr. Thomas Peters, Extension Sugarbeet Agronomist and Weed Control Specialist, NDSU and U of MN

Producers need to consider extraordinary action as they prepare for 2021 to beat pigweed including waterhemp. So far, we have learned waterhemp is different from other weeds; a formidable foe requiring producers follow a different script for control. I want to incite you to think differently, to consider bold new ideas. Producers sometimes get trapped into a 'one size fits all weed management mentality.' That approach will not work with waterhemp; waterhemp will fight you from planting well into August and will not lay down and play dead.

2:30 - 3:05 P.M.

Spring Wheat Variety Selection and Update - Dr. Jochum Wiersma, Small Grains Specialist, U of MN
Jochum will share the multiple year and location yield data on public and private spring wheat varieties. It's important information to help you pick the best varieties for your farm in 2021.

What is Going on in Your Watershed? - Rob Sip, Executive Director, Red River Water Management Board
Join Rob with the Red River Watershed Management Board (RRWMB) and local administrators to hear about what is going on in the Red River Watershed. This session will explore the RRWMB, its functions, authorities, and projects and initiatives that are funded or sponsored. The RRWMB is a joint-powers board that is comprised of seven watershed districts in the Minnesota portion of the Red River Basin. Since 1976, the RRWMB has had taxation authority under Minnesota statute.

Most conference sessions will be RECORDED

and available to conference attendees one week after the conference.

CEU Credits will be available for most sessions.

More details to come.

DON'T MISS IT -the Prairie Grains Conference comes to you virtually in 2020!

CONFERENCE DETAILS AND REGISTRATION: <https://bit.ly/2JmHT7T>

This year's Prairie Grains Conference is FREE for anyone to attend and will be delivered to you virtually! We are excited about this opportunity to continue delivering important educational sessions that will help you on your farm. From weather and marketing to research, you will be sure to gain new and valuable information. Our wide variety of speakers are sure to answer some of the questions you may have.

PRE-REGISTRATION IS REQUIRED!

**** PRE-REGISTER for the Prairie Grains Conference at <https://bit.ly/2JmHT7T>**
Pre-Registration is required to gain access to the sessions and exhibit hall.

OTHER MEETINGS AND INFORMATION



MN WHEAT and BARLEY ANNUAL BUSINESS MEETING will be held on on December 9th at 6:00 p.m. via Zoom. Members will be notified via a separate invitation.



NDGGA ANNUAL BUSINESS MEETING will be held virtually on December 9th at 4:00 p.m. Members will be notified via a separate invitation.



**ON-FARM RESEARCH
NETWORK
MINNESOTA WHEAT**

Virtual **SAVE THE DATE** **8th Annual On-Farm Research Summit**

Wednesday, January 20, 2021

More detailed information will be mailed and available online at mnwheat.org

Participate in group discussions about what the data mean for your farm and bring your ideas for new research to investigate!

Melissa Carlson, MN Wheat's On-Farm Research Network Coordinator and others will give updates on this year's on-farm research results. Participate in group discussions about what the data means for your farm and bring your ideas for new research to investigate!



Carmen, place Ag-
Country ad from
August issue. Page 32

Joe Allen Smith

February 13, 1950 - October 21, 2020

Sometimes facts and figures just do not tell the whole story. Earlier this fall the spring wheat community lost a giant. Joe Smith, longtime AgriPro spring wheat breeder who retired in 2015, passed away in a boating accident. He and his AgriPro colleagues (and fishing buddies of decades) would close out the summer season with a fly fishing trip to Idaho each and every year. And while most had retired in recent years, the tradition had continued.

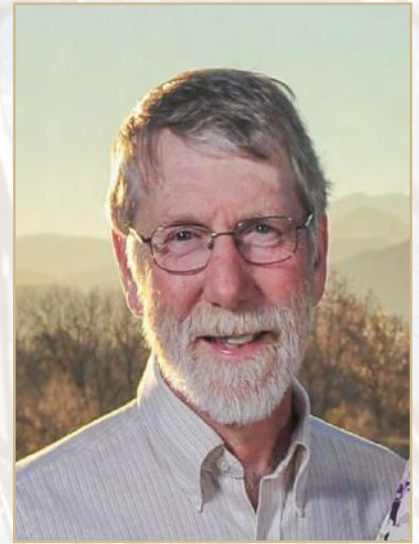
The legacy of breeders and their imprint on a breeding

program continues long after their retirement; varieties that were selected during their tenure are not just released after their retirement but live on as parents and grandparents in the next generations of releases.

A testament to his contribution is that his selections have held the top ranking or been in the top 3 in North Dakota since 2013. Likewise, at least one AgriPro variety has been among the top 5 in MN spring wheat acreage in 13 of the last 17 years. Joe's contributions to the spring wheat industry will

continue for years to come, even after SY Ingmar and SY Valda are no longer the top varieties in the region.

We would like to dedicate this issue of Prairie Grains and the 2020 Wheat Variety Performance data to the memory of Joe.



Jim Anderson
University of Minnesota

Jochum Wiersma
University of Minnesota

Andrew Green
North Dakota State University

Karl Glover
South Dakota State University

John Davies
Former Wheat Breeder
WestBred & AgriPro/Syngenta

Corey J. Dathe
Key Account Lead - Northern Plains
AgriPro

Mory Rugg
BASF

Yukiko Naruoka
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Westbred - Bayer Crop Science

Jason Reinheimer
Limagrain Cereal Seeds

David Bonnett
BASF

Greg Fox
21st Century Genetics

Obituary

Joe Allen Smith, 70, of Loveland, CO, passed away Oct. 21, 2020 due to a severe weather event that occurred while fishing on Henry's Lake, Idaho. He was born February 13, 1950 to Lloyd and Reva Smith in Berkeley Springs, WV. Joe graduated from Penn State University with a Masters degree in 1975. He was married to Jan in 1977. Joe is survived by his wife Jan, two children, Scott Smith and wife Sarah, Lisa Wong and husband Nick, three grandchildren, Alaina, Tristan, and Rylan, and three brothers Danny, Art and Jay.

Joe was a remarkable, world class plant breeder with 40

years of excellence releasing over 60 commercial wheat varieties for both the US and western Canada.

He had an unbelievable vision of what a successful wheat variety should look like and the determination and consistency to find the right combination of traits: short stature, good disease resistance and combination of high protein and high yield. Very few breeders in the world were able to find this success and it took his whole 40-year career to accomplish it.

Following retirement in 2015, the results of his hard work continue to live on. His dedication has pro-

duced the top two spring wheat varieties in North Dakota for the past five years. Joe was a wonderful father, grandfather and husband.

He was an avid fly fisherman and spent much of his time preparing for fishing trips, fishing on his boat with long-time friends, or reminiscing of his trips through his love of photography. Joe enjoyed traveling the world with his wife Jan, having taken trips to Europe, South America, Asia and Africa, and spent his time at home supporting his beloved Duke basketball. He loved spending time with his family and will be remembered as a gentle, kind, and fun-

loving husband, father, grandfather and friend.

There was a viewing and visitation for friends and family Tuesday, October 27th, 2020 at the Kibbey-Fishburn Funeral Home.

Joe's family is holding a private memorial service at a later date but would love for you to share a memory of Joe in the guest book. In lieu of flowers, please make a donation to the Northern Colorado Red Cross for the Colorado wildfire relief.

<https://www.redcross.org/local/colorado/about-us/Locations/northern-colorado.html>

Joe Smith — Hard Red Spring Wheat Varieties

In his 40-plus year wheat breeding career, Joe Smith brought more than 60 commercial wheat varieties to market in the United States and Canada. Below is a sampling of his most memorable AgriPro® releases:

1980s

Oslo
Erik
Norseman
Celtic
Fjord
Nordic
Stockholm

1990s

Fjeld
Bergen
Dalen
Krona
Sonja
Voss
Hamer
Lars
Norlander
Dressler
Saxon
Gunner
Ivan
Nora
Hagar
Kari

2000s

Norpro
Hanna
Knudson
Freyr
AP603 CL
Kelby
AP604 CL
Kuntz
Alpine
Jenna
Brennan
SY Goliad

2010s

SY 605 CL
SY Tyra
SY Soren
SY Rowyn
SY Ingmar
SY Valda

AgriPro

'20 Wheat, Barley and Oats Variety Performance in Minnesota Preliminary Report - Preliminary Report

Preface: Jochum Wiersma

As for the twenty-twenty season itself: it will be remembered for lots of reasons, the small grains growing season not being one of them. Everyone was hoping if not praying for a stellar 2020 growing season to make up for lost ground that was the 2019 growing season. As we near the end of October it is safe to say that, with a few exceptions here and there, for small grains it was just a mediocre year.

The absurdly wet fall of 2019 not only left crop standing in the field it also meant that little fall tillage was completed and even less fertilizer was applied. Those two factors alone meant that small grains planting was delayed even after conditions turned favorable. This delay was illustrated by the planting progress of sugar beets versus spring wheat; a third of the sugarbeet acres versus a mere six percent of the spring wheat acres were seeded in the last week of April as milder and drier weather allowed field work to start in earnest across Minnesota. That same week nearly half of the state's corn acres were seeded too. Dry but cooler conditions halted planting progress in NW Minnesota as producers had to wait for last fall's soggy mess to further dry out. By May 9th, 40% of the spring wheat acreage had been seeded, which was slightly ahead of last year's pace but more than 25%

behind the 5-year average. By May 23th, we passed the 90% completion rate.

The month of May finished with above normal temperatures and this trend continued for much of the growing season. With only 17% of the spring wheat crop jointed by May 31st, the crop as a whole was some 10 days behind the 5-year average. This gap narrowed to just 4 days by mid-June and by the 28th of June the spring wheat's crop development had surpassed the 5-year average. All this did not bode well for the yield potential of the crop. Whilst a swath on either side of the diagonal from Lake Traverse on the South Dakota border to Duluth suffered drought stress, parts on either side of this swath saw torrential rains and thunderstorms in rapid succession. By the end of July the northern end of the Red River Valley and adjacent area to the east had received one and half to two times their normal rainfall for the growing season. With the rains also came higher dew points.

The high dew points, and with it the higher nighttime temperatures, also meant that the risk of Fusarium Head Blight (FHB) was high across much of the State during anthesis and much of the grain fill period. The decision to apply a fungicide to suppress FHB was not a question of 'if' but a question of 'when'. It was not hard to find FHB in the yield trials across Minnesota.

The field severities were nowhere near disastrous but high enough in some of the more susceptible varieties that you would be faced with discounts upon delivery of the grain to the elevator because the DON content would have exceeded the 2 ppm limit. Severities in the commercial fields I scouted and some of the comments I received from crop consultants indicated that FHB severities were generally low and even a bit lower compared to 2019. Data from US Wheat Associates' US Hard Red Spring Wheat Regional Quality Report bears that out as the average DON content dropped from 0.7 ppm in 2019 to 0.2 ppm in 2020. This is a testament to the efficacy of the fungicides and the importance of selecting varieties with better ratings for FHB. Likewise, the incidence of Bacterial Leaf Streak (BLS) was much higher and more widespread across the state when compared to recent years. In contrast, stripe rust, leaf rust, and stem rust were largely absent.

USDA-NASS' initial spring wheat yield forecast on July 1st was 57 bu/acre for Minnesota. This was 5 bushels lower than their July 2019 forecast. And while USDA-NASS corrected their forecast upwards with 1 bu/acre one month later, I was more pessimistic and felt that 57 bu/acre was even a bit optimistic. In the September Small Grains Summary USDA-NASS reported

Minnesota's average spring wheat yield as 53 bu/acre, more than 20% lower compared the record set in 2017 and 4 bushels lower than last year's state average.

The story was the same if not worse for barley as most of the acreage is in the northern Red River Valley. The state's average barley yield dropped to 47 bu/acre, a 40% decline from just two years ago. Oats fared much better; a few dry days in southern Minnesota allowed some of the oats to be seeded as early as April 1st. Planting progress stayed ahead of the 5-year average. Eventually USDA-NASS reported the state's average oat yield to be 66 bu/acre, up 4 and 9 bu/acre compared to 2019 and 2018, respectively. More widespread adoption of fungicides to control crown rust help partially explain this upward yield trend.

The quality of the spring wheat crop was less variable than last year. Problems with Hagberg Falling numbers were limited to a small area in the heart of the Red River Valley as the average HFN test score of 396 seconds is well above the market's minimum threshold and more in line with historical averages. The US Hard Red Spring Wheat Regional Quality Report also showed that Minnesota's crop had, on average, a slightly higher test weight but with a lower vitreous kernel count and 0.6 percentage points lower

grain protein content, resulting in an overall grade of #1 Northern Spring (NS).

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 2020 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.

The MAES and the College of Food, Agricultural and Natural Resource Sciences (CFANS) grants permission to reproduce, print, and distribute the data in this publication - via the tables - only in their entirety, without rearrangement, manipulation, or reinterpretation. Permission is also granted to reproduce a maturity group sub-table provided the complete table headings and table notes are included. Use and reproduction of any material from this publication must credit the MAES and the CFANS as its source.

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 2020 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 (2020) and multiple year (2018-2020) 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

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SPRING WHEAT

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

Linkert maintained its first place rank at just over a fifth of the acreage. SY Valda maintained its second place rank while WB 9479 and WB 9590 moved up to third and fourth >>

» place, and Shelly was fifth. The endurance of Linkert and the rapid ascend of WB 9479 and WB 9590 are indicative of the weight producers place on straw strength when choosing varieties.

First-time entrants in the 2020 trials were AP Murdock (was also tested in 2019 under its experimental designation), CP3055, CP3903, Driver, LCS Buster, MS Ranchero, TCG-Wildcat, and ND Frohberg. Testing of Boost, CP3888, CP3939, Dyna-Gro Caliber, LCS Breakaway, MS Camaro, ND-VitPro, Surpass, and TCG-Climax was discontinued. WestBred continues to not test any HRSW varieties in the University of Minnesota variety trial system. WB Mayville, WB 9479, WB 9590, however, were included in the testing in 2020 as they occupied more than 5% of the acreage in 2019.

The results of the variety performance evaluations for spring wheat are summarized in Tables 1 through 7. 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. Table 7 presents the grain yield when fungal pathogens are controlled to the maximum extent possible compared to the same trials without the use of fungicides. The average yield across the six southern testing locations was 66 bu/acre in 2020. This average compares to a southern average of 63 bu/acre in 2019 and a three-year average of 65 bu/acre. The eight northern locations averaged 75 bu/acre in 2020 compared to 77 bu/acre last year and

80 bu/acre for the three-year average. LCS Trigger, LCS Buster, and LCS Cannon together with AP Murdock, Dyna-Gro Ballistic, and SY Valda are among the highest yielding varieties in single and multi-year comparisons in both the north and southern portions of the state. 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.

Lodging is a serious production risk. Varieties with a lodging score of 2 and 3 are considered exceptionally good and will only lodge in extreme cases, while varieties with a rating of 4 or 5 have adequate straw strength most years. Increasing seeding rates generally increases the risk of lodging for all but the strongest and shortest semi-dwarf HRSW varieties. Conversely, lower seeding rates will lower the risk of lodging, but commonly results in lower grain yield potential. Linkert continues to be rated superior for straw strength, whilst Rollag and MS-Washburn are the only two other public releases that have a lodging rating of 3. Private releases that have a lodging rating of 3 include CP3910, Dyna-Gro Velocity, MS Barracuda, all entries in the variety trials of both 21st Century Genetics (TCG) and WestBred.

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. CP3915, Dyna-Gro Ballistic, Lang-MN, LCS Rebel, LCS Trigger, MN-Torgy, MN-Washburn, ND Frohberg, SY Ingmar, SY Valda, and TCG-Spitfire provide the best resistance against BLS.

LCS Trigger, Lang-MN, and Rollag provide the best resistance against FHB while another twelve 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, Brian Steffenson, Karen Beaubien and

Ed Schiefelbein

The results of the variety performance evaluations for spring barley are summarized in Tables 8 through 12. The varietal characteristics are presented in Tables 8 and 9. Tables 10 through 12 present the relative grain yield of the tested varieties in single and multiple year comparisons. The average yield across the twelve testing locations was 95 bu/acre in 2020. In 2020, the Crookston location was lost due to excessive precipitation late in the season. The highest yields this year were recorded in Oklee (123 bu/A) while the lowest grain yields were recorded in Strathcona (54 bu/A).

We have been testing fewer six-row varieties as the malting and brewing industries increasingly favor two-row varieties. Last year we did not test Rasmusson and Quest so only 2020 data is presented. Rasmusson and AAC Synergy were the highest yielding varieties based on the 2020 state average (Table 10). The six-row varieties were more resistant to lodging while Conlon was the most prone to lodging. Grain protein content varied between 11.4% and 13.1%. Brewers in general require low grain protein with all-malt brewers desiring less protein than adjunct brewers. The two-row varieties ND-Genesis and Pinnacle have the lowest grain protein.

Table 9 describes the reaction of the currently grown varieties to the five 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. Net blotch can be an important disease, however we have only obtained good data in 2020 which is not presented since it is only a single year of data. It is notable that Pinnacle is highly susceptible to net blotch. The varieties with the best resistance to *Fusarium* head blight, expressed as lower concentrations of vomitoxin or DON, are Quest and Conlon.

Bacterial Leaf Streak (BLS) cannot be controlled by fungicides and there are only minor differences in resistance among the current varieties. All listed varieties carry stem rust resistance to the predominant *Puccinia graminis* f. sp. *tritici* race (MCCF). They do not, however, carry resistance to African stem rust races in the Ug99 lineage or the virulent domestic race QCCJ. Most varieties possess pre-heading resistance to stem rust; thus, they will not likely incur much damage unless the disease epidemic is severe.

OATS

Jo Heuschele, Ruth Dill-Macky, Dimitri von Ruckert, Karen Beaubien, Jochum Wiersma, Kevin Smith

This past growing season was good to oats and resulted in higher yield averages across the state. Trial locations included Becker, Lambertson, Le Center, Rochester, Morris and Waseca in southern Minnesota and Crookston, Fergus Falls, Roseau, and Stephen in northern Minnesota. The trials near Kimball were moved a little east to the University

of Minnesota's Sand Plains Research Farm near Becker. In addition, entries were evaluated for disease resistance to crown rust, barley yellow dwarf virus (BYDV), and smut in dedicated, inoculated nurseries. Damage from wildlife caused yield trials near Morris to be abandoned, while extreme drought eliminated Becker.

The newest varieties available this year are Esker 2020 and Rushmore. Esker 2020 has improved crown rust resistance, a maturity similar to Deon, and moderate grain quality. Rushmore also has improved crown rust resistance, a maturity later than Deon, and has a white husk.

The results of the variety evaluations are summarized in Tables 13 to 17. The origin and agronomic characteristics of the tested oat varieties are listed in Table 13. Maturity, height, and test weight data are presented as statewide averages from 2018-2020 except where noted. Lodging data is also a statewide average from the same period, but only from locations where lodging was present. Maturity, height, and lodging are important considerations for variety selection based on the intended location and expected end use of the crop.

Crown rust continues to be a major limiting factor to oat production in Minnesota that must be managed to achieve optimal yield. Buckthorn (*Rhamnus cathartica* L.), the alternate host of crown rust is widespread in Minnesota, allowing for a persistent and particularly

aggressive pathogen population. Rust in all yield trials was managed through treatment with a propiconazole-based fungicide when the flag leaf was fully extended (Feekes 9) to evaluate the yield potential with little to no disease. Crown rust and other disease resistance ratings are listed in Table 14. All disease scores were converted to a 1-9 scale. Where a score of 1 is very resistant and a score of 9 is very susceptible. Crown rust resistance was evaluated in the Buckthorn Nursery in St. Paul managed by the USDA-ARS Cereal Disease Laboratory. The most economical way of controlling crown rust is through resistant varieties; however, 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. Deon and Sumo continue to be the best varieties for crown rust resistance.

Other important diseases include BYDV and smut which were evaluated in inoculated nurseries at the University of Illinois and the University of Minnesota, respectively. Varieties susceptible to BYDV (rating > 3) should be selected with caution particularly in the southern Minnesota, where aphids are more common early in the season. A seed treatment and certified seed should be used to manage smut.

Choose the varieties with the lowest disease ratings in an organic production system and plant as early as possible to reduce the risk of yield losses caused by BYDV or crown rust.

For grain production, lodging and grain quality traits should be considered when choosing a variety (Table 13). Oat varieties with high protein and low oil are preferred in the food market. High test weight, as a proxy for milling yield, is very important in both the food and feed markets. Contact your local elevator or buyer and ask whether they prefer particular varieties.

Tables 15 through 17 present the relative grain yield of the tested varieties in single and multiple year comparisons. MN-Pearl continues to be the top yielding variety in statewide averages for 2020 and in multi-year comparisons. However, Rushmore and Hayden surpassed MN-Pearl in yield in a few locations this past season. Based on the yield data from this year, MN-Pearl, Hayden and Rushmore are recommended for both northern and southern regions of Minnesota. In general, earlier maturing varieties perform better in southern Minnesota because flowering can occur when it is cooler. In these locations, a variety maturing similar to Sumo or Saddle may be a good choice. In northern locations varieties that mature later such as Hayden or Deon may be prudent.

University of Minnesota
Tables #1 - 17 are on
pages 18 through 35.

Table 1. Origin and agronomic characteristics of hard red spring wheat varieties in Minnesota in single-year (2020) and multiple-year comparisons.

Entry	Origin ¹	Legal Status	Desired Stand (Plants/Acre) ²	Days to Heading ³	Height Inches ³	Straw Strength ⁴
Linkert	2013 MN	PVP (94)	1.3	57.1	26.4	2
CP3910	2019 CROPLAN by WinField United	PVP (94) (pending)	1.3	54.8	26.7	3
Dyna-Gro Velocity	2020 Dyna-Gro	PVP (94)	1.4	56.7	27.1	3
MN-Washburn	2019 MN	PVP (94) (pending)	1.3	59.0	27.2	3
MS Barracuda	2018 Meridian Seeds	PVP (94)	1.3	54.1	26.9	3
Rollag	2011 MN	PVP (94)	1.3	57.2	26.6	3
TCG-Heartland	2019 21st Century Genetics	PVP (94), Patend pending	1.5	55.8	26.4	3
TCG-Spitfire	2016 21st Century Genetics	PVP (94)	1.5	59.9	29.4	3
TCG-Wildcat	2020 21st Century Genetics	Patend pending	1.5	58.5	29.0	3
WB-Mayville	2011 WestBred	PVP (94)	1.3	56.0	25.5	3
WB9479	2017 WestBred	Patented, PVP(94)	1.3	56.1	25.3	3
Bolles	2015 MN	PVP (94)	1.3	59.5	30.0	4
CP3915	2019 CROPLAN by WinField United	PVP (94) (pending)	1.3	58.3	28.2	4
Driver	2020 SDSU	PVP (94) (pending)	1.3	58.2	29.9	4
Dyna-Gro Ambush	2016 Dyna-Gro	PVP (94)	1.4	55.5	28.3	4
Dyna-Gro Commander	2019 Dyna-Gro	PVP (94)	1.4	55.8	28.6	4
Lang-MN	2017 MN	PVP (94)	0.9	58.6	28.9	4
LCS Cannon	2018 Limagrain Cereal Seeds	PVP (94)	1.3	53.3	26.7	4
MN-Torgy	2020 MN	PVP (94) (pending)	1.3	57.6	27.8	4
SY 611 CL2 ⁵	2019 AgriPro/Syngenta	PVP (94) (pending)	1.3	57.3	26.4	4
SY Ingmar	2014 AgriPro/Syngenta	PVP (94)	1.3	58.5	27.9	4
SY Longmire ⁶	2019 AgriPro/Syngenta	PVP (94) (pending)	1.3	58.0	28.1	4
SY McCloud	2019 AgriPro/Syngenta	PVP (94) (pending)	1.3	56.4	28.3	4
AP Murdock	2020 AgriPro/Syngenta	PVP (94) (pending)	1.3	56.5	26.5	5
CP3530	2015 CROPLAN by WinField United	Patented	1.3	58.9	31.4	5
Dyna-Gro Ballistic	2018 Dyna-Gro	PVP (94)	1.1	58.1	29.7	5
LCS Buster	2020 Limagrain Cereal Seeds	PVP (94) (pending)	1.3	61.2	30.1	5
LCS Trigger	2016 Limagrain Cereal Seeds	PVP (94)	1.3	61.2	30.5	5
MS Chevelle	2014 Meridian Seeds	PVP (94)	1.3	56.1	27.0	5
Shelly	2016 MN	PVP (94)	1.3	58.5	26.3	5
SY Valda	2015 AgriPro/Syngenta	PVP (94)	1.3	57.6	27.5	5
LCS Rebel	2017 Limagrain Cereal Seeds	PVP (94)	1.3	55.8	30.6	6
Prosper	2011 NDSU	PVP (94)	1.3	58.4	29.9	6
CP3055	2020 CROPLAN by WinField United	PVP (94) (pending)	1.3	62.9	30.1	3-4
CP3903	2019 CROPLAN by WinField United	PVP (94) (pending)	1.3	56.0	28.3	4-5
MS Ranchero	2020 Meridian Seeds	PVP (94) (pending)	1.3	56.7	28.9	4-5
ND Frohberg	2020 NDSU	PVP (94) (pending)	1.3	58.6	29.7	4-5
WB9590	2017 WestBred	Patented, PVP(94)	1.3	55.7	25.3	3
Mean				57.5	28.1	

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

² Our standard seeding rate is designed to achieve a desired stand of 1.3 million plants/acre, assuming a 20% stand loss and adjusting for the germination percentage and seed weight of

³ 2020 data

⁴ 1-9 scale in which 1 is the strongest straw and 9 is the weakest. Based on 2014-2020 data. The rating of newer entries may change by as much as one rating point as more data are collected.

⁵ SY 611 CL2 has tolerance to Beyond® herbicide.

⁶ SY Longmire has solid stems.

Table 2. Grain quality of hard red spring wheat varieties in Minnesota in single-year (2020) and multiple-year comparisons.

Entry	Test Weight (Lb/Bu)		Protein (%) ¹		Baking Quality ²	Pre-Harvest Sprouting ³
	2020	2 yr	2020	2 yr		
AP Murdock	59.7	59.9	14.7	14.2	–	1
Bolles	58.9	59.2	16.7	16.1	1	1
CP3055	55.1	–	13.1	–	–	2–3
CP3530	59.5	59.8	15.2	14.5	3	1
CP3903	60.2	–	15.2	–	–	2–3
CP3910	60.7	60.5	14.9	14.4	–	2*
CP3915	60.5	60.3	14.9	14.4	–	1
Driver	60.5	–	14.7	–	–	2–3
Dyna-Gro Ambush	61.4	61.4	15.2	14.8	2	3*
Dyna-Gro Ballistic	59.3	59.3	14.1	13.9	5	3*
Dyna-Gro Commander	59.9	60.1	15.0	14.6	–	1
Dyna-Gro Velocity	60.7	60.9	15.9	15.2	–	2
Lang-MN	60.3	60.8	15.3	14.9	3	1
LCS Buster	57.3	–	12.7	–	–	5
LCS Cannon	60.8	61.2	14.6	14.1	4	3*
LCS Rebel	61.2	61.2	15.2	14.8	3	5
LCS Trigger	60.0	60.0	12.8	12.3	7	2
Linkert	60.3	60.4	15.7	15.3	1	1
MN-Torgy	60.0	60.3	15.2	14.7	4	1
MN-Washburn	59.7	59.9	14.7	14.2	3	1
MS Barracuda	60.0	60.2	15.3	14.9	4	3
MS Chevelle	59.5	59.5	14.2	13.7	5	4
MS Rancho	58.4	–	14.7	–	–	4
ND Frohberg	60.4	–	15.1	–	–	4
Prosper	59.5	59.8	14.3	13.7	5	1
Rollag	60.3	60.5	15.7	15.3	6	1
Shelly	59.5	59.5	14.3	13.9	5	1
SY 611 CL2	60.4	60.7	15.2	14.7	–	2*
SY Ingmar	60.0	60.1	15.5	15.1	2	2
SY Longmire	59.5	59.4	15.3	14.8	–	2*
SY McCloud	60.9	61.2	15.6	15.1	3	2*
SY Valda	60.2	60.2	14.7	14.1	6	2
TCG-Heartland	61.0	60.9	15.8	15.3	–	2
TCG-Spitfire	59.9	59.0	14.2	13.8	2	3*
TCG-Wildcat	60.6	–	15.4	–	–	1
WB-Mayville	60.2	60.3	15.7	15.2	2	3*
WB9479	60.4	–	16.0	–	–	2
WB9590	59.9	–	15.5	–	–	2
Mean	59.9	60.2	14.9	14.5		
No. Environments	10	21	10	22		

¹ 12% moisture basis.

² 2014-2018 crop years, where applicable

³ 1-9 scale in which 1 is best and 9 is worst. Values of 1-2 should be considered as resistant. Falling number data was collected from nine 2019 locations. Varieties with an * following their pre-harvest sprouting rating had lower than expected falling numbers based on their PHS rating.

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

Entry	Leaf Rust	Stripe Rust ²	Stem Rust ³	Bacterial Leaf Streak ⁴	Other Leaf Diseases ⁵	Scab ⁶
AP Murdock	3	–	1	4	6	7
Bolles	2	1	2	4	3	4
CP3055	2	–	2	4	4	5–6
CP3530	3	3	1	4	4	4
CP3903	3	–	1	2–3	4	4–5
CP3910	3	–	1	6	5	6
CP3915	1	–	1	2	5	4–5
Driver	3	–	1	3–4	5	3–4
Dyna-Gro Ambush	2	–	2	5	4	4
Dyna-Gro Ballistic	3	–	3	3	5	4–5
Dyna-Gro Commander	2	–	1	4	6	5
Dyna-Gro Velocity	3	–	1	6	7	6
Lang-MN	1	–	2	3	4	3
LCS Buster	2	–	1	4	3	4
LCS Cannon	3	–	2	5	7	5
LCS Rebel	6	–	2	3	4	4
LCS Trigger	1	–	2	2	3	3
Linkert	3	1	1	5	4	5
MN-Torgy	3	–	1	3	3	4
MN-Washburn	1	2	1	3	3	4
MS Barracuda	6	–	2	7	5	5
MS Chevelle	3	1	1	6	6	5
MS Rancho	1	–	1	6–7	3	3–5
ND Frohberg	3	–	1	3	4	3–4
Prosper	6	5	2	4	4	4
Rollag	4	1	2	7	6	3
Shelly	3	1	2	6	4	4
SY 611 CL2	3	–	5	4	4	4
SY Ingmar	2	2	2	3	5	4
SY Longmire	5	–	1	3	5	7
SY McCloud	3	–	1	5	5	5
SY Valda	1	2	1	3	4	4
TCG-Heartland	3	–	2	5	5	7
TCG-Spitfire	4	–	2	3	4	5
TCG-Wildcat	3	–	3	6–7	7	6–8
WB-Mayville	3	3	3	7	7	8
WB9479	6	–	2	6	5	7
WB9590	6	–	2	6	6	7

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 entries may change as more data is collected.

⁵ Combined rating of tan spot and septoria.

⁶ Varieties showing a ratings range are based on initial data. With further testing, a single numerical rating will be assigned



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Shelly - High Yield

Lang-MN - Well-balanced

Bolles - High Protein

Rollag - Scab Resistant

OATS

Deon - Proven High Yield

MN-Pearl - High Yielding, White Oat

BARLEY

Lacey - Yield and Quality

Quest - Scab Resistant

Rasmusson - High Yield

Visit the Minnesota Agricultural Experiment Station at www.maes.umn.edu or check your state or local variety trials. For a list of seed producers, visit the Minnesota Crop Improvement Association at www.mncia.org or call 1-800-510-6242.

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Table 4. Relative grain yield of hard red spring wheat varieties in northern Minnesota

Entry	Crookston			Fergus Falls			Hallock	
	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr
AP Murdock	107	108	–	96	99	–	99	106
Bolles	94	98	97	90	91	91	94	96
CP3055	95	–	–	112	–	–	110	–
CP3530	92	96	96	95	99	100	112	106
CP3903	93	–	–	97	–	–	108	–
CP3910	98	103	–	97	99	–	103	106
CP3915	103	104	–	99	103	–	90	95
Driver	99	–	–	104	–	–	115	–
Dyna-Gro Ambush	105	104	100	98	100	99	104	101
Dyna-Gro Ballistic	107	108	105	105	109	111	102	106
Dyna-Gro Commander	94	97	–	100	101	–	102	104
Dyna-Gro Velocity	93	92	–	96	95	–	95	96
Lang-MN	99	98	99	99	98	99	102	98
LCS Buster	103	–	–	114	–	–	111	–
LCS Cannon	98	100	100	96	100	101	89	98
LCS Rebel	97	101	101	101	97	97	106	102
LCS Trigger	114	116	114	118	115	113	127	118
Linkert	92	92	92	93	92	92	95	97
MN-Torgy	106	101	104	105	105	104	93	100
MN-Washburn	98	99	99	98	101	102	97	99
MS Barracuda	94	97	98	95	94	96	94	95
MS Chevelle	95	101	102	97	100	100	115	109
MS Rancho	101	–	–	93	–	–	108	–
ND Frohberg	93	–	–	103	–	–	87	–
Prosper	109	109	106	108	109	108	105	103
Rollag	77	87	85	89	91	89	91	97
Shelly	107	106	106	107	111	110	109	110
SY 611 CL2	102	102	–	102	103	–	90	99
SY Ingmar	95	95	97	106	100	100	89	92
SY Longmire	97	100	–	95	101	–	92	97
SY McCloud	91	92	95	99	97	99	103	98
SY Valda	103	104	107	103	99	101	107	109
TCG-Heartland	102	99	–	100	97	–	87	89
TCG-Spitfire	108	106	108	105	104	104	90	94
TCG-Wildcat	102	–	–	100	–	–	95	–
WB-Mayville	85	88	89	89	90	93	89	89
WB9479	110	–	–	96	–	–	103	–
WB9590	113	–	–	99	–	–	120	–
Mean (Bu/Acre)	70.1	74.7	71.4	83.7	83.4	88.8	66.8	76.3
LSD (0.10)	7.6	6.5	6.1	6.5	6.6	4.6	17.7	8.0

ta locations in single-year (2020) and multiple-year comparisons (2018-2020).

	Oklee			Perley			Roseau		
3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr
-	111	110	-	110	112	-	107	108	-
93	90	91	91	100	95	93	94	91	93
-	115	-	-	78	-	-	107	-	-
103	100	98	98	104	106	106	94	98	98
-	90	-	-	108	-	-	92	-	-
-	92	101	-	106	104	-	83	98	-
-	87	95	-	95	95	-	117	114	-
-	106	-	-	111	-	-	98	-	-
101	103	104	106	107	96	96	92	90	94
106	104	109	107	107	104	106	118	114	113
-	99	100	-	91	104	-	98	104	-
-	89	88	-	90	88	-	99	100	-
98	95	98	96	96	98	97	102	100	103
-	126	-	-	120	-	-	122	-	-
101	102	104	104	113	115	111	92	99	100
101	91	96	98	109	108	109	110	108	105
111	116	119	115	125	119	119	118	118	117
97	92	93	92	90	88	90	90	89	91
101	106	105	102	94	97	103	102	105	102
98	97	101	98	97	100	104	73	85	92
97	100	103	103	82	93	92	87	93	97
110	97	98	101	98	94	98	114	110	108
-	102	-	-	100	-	-	110	-	-
-	98	-	-	93	-	-	92	-	-
105	109	108	109	101	96	102	107	104	107
96	94	93	92	92	95	93	84	82	84
107	104	105	105	94	96	96	90	102	103
-	109	106	-	99	95	-	105	102	-
96	102	100	100	96	102	99	104	102	99
-	91	98	-	95	85	-	90	92	-
98	101	98	98	97	96	93	97	97	97
111	100	103	107	108	102	104	96	109	107
-	92	93	-	114	110	-	95	92	-
96	103	104	104	106	109	107	100	107	105
-	96	-	-	100	-	-	109	-	-
92	89	91	94	107	109	105	80	90	91
-	104	-	-	83	-	-	91	-	-
-	104	-	-	109	-	-	105	-	-
83.5	81.0	72.5	80.6	67.4	67.7	70.1	88.3	86.9	87.4
6.6	12.0	9.7	6.1	18.6	12.3	9.0	18.7	14.0	9.9

Table 5. Relative grain yield of hard red spring wheat varieties in southern Minnesota locations in single-year (2020) and multiple-year comparisons (2018-2020).

Entry	Benson			Kimball ¹	Lamberton			Le Center			Morris ²		St. Paul			Waseca		
	2020	2 Yr	3 Yr	2 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr
AP Murdock	95	102	-	-	110	114	-	101	110	-	103	103	109	112	-	115	123	-
Bolles	98	100	97	90	86	88	81	102	96	97	97	99	98	99	97	94	99	102
CP3055	120	-	-	-	96	-	-	99	-	-	127	-	82	-	-	81	-	-
CP3530	110	115	111	102	104	112	116	97	102	106	93	104	102	107	106	95	104	108
CP3903	99	-	-	-	91	-	-	90	-	-	87	-	99	-	-	92	-	-
CP3910	98	98	-	-	106	102	-	88	92	-	102	105	119	108	-	105	102	-
CP3915	90	99	-	-	97	96	-	106	104	-	101	97	85	90	-	87	84	-
Driver	98	-	-	-	96	-	-	108	-	-	103	-	102	-	-	107	-	-
Dyna-Gro Ambush	104	98	97	109	104	111	107	94	96	97	111	107	109	112	105	111	114	108
Dyna-Gro Ballistic	113	109	108	106	105	104	102	110	109	110	104	111	105	102	103	104	108	107
Dyna-Gro Commander	113	104	-	-	102	101	-	101	101	-	114	112	107	107	-	120	114	-
Dyna-Gro Velocity	90	93	-	-	94	99	-	80	84	-	82	88	97	91	-	92	94	-
Lang-MN	99	98	101	102	97	100	99	93	97	101	102	102	101	101	103	103	106	115
LCS Buster	106	-	-	-	108	-	-	115	-	-	115	-	102	-	-	120	-	-
LCS Cannon	94	91	91	114	112	111	111	103	102	98	116	106	120	115	114	114	114	111
LCS Rebel	98	99	97	94	102	100	96	107	105	106	93	97	106	98	97	114	110	104
LCS Trigger	126	123	119	98	110	114	115	121	121	119	133	118	104	104	107	128	117	121
Linkert	100	93	91	101	89	88	87	91	89	82	89	90	100	99	99	83	91	82
MN-Torgy	101	105	106	106	107	107	109	112	111	107	109	109	100	101	100	95	107	114
MN-Washburn	89	92	93	91	105	101	102	102	105	106	90	97	92	100	99	107	101	101
MS Barracuda	94	93	93	109	107	106	107	101	90	86	90	89	113	113	109	105	102	93
MS Chevelle	94	92	93	95	102	100	97	88	90	86	100	105	105	101	98	102	101	94
MS Rancho	94	-	-	-	91	-	-	93	-	-	102	-	114	-	-	102	-	-
ND Froberg	100	-	-	-	96	-	-	100	-	-	107	-	103	-	-	103	-	-
Prosper	105	104	107	102	108	106	103	116	117	121	101	110	106	101	104	99	95	103
Rollag	92	93	92	96	92	85	78	78	79	79	112	92	93	85	83	93	92	83
Shelly	109	104	106	98	108	104	106	99	95	97	113	108	99	104	104	95	102	102
SY 611 CL2	92	101	-	-	88	92	-	92	90	-	91	100	100	93	-	88	97	-
SY Ingmar	95	97	98	100	92	92	95	99	104	104	91	87	92	99	100	93	99	102
SY Longmire	90	96	-	-	94	92	-	110	104	-	91	91	88	88	-	75	71	-
SY McCloud	91	90	94	102	97	93	92	81	88	89	90	93	105	102	102	89	94	89
SY Valda	105	109	111	106	105	113	108	97	102	108	99	101	98	99	100	108	111	108
TCG-Heartland	100	100	-	-	96	93	-	94	90	-	84	91	100	104	-	103	101	-
TCG-Spitfire	106	115	112	101	101	106	110	126	124	120	129	118	98	101	102	92	95	98
TCG-Wildcat	96	-	-	-	105	-	-	106	-	-	98	-	102	-	-	100	-	-
WB-Mayville	99	95	92	99	93	92	94	103	100	91	92	99	109	108	106	97	103	94
WB9479	89	-	-	-	96	-	-	89	-	-	89	-	97	-	-	101	-	-
WB9590	99	-	-	-	109	-	-	102	-	-	95	-	108	-	-	105	-	-
Mean (Bu/Acre)	85.1	91.0	86.9	73.3	63.2	47.8	45.7	78.0	68.4	64.8	48.1	57.1	74.3	73.1	72.3	46.6	44.1	44.4
LSD (0.10)	16.7	11.1	8.2	11.6	13.4	14.9	12.5	12.8	9.2	9.7	16.8	15.3	8.0	11.5	8.6	12.8	14.3	20.5



Table 6. Relative grain yield of hard red spring wheat varieties in Minnesota in single-year (2020) and multiple-year comparisons (2018-2020).

Entry	State			North			South		
	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr	2020	2 Yr	3 Yr
AP Murdock	107	109	–	109	108	–	105	110	–
Bolles	94	94	93	92	93	93	95	96	94
CP3055	102	–	–	102	–	–	101	–	–
CP3530	101	104	103	100	101	100	101	108	108
CP3903	94	–	–	95	–	–	94	–	–
CP3910	98	101	–	95	101	–	103	102	–
CP3915	96	99	–	97	101	–	94	95	–
Driver	103	–	–	104	–	–	101	–	–
Dyna-Gro Ambush	103	102	101	103	100	100	105	106	103
Dyna-Gro Ballistic	106	107	107	106	108	107	107	107	107
Dyna-Gro Commander	103	103	–	99	102	–	108	106	–
Dyna-Gro Velocity	91	92	–	91	92	–	90	92	–
Lang-MN	99	100	100	100	99	99	98	100	102
LCS Buster	113	–	–	116	–	–	110	–	–
LCS Cannon	102	104	104	98	102	103	109	106	105
LCS Rebel	102	101	100	102	102	101	103	101	98
LCS Trigger	118	116	114	118	117	114	119	115	113
Linkert	91	91	91	90	91	92	93	93	91
MN-Torgy	104	104	104	104	103	103	104	106	106
MN-Washburn	93	97	98	91	96	98	97	98	98
MS Barracuda	97	99	99	94	97	99	102	100	99
MS Chevelle	98	99	99	98	100	102	98	98	96
MS Rancho	104	–	–	107	–	–	99	–	–
ND Frohberg	97	–	–	94	–	–	101	–	–
Prosper	106	105	106	106	105	106	106	104	106
Rollag	92	91	89	92	92	92	92	88	86
Shelly	103	104	104	102	105	105	104	103	104
SY 611 CL2	97	100	–	101	102	–	92	97	–
SY Ingmar	96	97	98	98	98	98	94	96	98
SY Longmire	91	93	–	91	95	–	92	90	–
SY McCloud	95	95	96	96	96	97	93	94	95
SY Valda	104	106	107	105	107	108	102	106	106
TCG-Heartland	98	97	–	98	96	–	97	97	–
TCG-Spitfire	104	105	105	101	103	103	108	109	108
TCG-Wildcat	102	–	–	103	–	–	101	–	–
WB-Mayville	93	95	95	89	92	93	99	99	96
WB9479	96	–	–	99	–	–	93	–	–
WB9590	105	–	–	106	–	–	103	–	–
Mean (Bu/Acre)	71.1	71.1	72.9	74.9	76.2	79.7	66.0	64.8	65.2
LSD (0.10)	4.9	3.2	2.5	6.5	3.9	2.9	7.2	5.1	4.3
No. Environments	14	29	43	8	16	23	6	13	20

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

Entry	North												South												State											
	2020		2-year		3-year		2020		2-year		3-year		2020		2-year		3-year		2020		2-year		3-year													
	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int												
AP Murdock	84.6	91.5	87.0	90.7	--	--	56.8	55.0	55.5	59.5	--	--	70.7	73.2	71.3	75.1	--	--																		
Bolles	74.4	72.9	75.8	74.8	75.4	74.2	55.0	56.2	51.0	54.8	49.1	52.1	64.7	64.6	63.4	64.8	63.4	64.1																		
CP3055	80.6	86.1	--	--	--	--	61.9	68.6	--	--	--	--	71.3	77.3	--	--	--	--																		
CP3530	73.8	85.8	78.6	88.2	77.2	86.0	53.3	56.7	54.0	58.8	52.7	56.6	63.5	71.3	66.3	73.5	66.1	72.6																		
CP3903	73.3	81.6	--	--	--	--	49.4	51.9	--	--	--	--	61.4	66.8	--	--	--	--																		
CP3910	71.0	79.7	81.0	85.8	--	--	52.1	52.1	51.9	52.6	--	--	61.6	65.9	66.4	69.2	--	--																		
CP3915	87.7	86.4	88.4	87.2	--	--	57.9	55.9	52.4	56.0	--	--	72.8	71.2	70.4	71.6	--	--																		
Driver	77.9	73.2	--	--	--	--	58.8	54.7	--	--	--	--	68.4	63.9	--	--	--	--																		
Dyna-Gro Ambush	77.7	76.6	77.9	75.7	76.6	76.7	56.8	54.6	53.7	58.0	51.1	54.6	67.3	65.6	65.8	66.8	65.0	66.7																		
Dyna-Gro Ballistic	89.4	81.3	89.9	89.7	86.8	88.9	59.5	63.5	57.7	64.0	55.3	61.4	74.4	72.4	73.8	76.8	72.5	76.4																		
Dyna-Gro Commander	76.3	77.3	81.3	83.1	--	--	59.6	57.3	56.2	56.5	--	--	68.0	67.3	68.8	69.8	--	--																		
Dyna-Gro Velocity	76.3	68.6	78.0	80.0	--	--	44.8	45.5	44.9	48.6	--	--	60.6	57.0	61.4	64.3	--	--																		
Lang-MN	79.8	79.9	80.2	83.3	81.0	82.4	53.6	56.2	52.2	57.8	51.1	57.7	66.7	68.0	66.2	70.5	67.4	71.1																		
LCS Buster	90.1	86.7	--	--	--	--	64.7	62.9	--	--	--	--	77.4	74.8	--	--	--	--																		
LCS Cannon	74.7	78.5	80.1	83.2	79.4	82.7	60.3	57.1	54.3	55.5	50.8	52.3	67.5	67.8	67.2	69.4	66.4	68.9																		
LCS Rebel	82.9	77.2	84.4	79.1	81.7	79.1	56.3	56.6	52.7	57.6	51.1	55.1	69.6	66.9	68.5	68.3	67.8	68.2																		
LCS Trigger	92.1	84.7	94.8	93.9	91.9	94.2	69.4	71.6	62.1	68.8	59.3	66.0	80.8	78.1	78.4	81.3	77.1	81.4																		
Linkert	71.9	79.5	73.0	80.2	72.2	78.8	49.9	51.2	46.6	49.0	42.7	46.8	60.9	65.4	59.8	64.6	58.8	64.2																		
MN-Torgy	82.6	80.9	83.4	86.6	81.9	85.9	61.7	53.0	57.7	55.2	54.3	54.3	72.1	67.0	70.5	70.9	69.3	71.5																		
MN-Washburn	66.6	90.4	74.0	88.5	75.4	87.6	54.4	52.5	52.8	55.7	51.1	54.5	60.5	71.5	63.4	72.1	64.3	72.6																		
MS Barracuda	71.3	71.0	76.9	77.3	77.3	77.8	54.0	50.6	46.9	49.5	43.8	47.5	62.7	60.8	61.9	63.4	62.1	64.0																		
MS Chevelle	83.3	79.6	85.7	87.2	83.4	86.3	51.8	57.8	51.6	55.5	47.6	53.2	67.6	68.7	68.7	71.4	67.1	71.2																		
MS Rancho	84.1	77.7	--	--	--	--	54.0	46.1	--	--	--	--	69.0	61.9	--	--	--	--																		
ND Frohberg	73.5	73.5	--	--	--	--	57.9	55.5	--	--	--	--	65.7	64.5	--	--	--	--																		
Prosper	85.4	85.9	86.0	91.4	84.7	89.6	60.9	61.7	59.0	63.6	58.1	62.4	73.1	73.8	72.5	77.5	72.6	77.2																		
Rollag	64.1	75.4	68.3	77.2	67.1	74.7	51.9	51.4	45.1	50.2	42.8	48.1	58.0	63.4	56.7	63.7	56.1	62.6																		
Shelly	76.9	88.3	83.9	90.0	83.1	87.6	58.4	51.1	53.2	55.1	51.2	53.5	67.7	69.7	68.5	72.6	68.6	72.1																		
SY 611 CL2	82.2	83.2	82.5	89.5	--	--	51.0	52.0	49.9	52.3	--	--	66.6	67.6	66.2	70.9	--	--																		
SY Ingmar	79.2	78.5	79.9	80.3	77.7	80.4	53.6	54.4	49.8	54.5	48.6	52.7	66.4	66.4	64.8	67.4	64.5	67.8																		
SY Longmire	73.4	79.9	77.3	83.4	--	--	56.5	55.4	50.6	53.7	--	--	64.9	67.6	63.9	68.6	--	--																		
SY McCloud	74.9	77.9	76.8	81.1	76.4	80.5	47.5	46.9	47.6	49.0	45.7	48.0	61.2	62.4	62.2	65.1	62.4	65.7																		
SY Valda	78.5	84.6	86.2	90.4	85.2	89.5	54.4	53.8	52.9	55.5	52.4	54.2	66.5	69.2	69.5	73.0	70.2	73.5																		
TCG-Heartland	77.9	82.6	77.0	83.1	--	--	50.0	46.5	47.4	49.6	--	--	63.9	64.5	62.2	66.4	--	--																		
TCG-Spittfire	82.0	89.4	85.9	91.6	84.5	89.8	71.4	67.3	63.4	63.8	59.9	61.2	76.7	78.4	74.6	77.7	73.3	76.8																		
TCG-Wildcat	83.7	85.3	--	--	--	--	57.2	57.3	--	--	--	--	70.4	71.3	--	--	--	--																		
WB-Mayville	65.0	72.8	72.1	78.9	71.5	78.3	55.0	54.1	52.3	53.9	47.6	49.1	60.0	63.5	62.2	66.4	60.7	65.0																		
WB9479	78.5	77.4	--	--	--	--	49.7	48.4	--	--	--	--	64.1	62.9	--	--	--	--																		
WB9590	86.0	87.5	--	--	--	--	55.5	55.6	--	--	--	--	70.8	71.5	--	--	--	--																		
Mean (Bu/Acre)	78.5	80.8	80.9	84.5	79.5	83.4	56.0	55.2	52.6	55.7	50.8	54.3	67.2	68.0	66.7	70.1	66.5	70.2																		
LSD (0.10)	10.7	11.0	6.6	7.2	4.7	5.1	8.5	7.2	5.7	5.2	5.1	4.8	6.8	6.8	4.4	4.6	3.5	3.6																		
No. Environments	2	2	4	4	6	6	2	2	4	4	5	5	4	4	8	8	11	11																		



Farming and ranching can be stressful occupations, and that stress can have a multifaceted effect on a person. While you get to be your own boss, you feel responsible for a lot and can control very little. Fluctuating markets, uncertain crop yields and unpredictable weather can cause high stress, anxiety and depression.

There are places to seek help.

CONTACT:
 Minnesota Farm and Rural Helpline:
 1-833-600-2670

MN Crisis Text Line: text "Home" to 741741

ND Crisis Text Line: text "GO" to 741741

National Suicide Prevention Lifeline:
 1-800-273-8255

Reach Out - We are here to help.



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Good Scab and BLS Resistance
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Very Good Yield
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Visit the Minnesota Agricultural Experiment Station at www.maes.umn.edu or check your state or local variety trials. For a list of seed producers, visit the Minnesota Crop Improvement Association at www.mncia.org or call 1-800-510-6242.

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Table 9. Disease reactions of barley varieties in multiple year comparisons (2018-2020).

Variety	Don ¹	Spot Blotch ¹	Stem Rust ^{1,2}	Bacterial Leaf Streak ¹
----- (1-9) -----				
2-row				
AAC Synergy	7	3	5	4
Conlon	3	9	4	5
ND Genesis	4	4	7	4
Pinnacle	5	5	8	6
Pinnacle	7	3	5	4
6-row				
Lacey	6	2	6	4
Quest	3	3	4	5
Rasmusson	7	3	7	5
Robust	8	1	5	4
Tradition	4	3	5	5
No. of Environments	4	3	3	4

¹ Trait measured on a scale from 1-9 where 1=resistant and 9=susceptible. Deoxynivalenol (DON) is the mycotoxin produced by the Fusarium head blight pathogen.

² Data is for stem rust pathogen QCCJ. All lines were resistant to stem rust pathogen MCCF in years tested.



MN-TORGY WHEAT



- High Yielding
- Very Good Protein
- Good Scab and BLS Resistance
- Adapted to MN, ND and SD
- Named in honor of Dave Torgerson, former Executive Director of the MAWG

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Table 10. Relative grain yield of barley varieties in northern Minnesota locations in a single-year (2020) and multiple-year comparisons (2018-2020).

Variety	Crookston		Hallock		Oklee		Perley		Roseau	Stephen		Strathcona	
	2 yr ²		2020	3 yr	2020	3 yr	2020	3 yr	2 yr ²	2020	3 yr	2020	3 yr
-----(% of mean)-----													
2-row													
AAC Synergy	98		116	106	108	104	97	102	102	100	102	188	122
Conlon	93		98	96	86	92	92	92	94	117	100	15	69
ND Genesis	100		91	99	107	107	108	101	105	101	98	70	103
Pinnacle	113		97	107	101	102	110	94	105	111	109	138	111
6-row													
Lacey	105		84	90	95	97	87	98	104	103	100	100	104
Quest1	-		84	-	97	-	93	-	-	92	-	119	-
Rasmusson1	-		101	-	96	-	85	-	-	87	-	140	-
Robust	91		99	96	96	98	102	101	96	96	94	59	93
Tradition	101		130	105	115	100	125	112	95	92	97	71	98
Mean (bu/acre)	124		93	100	123	110	98	90	106	85	114	54	94
LSD (0.05)	22		34	22	22	15	23	18	11	27	15	27	32

¹ Line was tested for yield in 2020 only. Refer to 2018 and prior years' reports for additional data

² Trial data is from 2019 and 2018 only.

Table 11. Relative grain yield of barley varieties in southern Minnesota locations in single-year (2020) and multiple-year comparisons (2018-2020).

Variety	Fergus Falls		Lamberton	Le Center		New Ulm		Rochester		St Paul	
	2020	3 yr	2020 ²	2020	3 yr	2020	2 yr ³	2020	2 yr ⁴	2020	3 yr
-----(% of mean)-----											
2-row											
AAC Synergy	106	97	113	106	107	115	107	99	101	121	113
Conlon	89	72	78	88	96	94	97	72	73	65	56
ND Genesis	104	113	94	108	110	98	104	91	98	111	109
Pinnacle	105	111	93	105	93	95	101	102	105	112	101
6-row											
Lacey	94	103	109	96	99	100	98	109	114	111	113
Quest1	94	-	74	104	-	91	-	96	-	95	-
Rasmusson1	108	-	119	103	-	114	-	112	-	104	-
Robust	95	96	99	85	91	84	85	110	101	95	102
Tradition	106	109	120	106	104	110	107	109	109	87	105
Mean (bu/acre)	112	80	69	107	93	69	63	107	92	87	81
LSD (0.05)	13	19	10	11	24	13	13	15	20	11	19

¹ Line was tested for yield in 2020 only. Refer to 2018 and prior years' reports for additional data.

² Trial data is from 2020 only.

³ Trial data is from 2020 and 2018 only.

⁴ Trial data is from 2020 and 2019 only.

Table 12. Relative grain yield of barley varieties in a single-year (2020) and multiple year comparisons (2018-2020)

Variety	State			North			South		
	2020	2yr	3yr	2020	2yr	3yr	2020	2yr	3yr
	-----(% of mean)-----								
2-row									
AAC Synergy	112	107	105	115	106	105	109	107	105
Conlon	84	85	86	87	88	91	81	81	76
ND Genesis	100	105	103	98	104	102	102	105	106
Pinnacle	105	104	105	108	107	106	102	100	102
6-row									
Lacey	98	101	102	93	98	99	103	105	106
Quest ¹	94	-	-	95	-	-	93	-	-
Rasmusson ¹	104	-	-	98	-	-	109	-	-
Robust	94	95	96	94	94	96	95	96	96
Tradition	108	104	103	111	102	101	106	106	108
Mean (bu/acre)	91	88	95	91	94	104	91	81	81
LSD (0.05)	10.5	7.0	5.6	20.9	11.3	7.6	9.7	7.8	8.1
No. Environments	11	22	32	5	12	19	6	10	13

¹ Line was tested for yield in 2020 only. Refer to 2018 and prior years' reports for additional data.



MN-PEARLOAT



- High yielding
- Good straw strength
- Resistant to crown rust
- Resistant to smut
- Later maturing
- White hulled

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Table 13. Origin and agronomic characteristics of oat varieties in Minnesota in multiple-year comparisons (2018-2020).

Variety	Origin	Year of Release	Legal status	Seed Color	Days to Heading (days)	Plant Height (inches)	Straw Strength ³ (1-9)	Test Weight (lbs/bu)	Grain Protein ^{4,5} (%)	Grain Oil ^{4,5} (%)	Grain Beta-glucan ^{4,5} (%)
Antigo	WI	2017	Pending	Yellow	53.4	34.0	3.0	37.7	19.4	6.9	6.0
Badger	WI	2010	PVP(94)	Yellow	52.8	35.7	3.3	33.8	16.9	6.2	5.3
Deon	MN	2014	PVP(94)	Yellow	56.9	35.7	3.3	35.1	16.1	6.6	5.5
Esker ¹	WI	2006	PVP(94)	White	53.9	34.1	2.6	34.8	17.2	5.8	5.6
Esker 2020 ¹	WI	2020	Pending	Yellow	55.1	34.3	3.0	33.5	16.8	5.6	6.1
Hayden	SD	2015	PVP(94)	White	57.0	36.8	4.1	36.1	15.1	7.2	5.7
MN Pearl	MN	2018	Pending	White	57.4	38.5	3.0	35.4	14.5	7.2	5.2
Newburg	ND	2011	PVP(94)	White	58.1	38.5	4.6	34.0	15.8	6.7	6.7
Reins	IL	2016	PVP(94)	White	53.7	32.6	1.7	36.1	16.6	6.0	5.5
Rushmore ¹	SD	2020	Pending	White	58.5	37.0	3.7	35.0	15.6	7.9	5.8
Rockford ¹	ND	2008	PVP(94)	White	55.2	34.3	2.7	36.4	16.7	5.8	5.5
Saber	IL	2010	PVP(94)	Yellow	53.5	33.5	3.0	34.6	16.4	5.5	5.8
Saddle	SD	2018	Pending	White	52.9	34.0	1.6	36.0	16.6	6.1	5.2
Shelby 427	SD	2011	PVP(94)	White	54.1	36.0	3.7	36.3	15.9	6.9	5.2
Streaker ²	SD	2016	PVP(94)	Hulless	55.0	34.5	4.6	41.6	16.7	6.9	5.8
Sumo	SD	2017	Pending	White	52.3	34.4	2.7	36.5	18.2	5.6	5.3
Warrior ¹	SD	2019	Pending	White	55.7	32.2	1.7	35.2	16.6	6.2	5.2

¹ Line tested in 2019 and 2020 ² Hulless oat ³ 1-9 scale where 1=most resistant, 9=most susceptible ⁴ 12% Grain moisture
⁵ Trait measured in 2019 for 3 locations

Table 14. Disease characteristics of oat varieties.

Variety	Crown Rust ¹ (1-9)	Loose Smut ² (1-9)	BYDV ³ (1-9)
Antigo	4	3	7
Badger	6	1	5
Deon	3	1	4
Esker	5	2	5
Esker 2020	4	1	6
Hayden	5	1	3
MN Pearl	5	1	6
Newburg	5	4	3
Reins	6	1	6
Rockford	6	3	3
Rushmore	4	2	4
Saber	5	5	6
Saddle	4	2	5
Shelby 427	5	2	6
Streaker	5	1	3
Sumo	4	1	7
Warrior	3	2	6

¹ Tested in 2018, 2019, and 2020 with a mixed race population of crown rust; 1 = most resistant, 9 = most susceptible
² Tested in 2018 and 2019; 1 = most resistant, 1 = most susceptible
³ Tested in 2015, 2016, and 2018; 1 = most resistant, 1 = most susceptible

Table 15. Relative grain yield of oat varieties in northern Minnesota locations in single-year (2020) and multiple-year comparisons (2018-2020).

Variety	Crookston		Fergus Falls ³		Roseau		Stephen					
	2020	3yr	2020	3yr	2020	3yr	2020	3yr				
	-----(% of mean)-----											
Antigo	100	102	90	96	65	88	86	85				
Badger	94	102	87	84	91	98	82	91				
Deon	106	100	91	100	115	114	114	115				
Esker ¹	103	-	87	-	86	-	86	-				
Esker 2020 ¹	108	-	83	-	105	-	102	-				
Hayden	120	121	112	115	123	109	107	108				
MN Pearl	111	110	121	126	112	120	118	118				
Newburg	100	101	123	122	84	91	115	106				
Reins	99	96	101	92	106	104	102	108				
Rockford ¹	97	-	130	-	115	-	101	-				
Rushmore ¹	114	-	116	-	117	-	127	-				
Saber	113	114	90	100	105	105	108	105				
Saddle	90	99	93	91	99	106	106	105				
Shelby 427	99	102	96	95	98	98	95	95				
Streaker ²	75	84	102	101	72	75	69	75				
Sumo	76	69	61	76	84	92	82	90				
Warrior ¹	98	-	117	-	122	-	101	-				
Mean (bu/acre)	164	132	145	143	101	118	154	138				
LSD (0.1)⁴	25	19	41	33	37	25	28	20				

¹ Line was tested in 2020 and 2019 only ² Hullless oat ³ Location was tested in 2018 and 2020
⁴ A large LSD suggests large variability from year to year for the specific location



NEW 2019 Varieties

- ND Rolette
- ND Hammond

Top Varieties

- ND Grano Durum
- ND Riveland Durum
- ND17009GT Soybean
- ND VitPro Hard Red Spring Wheat



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Table 16. Relative grain yield of oat varieties in southern Minnesota locations in single-year (2020) and multiple-year comparisons (2018-2020).

Variety	Kimball ³		Lamberton		LeCenter		Rochester ⁴		St Paul ⁵		Waseca	
	3yr		2020	3yr	2020	3yr	2020	3yr	2020		2020	3yr
-----(% of mean)-----												
Antigo	108		105	106	99	97	100	107	85		82	100
Badger	100		99	90	99	98	98	94	73		103	104
Deon	94		113	129	104	105	107	110	110		107	114
Esker ¹	-		105	-	96	-	96	105	102		103	-
Esker 2020 ¹	-		112	-	97	-	94	103	101		104	-
Hayden	92		87	99	113	108	112	107	120		109	97
MN Pearl	98		116	133	100	117	108	110	129		119	131
Newburg	97		94	105	102	101	95	94	102		104	87
Reins	117		105	86	91	97	94	107	103		107	111
Rockford ¹	-		87	-	108	-	99	90	89		103	-
Rushmore ¹	-		120	-	118	-	112	113	99		110	-
Saber	101		84	89	118	112	116	115	112		100	93
Saddle	117		95	99	100	108	101	103	98		82	103
Shelby 427	98		74	87	107	102	99	98	105		97	89
Streaker ²	75		66	70	83	66	72	67	78		79	73
Sumo	104		113	106	81	89	102	94	80		96	97
Warrior ¹	-		125	-	83	-	95	82	114		96	-
Mean (bu/acre)	128		118	105	133	146	138	126	126		122	79
LSD (0.1)⁶	36		21	20	30	21	23	27	12		16	20

¹ Line tested in 2018 and 2019 only

² Hulless oat

³ Location was tested in 2018 and 2019

⁴ Location was tested in 2019 and 2020

⁵ Location was tested in 2020 only

⁶ A large LSD suggests large variability from year to year for the specific location



Table 17. Relative grain yield of oat varieties in Minnesota in single-year (2020) and multiple-year comparisons (2018-2020).

Variety	North			South			State		
	2020	2yr	3yr	2020	2yr	3yr	2020	2yr	3yr
	-----(% of mean)-----								
Antigo	87	90	92	94	101	102	91	96	97
Badger	88	94	95	94	93	95	91	94	95
Deon	106	105	108	108	111	110	107	109	109
Esker ¹	91	96	-	100	97	-	96	97	-
Esker 2020 ¹	99	100	-	101	105	-	100	103	-
Hayden	115	111	113	108	104	103	111	107	108
MN Pearl	116	114	118	114	117	119	115	116	118
Newburg	107	106	104	99	98	98	103	101	101
Reins	102	99	101	99	100	102	100	100	101
Rockford ¹	110	108	-	98	87	-	103	96	-
Rushmore ¹	118	114	-	112	115	-	115	115	-
Saber	104	106	107	107	104	103	106	105	105
Saddle	97	99	101	96	104	105	96	102	103
Shelby 427	97	95	98	97	97	96	97	96	97
Streaker ²	80	83	83	76	71	70	78	76	76
Sumo	75	76	82	94	94	96	85	86	89
Warrior ¹	108	103	-	102	102	-	105	102	-
Mean (bu/acre)	141	128	132	127	121	116	133	124	123
LSD (0.1)	21	15	13	16	12	11	13	10	8
# of Environments	4	7	11	5	10	14	9	17	25

¹ Line was tested in 2020 and 2019 only

² Hullless oat



MGGA Announces Chief Executive Transition

Great Falls – The Montana Grain Growers Association (MGGA) announced that executive vice president Lola Raska will retire from the organization at the end of this calendar year. The organization also announced that Alison Vergeront has been hired as MGGA's new executive vice president, effective January 1, 2021.



Alison Vergeront

Lola Raska has been on staff at MGGA for 21 years, serving as the organization's farm policy associate and website manager before being hired as executive vice president in 2006. Prior to joining the staff, Raska represented District 9 on the MGGA board of directors from 1997 to 2001. She grew up on the family farm near Plentywood, MT and, after receiving a degree in ag science from Montana State University, has been involved in the Montana agricultural industry for over 40 years.

Alison Vergeront was raised on the family farm near Polson, MT that was homesteaded in 1910. She has served as agricultural liaison and field representative for U.S. Senator Steve Daines for the past six years, regularly meeting with producers and other stakeholders across the state. Vergeront previously worked as administrative support in the Montana State Senate for several sessions and has coordinated

national young leadership conferences as well as Montana state-wide summits. Her professional, legislative and leadership experience at various levels of political and public service and her dynamic organizational skills will serve MGGA well.

In announcing the transition, MGGA president Vince Mattson of Chester said "We could not be more pleased that Alison has agreed to become our new executive vice president. I am confident that her qualifications, experience and dedication to agriculture are attributes that will help steward MGGA's legacy during this time of transition."

The Montana Grain Growers Association is the primary trade organization representing Montana wheat and barley producers who, by combining their strengths, voices, and ideas, are working to insure a better future for themselves, their industry and the consumer.

Advertorial

2020 LEARNINGS – MANAGEMENT vs. WEATHER

Grant Mehring, WestBred® Technical Product Manager, Northern Region

In farming, each year we should take time to review how our management decisions worked against what the environment and weather gave us. When considered in combination, we can respond better and adjust where necessary for the next growing season.

Northern Plains wheat in 2020 ranged from bountiful to stressed, with most everything in between. There was some fantastic wheat in many areas. There was later-planted wheat that out-yielded the early wheat by a significant margin. There was early-planted wheat that, given an inch or less of rain for most of the growing season, yielded poorly, and some that yielded surprisingly well, plus many other scenarios. Given what we saw, here are some key learnings:

Don't pull inputs too soon.

- In droughty environments, use tools such as solid crop rotation, early planting and fungicides. Nice yields can still be found.

Don't try to outguess the weather with one variety.

- Diversify your maturity and stress tolerance to hedge against the weather. Later-maturing WestBred brand WB9719 capitalized on the 2020 growing conditions to top my trials.

Wheat was variably impacted by the high heat during parts of the summer.

- Still strive for early planting dates. Nevertheless, spreading out planting dates can protect against certain weather events at the vulnerable growth stages.

Using what we've learned from 2020 will help make 2021 more productive. Although high protein and straw strength have not been as important to us the past few years, they are both critical traits to consider when choosing a variety to plant.

For additional information, contact Grant Mehring at 701-373-1591 or grant.mehring@bayer.com.

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Between weather, fluctuating markets and ever-shrinking margins, you have enough to worry about. The North Dakota Grain Growers Association will represent your interests on regulation and policy issues so you can focus on raising the best crop you can. Let's work together to ensure North Dakota agriculture remains profitable for generations to come.

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North Dakota Hard Red Spring Wheat Variety Trial Results for 2020 and Selection Guide - Preliminary Report

Joel Ransom, Andrew Green, Senay Simsek, Andrew Friskop, Matt Breiland, Tim Friesen, Zhaohui Liu and Shaobin Zhong (NDSU Main Station); John Rickertsen (Hettinger Research Extension Center); Eric Eriksmoen (North Central Research Extension Center, Minot); Bryan Hanson (Langdon Research Extension Center); Glenn Martin (Dickinson Research Extension Center); Gautam Pradhan (Williston Research Extension Center); Mike Ostlie (Carrington Research Extension Center)

Hard red spring (HRS) wheat was planted on 6 million acres in 2020, down from 6.6 million in 2019. The average yield of HRS wheat was 48 bushels/acre (bu/a), similar to 2019.

SY Ingmar was the most popular HRS wheat variety in 2020, occupying 19.2% of the planted acreage, followed by SY Valda (12.5%), WB9590 (6.1%), SY Soren (4.1%), Glenn (3.6%) and Faller (3.5%). SY Ingmar, SY Soren and SY Valda were released by Syngenta/AgriPro. WB9590 was released by Westbred/Monsanto. Glenn and Faller are NDSU releases.

Successful wheat production depends on numerous factors, including selecting the right variety for a particular area. The information included in this publication is meant to aid in selecting that variety or group of varieties. Characteristics to

consider in selecting a variety may include yield potential, protein content when grown with proper fertility, straw strength, plant height, response to problematic pests (diseases, insects, etc.) and maturity. Every growing season differs; therefore, when selecting a variety, we recommend using data that summarize several years and locations. Choose the variety that, on average, performs the best at multiple locations near your farm during several years.

Selecting varieties with good milling and baking quality also is important to maintain market recognition and avoid discounts. Hard red spring wheat from the northern Great Plains is known around the world for its excellent end-use quality.

Millers and bakers consider many factors in determining the quality and value of wheat they purchase. Several key parameters are: high test weight (for optimum milling yield and flour color), high falling number (greater than 300 seconds indicates minimal sprout damage), high protein content (the majority of HRS wheat export markets want at least 14% protein) and excellent protein quality (for superior bread-making quality as indicated by traditional strong gluten proteins, high baking absorption and large bread loaf volume).

Gluten strength, and milling and baking quality ratings are provided for individual varieties based on the results from the NDSU field plot variety trials in multiple locations in 2019. The wheat protein data often are higher than obtained in actual production fields but can be used to compare relative differences among varieties.

The agronomic data presented in this publication are from replicated research plots using experimental designs that enable the use of statistical analysis. These analyses enable the reader to determine, at a predetermined level of confidence, if the differences observed among varieties are reliable or if they might be due to error inherent in the experimental process.

The LSD (least significant difference) values beneath the columns in the tables are derived from these statistical analyses and apply only to the numbers in the column in which they appear. If the difference between two varieties exceeds the LSD value, it means that with 95% or 90% confidence (LSD probability 0.05 or 0.10), the higher-yielding variety has a significant yield advantage. When the difference between two varieties is less than the LSD value, no significant difference was found between those two varieties under those growing conditions.

NS is used to indicate no significant difference for that trait among any of the varieties at the 95% or 90% level of confidence. The CV stands for coefficient of variation and is expressed as a percentage. The CV is a measure of variability in the trial. Large CVs mean a large amount of variation that could not be attributed to differences in the varieties. Yield is reported at 13.5% moisture, while protein content is reported at 12% moisture content.

Presentation of data for the entries tested does not imply approval or endorsement by the authors or agencies conducting the test. North Dakota State University approves the reproduction of any table in the publication only if no portion is deleted, appropriate footnotes are given and the order of the data is not rearranged. Additional data from county sites are available from each Research Extension Center at www.ag.ndsu.edu/varietytrials/spring-wheat. Also consider using the online variety selection tool at www.ag.ndsu.edu/variety-selectiontool/, which allows you to generate tables of data from research locations nearest your farm and make head-to-head comparisons of varieties of interest.

NDSU
Tables are on
pages 39 through 47

Table 1. North Dakota hard red spring wheat variety descriptions, agronomic traits, 2020.

Variety	Agent or Origin ¹	Year Released	Height (inches)	Straw Strength ²	Days to Head ³	Reaction to Disease ⁴					
						Stem Rust ⁵	Leaf Rust	Stripe Rust	Tan Spot	Bact. Leaf Streak	Head Scab
AP Murdock	Syngenta/AgriPro	2019	26	4	53	NA	NA	NA	NA	5	6
Ambush	Dyna-Gro	2016	27	5	53	1	4	3	4	6	5
Ballistic	Dyna-Gro	2018	28	3	54	NA	5	NA	NA	5	3
Barlow	ND	2009	28	6	52	1	6	4	4	4	4
Bolles	MN	2015	28	4	56	2	3	5	4	6	5
Boost	SD	2016	29	5	56	1	4	3	8	2	5
Commander	Dyna-Gro	2019	27	3	53	NA	4	NA	3	4	5
CP3530	Croplan	2015	30	5	56	1	2	8	6	5	5
CP3903	Croplan	2020	27	2	53	NA	7	NA	NA	5	4
CP3910	Croplan	2019	26	5	52	NA	1	NA	8	8	6
CP3915	Croplan	2019	27	4	54	NA	1	NA	7	4	5
Dagmar ⁶	MT	2019	27	6	53	NA	7	NA	NA	7	7
Driver	SD	2019	28	3	55	NA	1	NA	NA	7	3
Elgin-ND	ND	2012	30	5	53	1	6	5	6	6	4
Faller	ND	2007	28	5	56	1	7	8	7	5	4
Glenn	ND	2005	30	4	52	1	6	4	6	4	4
Lang-MN	MN	2017	28	5	55	1	2	1	4	3	3
Lanning	MT	2017	26	4	54	NA	7	NA	NA	8	6
LCS Buster	Limagrain	2020	28	6	59	NA	NA	NA	NA	4	5
LCS Cannon	Limagrain	2018	26	4	51	NA	7	NA	5	7	6
LCS Rebel	Limagrain	2017	29	6	52	1	7	4	3	4	5
LCS Trigger	Limagrain	2016	29	5	60	1	1	2	6	3	3
Linkert	MN	2013	25	2	54	1	3	1	4	6	5
MN-Torgy	MN	2020	27	3	54	NA	4	NA	NA	3	3
MN-Washburn	MN	2019	26	3	56	NA	1	NA	6	5	5
MS Barracuda	Meridian	2018	25	4	51	NA	2	NA	7	7	6
MS Chevelle	Meridian	2014	26	5	53	1	4	3	6	7	6
MS Ranchero	Meridian	2020	27	5	54	NA	4	NA	NA	6	6
ND Frohberg	ND	2020	29	4	54	NA	5	NA	NA	4	5
ND VitPro	ND	2016	28	3	53	1	4	3	7	4	4
Shelly	MN	2016	26	4	56	2	6	5	3	7	5
SY 611CL2	Syngenta/AgriPro	2019	25	5	54	NA	6	NA	4	6	5
SY Ingmar	Syngenta/AgriPro	2014	27	3	54	1	3	6	6	4	5
SY Longmire ⁶	Syngenta/AgriPro	2019	27	4	54	NA	7	NA	2	6	7



Variety	Agent or Origin ¹	Year Released	Height (inches)	Straw Strength ²	Days to Head ³	Reaction to Disease ⁴					
						Stem Rust ⁵	Leaf Rust	Stripe Rust	Tan Spot	Bact. Leaf Streak	Head Scab
SY McCloud	Syngenta/ AgriPro	2019	27	4	54	NA	5	NA	7	8	5
SY Rockford	Syngenta/ AgriPro	2017	27	4	55	NA	6	NA	2	8	6
SY Soren	Syngenta/ AgriPro	2011	25	3	54	1	2	7	2	7	7
SY Valda	Syngenta/ AgriPro	2015	26	4	54	1	2	7	6	6	5
TCG-Heartland	21st Century Genetics	2019	26	3	52	NA	2	NA	5	7	6
TCG-Spitfire	21st Century Genetics	2015	27	3	57	1	5	4	8	4	6
TCG-Wildcat	21st Century Genetics	2020	27	3	55	NA	5	NA	NA	5	NA
Velocity	Dyna-Gro	2019	27	3	54	NA	2	NA	NA	6	5

- ¹ Refers to agent or developer: MN = University of Minnesota; MT = Montana State University; ND = North Dakota State University; SD = South Dakota State University. Bold varieties are those recently released, so data are limited and rating values may change.
- ² Straw Strength = 1 to 9 scale, with 1 the strongest and 9 the weakest. These values are based on recent data and may change as more data become available.
- ³ Days to Head = the number of days from planting to head emergence from the boot, averaged based on data from several locations in 2020.
- ⁴ Disease reaction scores from 1 to 9, with 1 = resistant and 9 = very susceptible, NA = not available.
- ⁵ Fargo stem rust nursery inoculated with Puccinia graminis f. sp. Tritici races TPMK, TMLK, RTQQ, QFCQ and QTHJ.
- ⁶ Solid stemmed or semisolid stem, imparting resistance to sawfly.

Table 2. Yield of hard red spring wheat varieties grown at six locations in eastern North Dakota, 2018-2020.

Variety	Carrington		Casselton		Grand Forks	Gwinner	Langdon		Steele Co.		Average	
	2020	3 Yr.	2020	3 Yr.	2020	2020	2020	3 Yr.	2020	3 Yr.	2020	3 Yr.
	------(bu/a)-----											
AP Murdock	46.5	--	87.7	--	65.7	80.4	87.4	--	81.1	--	74.8	
Ambush	44.5	54.3	69.0	63.7	55.7	66.8	68.1	77.5	68.4	68.5	62.1	66.0
Ballistic	47.7	--	89.1	--	66.3	65.2	73.1	--	68.6	--	68.3	--
Barlow	38.8	50.2	71.6	62.8	48.0	57.6	67.7	76.1	68.1	64.8	58.6	63.5
Bolles	33.2	48.6	67.4	62.5	50.6	53.0	67.9	74.0	71.5	68.2	57.3	63.3
Boost	47.1	53.7	74.6	68.0	57.4	54.9	71.0	77.8	69.5	73.3	62.4	68.2
Commander	29.8	--	80.3	--	60.9	70.2	74.1	--	78.3	--	65.6	--
CP3530	44.9	56.6	86.6	73.5	57.6	77.3	83.1	86.8	79.2	75.7	71.4	73.2

Table 2 continued

Variety	Carrington		Casselton		Grand Forks	Gwinner	Langdon		Steele Co.		Average	
	2020	3 Yr.	2020	3 Yr.	2020	2020	2020	3 Yr.	2020	3 Yr.	2020	3 Yr.
	------(bu/a)-----											
CP3903	41.7	--	74.3	--	57.5	71.9	76.9	--	73.9	--	66.0	--
CP3910	41.3	--	72.0	--	53.4	63.6	70.1	--	67.4	--	61.3	--
CP3915	53.0	--	78.8	--	61.3	72.0	80.0	--	77.7	--	70.5	--
Dagmar	45.9	--	74.8	--	57.5	64.0	66.0	--	69.4	--	62.9	--
Driver	49.4	--	79.9	--	60.8	70.0	72.7	--	74.6	--	67.9	--
Elgin-ND	48.3	53.5	78.9	69.7	55.0	65.5	66.1	78.5	62.6	63.8	62.7	66.4
Faller	53.6	60.3	82.2	73.6	63.7	81.2	80.6	87.3	78.0	75.7	73.2	74.2
Glenn	35.5	46.3	69.6	60.2	48.0	57.5	73.6	74.8	70.4	64.2	59.1	61.4
Lang-MN	51.7	56.6	78.7	68.1	57.7	55.2	72.3	76.1	68.9	67.2	64.1	67.0
Lanning	36.6	--	75.1	--	53.2	63.1	57.1	--	63.6	--	58.1	--
LCS Buster	44.5	--	85.2	--	61.2	68.0	73.4	--	81.5	--	69.0	--
LCS Cannon	37.9	49.6	88.3	71.1	53.0	68.2	73.3	81.4	75.4	--	66.0	--
LCS Rebel	43.7	52.4	70.9	65.9	63.3	65.7	75.5	83.1	76.6	73.7	66.0	68.8
LCS Trigger	48.9	58.9	82.6	76.1	76.0	66.8	80.6	92.5	76.5	80.6	71.9	77.0
Linkert	43.8	52.5	72.1	64.5	48.6	64.2	68.5	70.9	69.3	64.7	61.1	63.1
MN-Torgy	56.3	--	81.0	--	60.7	68.8	70.4	--	79.8	--	69.5	--
MN-Washburn	42.0	48.0	75.9	--	54.2	82.2	77.8	79.6	73.0	--	67.5	--
MS Barracuda	35.3	47.6	83.0	70.4	54.2	70.2	65.6	80.7	61.8	62.3	61.7	65.2
MS Chevelle	34.2	54.2	78.3	69.8	57.6	73.0	74.6	84.6	62.5	65.6	63.4	68.5
MS Rancho	50.5	--	78.2	--	60.4	52.2	61.8	--	51.8	--	59.2	--
ND Frohberg	47.4	57.3	73.9	--	53.1	65.2	73.4	80.8	75.9	--	64.8	--
ND VitPro	27.3	44.3	72.5	63.4	54.0	54.5	76.2	75.8	67.6	63.9	58.7	61.9
Shelly	53.3	56.2	90.4	75.3	60.8	74.0	57.7	76.0	67.7	67.4	67.3	68.7
SY 611CL2	29.5	46.8	81.4	--	54.9	70.3	77.7	81.6	74.7	--	64.8	--
SY Ingmar	35.2	51.9	73.3	68.9	60.1	65.6	77.1	83.1	77.2	69.9	64.7	68.4
SY Longmire	44.4	52.5	75.9	--	55.6	72.6	78.1	--	70.7	--	66.2	--
SY McCloud	36.6	47.0	76.7	--	48.0	72.7	75.9	79.0	73.5	--	63.9	--
SY Rockford	40.4	53.1	86.1	--	49.7	60.0	54.8	--	54.8	52.7	57.6	--
SY Soren	36.6	50.8	77.4	67.3	49.6	66.4	70.6	76.2	75.7	66.1	62.7	65.1
SY Valda	49.0	58.3	83.6	72.9	54.7	76.1	78.8	86.5	78.0	76.3	70.0	73.5
TCG-Heartland	37.3	--	78.4	--	50.0	64.6	66.5	--	71.8	--	61.4	--
TCG-Spitfire	47.7	56.2	74.0	69.4	63.5	81.4	79.9	83.4	83.2	78.8	71.6	71.9
TCG-Wildcat	41.6	--	75.0	--	60.4	66.3	73.6	--	84.8	--	67.0	--
Velocity	40.9	--	70.5	--	52.4	67.5	70.1	--	66.8	--	61.4	--
Mean	42.3	52.5	78.2	68.4	56.8	66.9	71.2	--	71.9	68.7	64.9	67.8
CV%	13.9	--	6.6	--	11.6	11.0	8.1	--	10.1	--	--	--
LSD 0.05	8.2	--	8.4	--	6.7	12.0	8.1	--	11.8	--	8.9	4.6
LSD 0.10	6.9	--	7.0	--	5.6	9.7	6.8	--	9.9	--	7.5	3.8

Table 3. Yield of hard red spring wheat varieties grown at four locations in western North Dakota, 2018-2020.

Variety	Dickinson		Mandan		Minot		Williston		Average	
	2020	3 Yr.	2020	3 Yr.	2020	3 Yr.	2020	3 Yr.	2020	3 Yr.
	----- (bu/a) -----									
AP Murdock	42.0	--	44.7	--	59.7	--	28.0	--	43.6	--
Ambush	40.8	49.6	42.9	43.2	59.9	64.1	28.7	--	43.1	--
Ballistic	48.5	--	52.6	--	65.3	--	31.8	--	49.6	--
Barlow	43.5	49.6	43.0	41.2	52.1	60.2	25.9	46.0	41.1	49.3
Bolles	38.6	47.3	40.7	41.6	59.1	62.2	28.0	44.2	41.6	48.8
Boost	42.3	49.2	44.5	43.3	58.6	65.2	28.5	43.6	43.5	50.3
Commander	40.7	--	44.5	--	66.7	--	29.5	--	45.4	--
CP3530	44.4	53.2	45.9	44.3	67.8	69.0	31.2	--	47.3	--
CP3903	42.2	--	42.0	--	60.6	--	30.1	--	43.7	--
CP3910	40.7	--	45.3	--	70.1	--	27.5	--	45.9	--
CP3915	44.5	--	47.9	--	55.6	--	30.4	--	44.6	--
Dagmar	44.8	--	40.5	--	51.6	--	28.6	--	41.4	--
Driver	45.4	--	50.7	--	65.0	--	28.7	--	47.5	--
Elgin-ND	43.8	50.4	51.6	46.4	60.9	64.8	30.2	53.6	46.6	53.8
Faller	46.8	56.7	48.3	45.3	63.8	74.5	36.5	51.6	48.9	57.0
Glenn	37.3	48.5	42.0	44.3	55.8	59.1	29.2	47.9	41.1	50.0
Lang-MN	42.6	51.7	48.8	46.7	58.2	62.1	29.8	44.1	44.9	51.2
Lanning	44.4	54.3	47.4	43.5	56.4	66.2	30.6	51.9	44.7	54.0
LCS Buster	52.2	--	54.0	--	75.9	--	32.6	--	53.7	--
LCS Cannon	44.4	49.4	41.5	42.9	56.3	61.3	26.7	46.1	42.2	49.9
LCS Rebel	44.4	51.3	46.8	45.2	60.2	61.0	34.1	50.6	46.4	52.0
LCS Trigger	51.6	58.2	50.2	45.1	73.0	75.1	34.3	54.4	52.3	58.2
Linkert	40.1	48.7	45.1	42.2	56.5	61.1	28.4	46.1	42.5	49.5
MN-Torgy	45.4	--	48.2	--	61.3	--	32.1	--	46.8	--
MN-Washburn	40.1	51.2	40.4	42.7	54.6	60.8	29.0	--	41.0	--
MS Barracuda	36.4	41.4	43.6	42.8	59.6	68.7	27.9	44.6	41.9	49.4
MS Chevelle	46.9	56.3	41.7	42.6	69.0	67.7	28.7	49.7	46.6	54.1
MS Ranchero	47.5	--	49.1	--	59.6	--	31.6	--	47.0	--
ND Frohberg	41.2	48.4	45.2	--	59.9	60.5	28.7	--	43.8	--
ND VitPro	38.9	47.7	46.1	43.4	52.3	56.2	28.2	48.5	41.4	49.0
Shelly	45.9	54.8	48.7	45.9	64.3	68.1	32.1	52.6	47.8	55.4
SY 611CL2	44.2	--	44.3	43.4	68.7	68.9	36.8	--	48.5	--
SY Ingmar	43.3	50.7	39.9	42.8	55.9	58.4	29.9	43.9	42.3	49.0
SY Longmire	43.0	51.4	45.1	43.4	63.5	63.8	32.9	--	46.1	--
SY McCloud	39.9	48.9	41.5	39.9	53.3	61.7	26.5	--	40.3	--
SY Rockford	47.5	55.4	49.6	44.6	64.6	72.5	31.4	52.2	48.3	56.2
SY Soren	40.5	50.3	39.4	39.3	61.7	65.0	28.5	46.3	42.5	50.2
SY Valda	46.6	52.2	51.5	46.3	52.1	61.8	31.0	51.2	45.3	52.9
TCG-Heartland	41.0	--	42.1	--	55.9	--	34.5	--	43.4	--



Table 3 continued

Variety	Dickinson		Mandan		Minot		Williston		Average	
	2020	3 Yr.	2020	3 Yr.	2020	3 Yr.	2020	3 Yr.	2020	3 Yr.
	----- (bu/a) -----									
TCG-Spitfire	47.7	55.5	48.7	45.5	68.9	68.1	33.1	54.5	49.6	55.9
TCG-Wildcat	47.3	--	38.9	--	65.7	--	32.8	--	46.2	--
Velocity	40.4	--	38.2	--	55.0	--	28.7	--	40.6	--
Mean	43.3	51.2	44.8	43.6	59.9	64.6	30.0	48.7	45.0	52.2
CV%	7.6	--	14.0	--	10.3	--	9.6	--	--	--
LSD 0.05	4.6	--	8.8	--	10	--	4.7	--	4.3	3.7
LSD 0.10	3.8	--	7.4	--	8.4	--	3.9	--	3.6	3.1

Table 4. Protein at 12% moisture of hard red spring wheat varieties grown at 10 locations in North Dakota, 2020

Variety	Carrington	Casselton	Grand Forks	Gwinner	Langdon	Steele Co.	Dickinson	Mandan	Minot	Williston	Avg.
		----- (%) -----									
Ambush	17.8	15.0	16.0	16.0	15.6	15.8	16.7	14.3	14.9	20.1	16.2
AP Murdock	16.3	14.4	15.1	14.4	14.0	14.7	15.8	14.3	14.0	18.4	15.1
Ballistic	17.0	14.1	15.2	15.1	15.1	15.1	16.1	13.9	13.9	18.7	15.4
Barlow	17.4	14.8	15.6	15.4	15.6	15.5	15.7	14.8	14.4	17.5	15.7
Bolles	19.4	16.4	17.6	17.0	16.6	16.8	18.5	17.2	16.7	17.9	17.4
Boost	16.9	14.8	16.1	15.1	14.8	15.8	17.0	15.1	14.9	18.2	15.9
Commander	19.3	14.7	15.0	15.1	14.7	14.8	16.7	14.7	14.4	18.0	15.7
CP3530	17.5	15.5	16.1	14.9	15.3	16.0	15.7	14.7	14.0	15.6	15.5
CP3903	16.5	14.9	16.0	15.0	14.9	15.7	16.3	15.0	15.3	18.4	15.8
CP3910	16.6	14.0	15.8	15.1	15.1	15.4	16.2	15.1	14.7	18.3	15.6
CP3915	16.2	14.9	15.7	15.2	14.9	15.1	16.4	14.4	13.7	17.8	15.4
Dagmar	16.2	15.0	16.0	15.7	16.2	16.0	16.3	15.3	15.1	17.9	16.0
Driver	16.3	14.6	15.3	15.1	14.5	15.0	15.7	13.9	13.8	17.4	15.2
Elgin-ND	16.4	14.3	15.1	14.7	14.7	15.2	15.7	14.2	14.7	18.1	15.3
Faller	16.1	13.4	14.6	14.3	14.1	14.6	16.0	13.8	13.6	18.5	14.9
Glenn	18.1	15.4	16.0	15.3	15.2	15.6	16.6	15.0	15.2	18.0	16.0
Lang-MN	16.3	15.7	16.5	16.6	15.6	16.4	16.1	14.9	14.0	17.2	15.9
Lanning	18.8	15.1	16.6	16.5	16.6	16.2	16.7	14.9	14.3	18.6	16.4
LCS Buster	16.6	12.8	13.1	13.0	12.8	13.0	13.9	12.2	12.2	19.2	13.9
LCS Cannon	17.9	14.3	15.1	15.0	14.8	14.8	15.3	14.8	13.9	18.3	15.4
LCS Rebel	16.9	15.0	16.1	14.8	15.4	15.7	16.7	15.6	14.0	15.4	15.6
LCS Trigger	15.8	13.1	13.2	13.3	12.6	13.5	14.4	12.1	12.2	18.3	13.8
Linkert	17.8	15.1	15.8	15.6	15.8	15.4	17.5	15.0	15.9	15.3	15.9
MN-Torgy	16.3	15.4	15.9	16.0	15.5	15.5	15.8	14.1	13.7	17.2	15.5
MN-Washburn	17.2	14.3	16.4	15.2	14.4	16.0	15.5	13.7	13.6	17.4	15.4
MS Barracuda	17.8	15.4	16.3	15.4	15.8	16.2	17.0	16.3	15.0	17.3	16.2
MS Chevelle	17.5	13.4	14.8	14.3	14.3	14.7	14.6	13.7	12.7	16.2	14.6
MS Rancho	15.7	14.5	15.0	15.9	15.4	15.3	15.2	14.3	12.9	18.5	15.3
ND Froberg	17.1	14.3	15.8	14.8	14.7	15.1	16.8	15.2	15.4	18.3	15.7

Table 4 continued

Variety	Carrington	Casselton	Grand Forks	Gwinner	Langdon	Steele Co.	Dickinson	Mandan	Minot	Williston	Avg.
	------(%)-----										
ND VitPro	19.4	14.8	16.2	15.6	15.1	15.8	17.0	15.7	15.1	16.6	16.1
Shelly	16.7	14.0	14.8	14.2	16.1	15.1	15.3	14.1	13.7	17.9	15.2
SY 611CL2	19.3	14.5	15.4	15.3	14.9	15.3	16.4	15.0	14.5	18.1	15.9
SY Ingmar	18.2	15.0	15.9	15.3	15.2	15.2	16.7	15.6	15.5	17.6	16.0
SY Longmire	17.8	14.8	15.9	15.3	15.2	15.3	16.0	15.4	14.9	17.2	15.8
SY McCloud	18.4	15.5	15.9	15.0	15.1	15.0	17.5	15.8	14.9	18.2	16.1
SY Rockford	17.8	14.5	16.1	15.9	15.8	15.8	16.1	15.2	13.4	17.3	15.8
SY Soren	18.6	14.8	15.8	15.5	15.1	14.9	16.9	15.0	15.4	18.2	16.0
SY Valda	16.3	14.2	15.4	14.7	14.2	15.3	15.0	14.1	13.5	19.1	15.2
TCG-Heartland	18.5	15.1	15.9	15.4	15.7	15.5	17.1	15.3	15.0	18.4	16.2
TCG-Spitfire	16.7	13.7	15.0	14.8	14.0	14.2	14.7	13.2	14.0	17.8	14.8
TCG-Wildcat	17.5	14.8	16.0	14.9	15.2	15.0	16.2	15.6	14.7	15.6	15.6
Velocity	17.7	15.7	16.7	16.0	16.1	16.5	17.0	14.8	15.4	17.3	16.3
Mean	17.4	14.7	15.6	15.2	15.1	15.3	16.2	14.7	14.4	17.7	15.6
CV%	5.1	--	1.5	2.4	3.0	1.8	3.6	3.3	5.5	2.3	--
LSD 0.05	1.3	--	0.3	0.6	0.6	0.3	0.8	0.7	1.3	0.6	0.5
LSD 0.10	1.0	--	0.3	0.5	0.5	0.3	0.7	0.6	1.0	0.5	0.4

Table 5. Test weight of hard red spring wheat varieties grown at 10 locations in North Dakota, 2020.

Variety	Carrington	Casselton	Grand Forks	Gwinner	Langdon	Steele Co.	Dickinson	Mandan	Minot	Williston	Avg.
	------(lb/bu)-----										
Ambush	62.6	60.0	58.6	58.2	59.6	58.0	61.3	61.5	61.8	59.8	60.2
AP Murdock	61.5	57.0	57.9	58.0	59.7	57.8	60.5	61.2	59.5	59.3	59.2
Ballistic	61.8	59.1	58.2	57.7	56.7	56.7	61.0	61.7	59.6	58.9	59.1
Barlow	62.4	59.6	58.9	59.0	59.3	58.8	62.2	62.1	61.4	60.0	60.4
Bolles	60.4	58.0	57.8	57.2	58.8	57.2	60.4	60.2	59.9	58.4	58.8
Boost	62.2	58.7	58.7	58.1	59.7	58.2	60.7	60.7	60.1	58.2	59.5
Commander	59.5	59.5	58.1	58.6	59.2	57.6	61.1	61.0	60.5	60.1	59.5
CP3530	61.3	56.9	58.4	58.7	60.1	58.8	61.0	62.2	60.3	59.4	59.7
CP3903	62.2	60.0	59.6	59.4	62.1	59.6	61.8	62.2	59.7	60.2	60.7
CP3910	63.4	59.4	58.3	58.2	58.6	56.9	62.2	63.1	61.0	60.4	60.1
CP3915	63.4	60.3	58.8	59.4	61.1	60.4	62.0	62.4	60.6	60.1	60.8
Dagmar	61.8	58.5	57.8	57.7	58.9	57.7	61.0	60.8	58.3	59.0	59.2
Driver	63.9	58.7	59.7	59.1	60.0	59.7	62.6	62.5	61.8	60.6	60.9
Elgin-ND	62.2	57.7	58.3	58.1	59.1	55.8	61.0	61.8	59.4	58.6	59.2
Faller	61.9	58.3	57.9	57.8	59.7	57.7	60.8	61.5	59.6	58.4	59.4
Glenn	61.8	61.1	59.2	59.9	62.5	59.6	62.6	62.4	61.0	60.9	61.1
Lang-MN	62.9	58.0	58.3	57.9	60.7	58.4	61.6	62.0	61.3	59.0	60.0
Lanning	60.0	56.1	56.6	55.8	55.1	55.6	60.4	61.1	59.2	59.1	57.9
LCS Buster	61.1	54.7	57.3	55.6	57.0	57.3	60.8	61.6	59.4	58.3	58.3
LCS Cannon	63.4	59.7	58.9	58.9	59.8	58.7	62.7	62.9	61.6	61.3	60.8
LCS Rebel	62.8	60.5	59.1	60.5	61.5	59.1	61.9	61.8	62.1	60.0	60.9



Table 5 continued

Variety	Carrington	Casselton	Grand Forks	Gwinner	Langdon	Steele Co.	Dickinson	Mandan	Minot	Williston	Avg.
	------(lb/bu)-----										
LCS Trigger	62.1	56.2	58.9	59.2	60.2	58.8	61.7	62.4	61.0	59.6	60.0
Linkert	61.2	59.3	58.5	58.0	59.8	58.7	60.9	62.1	60.5	59.3	59.8
MN-Torgy	63.2	58.7	59.3	58.1	59.1	58.9	61.5	62.4	60.8	60.0	60.2
MN-Washburn	61.7	58.6	58.6	58.7	60.0	59.3	61.2	61.6	60.1	59.2	59.9
MS Barracuda	61.3	59.1	57.4	57.6	57.9	55.0	60.9	60.6	60.2	59.4	58.9
MS Chevelle	60.8	58.7	57.0	57.3	58.1	55.8	61.7	61.5	60.5	59.5	59.1
MS Rancho	61.3	56.4	56.1	54.6	54.6	53.7	60.3	60.4	58.9	58.7	57.5
ND Frohberg	62.6	58.5	58.5	59.1	61.0	58.8	61.4	61.6	61.5	59.3	60.2
ND VitPro	59.9	60.6	60.1	60.1	62.2	59.1	61.8	62.4	60.8	60.4	60.7
Shelly	63.0	59.2	58.7	57.2	55.5	56.5	61.8	60.1	59.9	60.2	59.2
SY 611CL2	61.5	58.7	58.9	58.5	60.4	58.1	61.9	63.2	61.6	60.5	60.3
SY Ingmar	61.1	60.5	59.5	59.1	60.6	59.1	62.1	61.8	61.2	60.6	60.6
SY Longmire	62.5	58.3	58.5	58.7	59.4	58.1	61.5	62.3	60.5	60.0	60.0
SY McCloud	62.0	59.7	58.3	59.4	61.2	59.3	61.7	62.3	60.7	61.3	60.6
SY Rockford	60.7	56.1	53.6	53.7	54.9	51.8	59.8	60.1	59.2	58.7	56.9
SY Soren	61.5	58.1	57.9	57.6	59.5	58.1	61.3	61.9	60.5	60.1	59.6
SY Valda	63.1	60.1	58.2	58.9	59.9	58.6	61.8	61.8	60.3	59.8	60.3
TCG-Heartland	62.5	60.7	58.3	59.5	59.8	58.6	61.7	62.6	61.1	60.1	60.5
TCG-Spitfire	61.2	58.3	57.8	57.7	60.1	58.5	61.5	61.8	60.8	59.4	59.7
TCG-Wildcat	61.8	59.9	59.5	59.4	60.5	59.7	62.0	61.9	61.6	60.0	60.6
Velocity	62.2	58.5	58.6	58.9	60.3	59.0	61.7	61.3	61.2	59.7	60.1
Mean	61.9	58.7	58.3	58.2	59.1	57.9	61.4	61.6	60.3	59.5	59.8
CV%	1.3	2.0	2.1	1.0	1.8	2.1	0.7	1.5	1.2	0.6	--
LSD 0.05	1.1	1.9	1.4	0.9	1.5	2.0	0.6	1.3	1.2	0.5	2.5
LSD 0.10	0.9	1.6	1.2	0.8	1.2	1.7	0.5	1.1	1.0	0.5	2.1



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Table 6. Quality data from 2019 eastern North Dakota locations

Variety	Test Weight ¹	Vitreous Kernels ²	1,000 KWT ³	Falling Number ⁴	Wheat Protein ⁵	Flour Extraction ⁶	Farinograph Absorption ⁷	Farinograph Stability ⁸	Loaf Volume ⁹
	(lb/bu)	(%)	(gram)	(seconds)	(%)	(%)	(%)	(minutes)	(cubic cm)
Ambush	62.5	75	36.3	390	14.4	67.4	61.2	12.5	958
Barlow	62.4	70	34.6	339	14.4	69.7	65.8	10.1	946
Bolles	61.4	70	36.4	392	15.2	66.1	63.0	22.3	948
Boost	60.9	74	35.5	389	14.1	67.8	64.0	8.1	885
Commander	61.5	64	34.9	389	13.7	69.0	61.9	8.2	901
CP 3530	60.8	45	34.8	418	13.7	69.1	62.1	8.7	976
CP 3910	61.4	65	32.2	368	14.0	68.9	58.3	12.5	998
CP 3915	61.8	79	31.0	397	14.1	71.4	62.5	10.5	968
Elgin-ND	60.9	62	35.0	354	14.0	68.0	64.1	8.8	941
Faller	61.8	56	39.7	398	13.4	68.8	64.1	7.7	913
Glenn	64.0	91	34.5	354	14.6	66.6	63.5	13.0	1,008
Lang-MN	62.6	91	32.5	433	14.3	68.5	63.4	9.8	934
LCS Cannon	61.6	30	32.1	366	13.7	69.9	61.7	11.1	995
LCS Rebel	62.6	74	35.2	369	14.5	70.4	63.2	10.8	1,013
LCS Trigger	60.9	74	34.4	433	12.5	69.6	63.1	6.6	796
Linkert	61.5	67	37.4	408	14.5	66.6	62.5	15.3	1,005
MN-Torgy	61.6	62	34.1	343	14.6	68.2	61.9	11.3	915
MN-Washburn	61.1	86	34.5	384	13.8	71.1	61.1	11.0	955
MS Barracuda	61.3	75	36.7	364	14.6	68.4	63.6	9.3	986
MS Chevelle	61.5	55	34.2	340	12.9	67.7	62.2	10.0	950
ND Frohberg	62.2	67	38.2	333	13.7	67.7	64.4	11.6	963
ND VitPro	63.1	91	34.3	385	14.3	68.5	64.3	9.7	953
Shelly	61.2	31	33.9	393	13.0	70.3	59.9	12.1	919
SY 611 CL2	62.5	38	35.0	403	13.9	67.0	66.9	6.8	886
SY Ingmar	61.4	65	31.6	386	13.8	68.3	61.6	10.6	970
SY Longmire	62.0	63	34.9	386	13.9	68.0	63.1	7.7	954
SY McCloud	62.5	57	37.8	305	14.1	67.7	64.7	8.5	959
SY Rockford	60.6	57	36.2	390	13.7	67.7	62.5	10.4	954
SY Soren	62.0	45	32.7	397	14.4	67.7	62.5	8.2	994
SY Valda	61.5	77	35.2	376	12.9	69.1	60.9	7.3	905
TCG-Heartland	62.7	65	35.8	407	14.2	69.3	61.9	13.5	944
TCG-Spitfire	60.9	50	36.1	305	13.4	68.0	63.0	8.4	976
TCG-Stalwart	59.2	81	35.0	380	14.6	68.4	62.8	9.4	979

¹ Test weight - Expressed in pounds (lbs) per bushel. A high test weight is desirable. A 58 lb test weight is required for a grade of U.S. No. 1.

² Vitreous kernels - Expressed as a percentage of seeds having a vitreous-colored endosperm. A high percentage is desirable. US No. 1 DNS requires greater than 75% vitreous kernels.

³ 1,000 KWT - Estimate of weight of 1,000 seeds based on a clean 10g sample. Expressed in grams and used to approximate seed size.

⁴ Falling Number - Expressed in seconds at a 14% moisture basis. It is used as an indicator of sprouting based on elevated enzyme activity. A high falling number is desirable, preferably greater than 400 seconds.

⁵ Wheat Protein - Measured by NIR at a 12% moisture basis. A high protein is desirable for baking quality.

⁶ Flour Extraction - Percentage of milled flour recovered from cleaned and tempered wheat. A high flour extraction percentage is desirable.

⁷ Farinograph Absorption - Measured by NIR at a 14% moisture basis. A measure of dough water absorption, expressed as percent. A high absorption is desirable.

⁸ Farinograph Stability - A measure of dough strength. It is expressed in minutes above the 500 Brabender unit line during mixing. A high stability is desirable.

⁹ Loaf Volume - The volume of the pup loaf of bread, expressed in cubic centimeters. A high volume is desirable.

Table 7. Quality data from 2019 western North Dakota locations.

Variety	Test Weight ¹	Vitreous Kernels ²	1,000 KWT ³	Falling Number ⁴	Wheat Protein ⁵	Flour Extraction ⁶	Farinograph Absorption ⁷	Farinograph Stability ⁸	Loaf Volume ⁹
	(lb/bu)	(%)	(gram)	(seconds)	(%)	(%)	(%)	(minutes)	(cubic cm)
Ambush	61.8	42	38.3	393	16.4	66.0	62.7	10.7	975
Barlow	61.7	59	35.9	370	16.0	67.8	66.3	16.1	1,003
Bolles	60.2	53	37.1	446	17.8	64.4	65.4	30.7	990
Boost	60.3	55	37.4	424	15.7	66.8	65.3	8.5	988
Commander	61.3	40	38.4	401	15.9	67.0	64.1	7.5	905
CP 3530	60.8	30	37.7	380	15.1	69.0	65.4	10.9	965
CP 3910	62.6	81	34.8	363	16.2	69.4	61.9	13.5	1,015
CP 3915	62.5	88	34.3	422	16.3	70.7	64.5	15.0	960
Elgin-ND	60.7	50	34.1	391	15.7	66.9	65.5	9.6	975
Faller	60.5	36	38.1	400	14.6	68.3	63.2	12.2	955
Glenn	63.3	92	35.6	352	16.4	65.8	65.8	14.0	988
Lang-MN	61.5	81	36.0	395	16.4	67.3	66.1	9.5	918
Lanning	61.2	81	39.4	372	16.3	65.4	64.6	10.4	903
LCS Cannon	62.7	51	36.6	338	15.7	69.6	64.0	12.7	985
LCS Rebel	62.0	60	38.3	384	15.7	68.5	64.2	12.7	930
LCS Trigger	61.1	59	33.4	439	13.1	68.4	63.5	10.2	728
Linkert	61.1	59	39.6	430	16.9	65.1	65.7	20.2	1,000
MN-Torgy	61.6	46	35.7	449	15.8	66.3	63.5	19.0	858
MN-Washburn	61.0	94	33.0	431	15.0	69.4	61.8	18.0	883
MS Barracuda	61.4	56	41.7	447	16.7	67.4	65.7	12.2	1,013
MS Chevelle	61.1	45	34.5	367	14.6	67.8	64.0	11.2	970
ND Frohberg	61.8	56	39.0	426	16.0	65.7	68.6	13.3	980
ND VitPro	62.9	92	35.9	409	16.5	66.6	65.6	9.7	998
Shelly	61.4	35	37.8	470	15.2	70.0	61.6	25.7	878
SY 611 CL2	63.0	78	37.2	417	16.0	65.4	69.3	8.2	890
SY Ingmar	61.9	55	34.8	412	16.4	66.6	64.9	12.2	1,063
SY Longmire	61.9	47	36.8	447	16.0	67.8	65.4	12.3	993
SY McCloud	62.4	46	40.8	340	16.4	66.3	67.3	10.9	940
SY Rockford	60.0	41	36.9	452	15.3	66.3	66.4	11.4	905
SY Soren	61.7	32	34.0	413	16.6	67.1	64.8	10.3	1,038
SY Valda	60.9	67	37.3	380	15.1	67.2	62.8	9.6	933
TCG-Heartland	62.5	49	39.6	421	16.3	68.1	64.9	17.3	918
TCG-Spitfire	60.9	53	36.0	366	14.8	67.3	65.0	14.6	935
TCG-Stalwart	60.4	54	38.1	426	16.5	68.4	64.5	15.5	973

¹ Test weight - Expressed in pounds (lbs) per bushel. A high test weight is desirable. A 58 lb test weight is required for a grade of U.S. No. 1.
² Vitreous kernels - Expressed as a percentage of seeds having a vitreous-colored endosperm. A high percentage is desirable. US No. 1 DNS requires greater than 75% vitreous kernels.
³ 1,000 KWT - Estimate of weight of 1,000 seeds based on a clean 10g sample. Expressed in grams and used to approximate seed size.
⁴ Falling Number - Expressed in seconds at a 14% moisture basis. It is used as an indicator of sprouting based on elevated enzyme activity. A high falling number is desirable, preferably greater than 400 seconds.
⁵ Wheat Protein - Measured by NIR at a 12% moisture basis. A high protein is desirable for baking quality.
⁶ Flour Extraction - Percentage of milled flour recovered from cleaned and tempered wheat. A high flour extraction percentage is desirable.
⁷ Farinograph Absorption - Measured by NIR at a 14% moisture basis. A measure of dough water absorption, expressed as percent. A high absorption is desirable.
⁸ Farinograph Stability - A measure of dough strength. It is expressed in minutes above the 500 Brabender unit line during mixing. A high stability is desirable.
⁹ Loaf Volume - The volume of the pup loaf of bread, expressed in cubic centimeters. A high volume is desirable.

North Dakota Durum Variety Trial Results for 2020 and Selection Guide

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Durum was planted on 910,000 acres in North Dakota in 2020, up 26% from 2019. The average yield was 39 bushels per acre (bu/a), down from 42.5 last year. The most commonly grown varieties in 2020 and the

percent of the acreage they occupied were Joppa (29%), Divide (20%), ND Riveland (11%), VT Peak (9%), Carpio (7%) and Alkabo (6%).

Durum varieties are tested each year at multiple sites throughout North Dakota. The relative performance of these varieties is presented in table form. Variety performance data are used to provide recommendations to producers. Some varieties may not be included in the tables due to insufficient testing or lack of seed availability, or they offer no yield or disease advantage over similar varieties. Yield is reported at 13.5% moisture, while protein content is reported at 12% moisture.

The agronomic data presented in this publication

are from replicated research plots using experimental designs that enable the use of statistical analysis. These analyses enable the reader to determine, at a predetermined level of confidence, if the differences observed among varieties are significant or if they might be due to error inherent in the experimental process.

The LSD (least significant difference) numbers beneath the columns in tables are derived from these statistical analyses and only apply to the numbers in the column in which they appear. If the difference between two varieties exceeds the LSD value, it means that with 95% or 90% confidence

	Agent or Origin ¹	
AC Commander	Can.	
Alkabo	ND	
Alzada	WB	
Ben	ND	
Carpio	ND	
CDC Verona	Can.	
Divide	ND	
Grenora	ND	
Joppa	ND	
Lebsock	ND	
Maier	ND	
Mountrail	ND	
ND Grano ⁶	ND	
ND Riveland ⁶	ND	
Pierce	ND	
Rugby	ND	
Strongfield ⁶	Can.	
Tioga	ND	
VT Peak	Viterra	

¹ Refers to agent or developer: Can. = Agriculture Canada, WB = Westbred, ND = North Dakota State University.

² Plant height was obtained from the average of several locations in 2020.

³ Straw Strength = 1-9 scale, with 1 the strongest and 9 the weakest. Based on recent data. These values may change as more data become available.



(LSD probability 0.05 or 0.10), the higher-yielding variety has a significant yield advantage. When the difference between two varieties is less than the LSD value, no significant difference occurs between those two varieties under those growing conditions.

The abbreviation NS is used to indicate no significant difference for that trait

among any of the varieties at the 95% or 90% level of confidence. The CV is a measure of variability in the trial. The CV stands for coefficient of variation and is expressed as a percentage. Large CVs mean a large amount of variation that could not be attributed to differences in the varieties.

Presentation of data for the entries tested does not im-

ply approval or endorsement by the authors or agencies conducting the test. North Dakota State University approves the reproduction of any table in the publication only if no portion is deleted, appropriate footnotes are given and the order of the data is not rearranged.

Additional data from county sites are available from each Research

Extension Center at www.ag.ndsu.edu/varietytrials/durum. Use data from multiple locations and years when selecting a variety.

Table 1. Descriptions and agronomic traits of durum wheat varieties grown in North Dakota, 2020.

	Year Released	Height (inches) ²	Straw Strength ³	Days to Heading ⁴	Reaction to Disease ⁵				
					Stem Rust	Leaf Rust	Foliar Disease	Bact. Leaf Streak	Head Scab
	2002	25	5	57	1	1	6	NA	NA
	2005	27	2	56	1	1	5	7	6
	2004	24	6	54	1	1	8	NA	9
	1996	28	4	56	1	1	4	7	8
	2012	27	5	58	1	1	5	6	5
	2010	27	5	58	1	1	4	NA	8
	2005	27	5	58	1	1	5	7	5
	2005	26	5	55	1	1	5	7	6
	2013	27	5	57	1	1	5	7	5
	1999	27	3	55	1	1	5	7	6
	1998	27	5	56	1	1	5	NA	8
	1998	27	5	57	1	1	5	7	8
	2017	27	5	57	1	1	8	7	6
	2017	29	4	57	1	1	4	7	5
	2001	28	5	56	1	1	6	7	8
	1973	29	5	56	1	1	4	NA	8
	2004	26	6	58	1	1	6	NA	8
	2010	29	4	57	1	1	5	7	6
	2010	28	6	56	1	NA	NA	NA	NA

⁴ Days to Heading = the number of days from planting to head emergence from the boot. Averaged from several locations in 2020.

⁵ Disease reaction scores from 1-9, with 1 = resistant and 9 = very susceptible. NA = Not adequately tested. Foliar Disease = reaction to tan spot and septoria leaf spot complex.

⁶ Low cadmium accumulating variety.

Table 2. Yield of durum wheat varieties at six Research Extension Centers in North Dakota, 2018-2020.

Variety	Carrington		Langdon		Dickinson	
	2020	3 Yr.	2020	3 Yr.	2020	3 Yr.
	-----(bu/a)-----					
AC Commander	33.4	38.8	58.6	66.0	39.2	47.0
Alkabo	32.0	40.7	79.7	75.6	39.4	49.8
Alzada	32.1	33.5	47.5	53.9	35.4	41.4
Ben	31.7	38.2	74.5	72.7	36.1	48.4
Carpio	39.0	48.2	77.0	79.9	36.4	47.1
CDC Verona	37.8	44.9	61.3	69.5	41.7	51.9
Divide	30.2	43.4	78.0	78.5	38.3	50.1
Grenora	35.8	43.8	83.5	80.2	39.5	49.0
Joppa	28.4	43.8	75.9	80.3	41.5	52.8
Lebsock	30.2	39.1	74.9	73.9	38.0	50.4
Maier	28.4	36.9	61.5	70.0	35.1	46.8
Mountrail	33.7	41.6	70.2	75.1	40.9	52.6
ND Grano	38.0	45.5	75.2	76.2	38.7	52.4
ND Riveland	41.8	51.6	79.2	79.9	38.3	48.1
Pierce	34.9	42.1	75.5	78.6	37.8	47.3
Rugby	38.9	44.2	62.6	67.2	36.9	48.2
Strongfield	32.2	43.0	61.9	67.5	36.2	48.8
Tioga	30.9	43.2	76.7	78.5	37.6	51.0
VT Peak	23.9	41.0	79.9	77.9	37.7	49.5
Mean	33.3	42.3	71.2	73.8	38.1	49.1
CV %	15.3	--	8.6	--	7.4	--
LSD 0.05	7.7	--	8.8	--	4.0	--
LSD 0.10	6.5	--	7.4	--	3.3	--



	Hettinger		Minot		Williston		Average	
	2020	3 Yr.	2020	3 Yr.	2020	3 Yr.	2020	3 Yr.
----- (bu/a) -----								
	23.3	39.4	65.3	56.6	29.5	43.7	41.6	48.6
	22.1	44.6	64.2	58.3	28.2	42.3	44.3	51.9
	16.7	33.5	44.7	46.1	25.1	38.3	33.6	41.1
	20.4	37.5	54.0	59.3	26.9	39.7	40.6	49.3
	20.5	42.0	60.8	65.1	29.3	41.2	43.8	53.9
	25.8	43.2	53.3	55.2	31.2	43.6	41.9	51.4
	19.5	41.5	54.2	62.3	31.6	42.9	42.0	53.1
	22.9	43.0	68.4	59.9	30.7	43.6	46.8	53.2
	21.6	40.8	68.5	66.8	27.4	41.6	43.9	54.3
	20.4	39.5	65.2	62.9	25.5	39.8	42.4	50.9
	18.2	38.9	63.1	58.9	23.2	40.6	38.3	48.7
	23.7	42.8	70.0	68.0	25.9	42.5	44.1	53.8
	24.1	42.4	66.8	68.1	26.5	39.9	44.9	54.1
	22.5	43.9	67.7	61.6	29.4	42.2	46.5	54.5
	21.5	41.1	67.7	60.7	26.1	39.5	43.9	51.6
	23.1	38.1	61.6	56.7	27.5	39.8	41.8	49.0
	21.1	42.3	63.4	59.2	25.5	42.2	40.0	50.5
	20.5	39.0	66.2	63.5	24.2	42.6	42.7	53.0
	24.2	45.4	64.5	64.8	27.7	42.2	43.0	53.5
	21.7	41.0	62.6	60.7	27.4	41.5	42.4	51.4
	10.6	--	6.7	--	11.3	--	--	--
	3.3	--	7.1	--	4.9	--	4.8	2.9
	2.7	--	6.0	--	4.1	--	4.8	2.4



Table 3. Test weight and protein of durum wheat varieties at six Research Extension Centers in North Dakota, 2020.

Variety	Carrington		Langdon	Dickinson		
	Test Wt.	Protein	Test Wt.	Test Wt.	Protein	
	lb/bu	%	lb/bu	lb/bu	%	
AC Commander	58.4	16.5	54.7	60.2	15.4	
Alkabo	58.7	16.0	59.8	60.4	14.1	
Alzada	58.8	16.3	54.1	58.9	14.6	
Ben	58.8	16.7	59.5	60.3	15.6	
Carpio	58.9	16.2	59.5	59.7	14.7	
CDC Verona	57.9	16.7	54.9	61.2	15.3	
Divide	57.3	17.0	58.6	60.1	14.9	
Grenora	58.8	16.1	58.4	60.0	15.5	
Joppa	57.9	15.8	58.3	61.1	14.2	
Lebsock	58.6	16.5	60.4	60.8	14.9	
Maier	58.3	17.4	56.0	59.8	15.8	
Mountrail	57.5	16.5	57.4	59.7	14.5	
ND Grano	59.8	16.1	58.2	60.7	15.4	
ND Riveland	59.8	15.8	58.7	60.2	14.9	
Pierce	59.6	16.5	59.1	60.5	15.1	
Rugby	59.0	16.1	57.1	60.5	14.9	
Strongfield	58.0	17.7	56.2	59.9	15.9	
Tioga	57.9	16.2	58.4	59.7	15.2	
VT Peak	56.6	17.1	59.6	61.6	15.4	
Mean	58.7	16.4	58.3	60.2	15.1	
CV %	1.7	2.7	1.8	0.9	3.5	
LSD 0.05	1.3	0.6	1.5	0.8	0.7	
LSD 0.10	1.1	0.5	1.3	0.9	0.6	



	Hettinger		Minot		Williston		Average	
	Test Wt.	Protein	Test Wt.	Protein	Test Wt.	Protein	Test Wt.	Protein
	lb/bu	%	lb/bu	%	lb/bu	%	lb/bu	%
	57.0	15.3	58.5	14.6	58.9	18.0	58.0	16.0
	58.6	13.8	60.4	13.5	59.3	16.6	59.5	14.8
	54.7	15.3	55.3	13.9	58.3	17.1	56.7	15.4
	57.8	15.1	59.1	14.4	58.7	17.8	59.0	15.9
	57.5	14.6	61.4	13.0	59.4	16.2	59.4	14.9
	59.0	15.0	59.5	13.7	58.8	18.6	58.5	15.9
	58.4	14.6	60.0	14.3	58.6	17.5	58.8	15.7
	57.6	14.5	59.2	13.6	58.9	17.0	58.8	15.3
	58.9	14.1	60.3	13.4	58.9	16.8	59.2	14.9
	58.4	14.2	60.3	13.8	59.2	16.8	59.6	15.2
	57.4	15.7	59.9	14.7	58.5	18.5	58.3	16.4
	58.6	13.9	58.9	13.0	58.2	17.4	58.4	15.0
	59.2	13.9	60.7	13.5	59.4	17.6	59.7	15.3
	58.5	14.3	61.4	13.7	59.0	17.7	59.6	15.3
	58.8	14.2	60.7	13.4	59.7	16.2	59.7	15.1
	58.2	14.3	59.4	14.5	58.8	18.1	58.8	15.6
	57.9	15.1	58.7	15.1	58.5	19.4	58.2	16.6
	56.8	14.4	61.5	14.0	59.7	16.9	59.0	15.3
	59.2	15.0	61.4	13.7	59.8	17.6	59.7	15.8
	58.1	14.6	59.8	13.9	58.9	17.8	58.9	15.5
	1.2	2.9	1.8	4.9	0.7	2.1	--	--
	1.0	0.6	1.7	1.1	0.6	0.6	1.0	0.4
	0.8	0.5	1.5	0.9	0.5	0.5	0.8	0.3



Table 4. Durum wheat variety quality descriptions, milling and processing data averaged for five years (2015-2019) from drill strips (32 locations/years).

Variety	Test Weight	Vitreous Kernels	Large Kernels	Falling Number	Wheat Protein ¹	Gluten Index ²	Pasta Color ³	Spaghetti Firmness ⁴	Overall Quality ⁵
	(lb/bu)	(%)	(%)	(sec)	(%)		(1-12)	(g-cm)	
Alkabo	61.5	81	56	415	13.8	46	8.5	3.8	good
Alzada	59.5	86	64	505	14.5	84	8.1	4.3	good
Carpio	61.6	79	65	480	14.0	91	8.5	4.1	excellent
Divide	61.2	85	57	473	14.2	73	8.3	3.9	good
Joppa	61.4	86	49	461	13.7	82	8.7	3.9	good
Maier	60.8	87	52	439	14.7	54	8.3	4.1	good
Mountrail	60.6	89	47	456	14.2	25	7.9	3.7	fair
ND Grano	61.5	84	52	477	14.2	66	8.7	4.0	excellent
ND Riveland	61.3	88	62	466	14.2	80	8.5	4.0	excellent
Strongfield	60.6	88	56	468	14.8	66	8.0	4.1	good
Tioga	61.1	84	62	423	14.1	74	8.2	4.1	good
Average	61.0	85	57	460	14.2	67	8.3	4.0	

For all numbered footnotes, refer to bottom of Table 5.

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Table 5. Durum wheat variety quality descriptions, milling and processing data for 2019 at all locations from drill strips.

Variety	Test Weight	Vitreous Kernels	Large Kernels	Falling Number	Wheat Protein ¹	Gluten Index ²	Pasta Color ³	Spaghetti Firmness ⁴	Overall Quality ⁵
	(lb/bu)	(%)	(%)	(sec)	(%)		(1-12)	(g-cm)	
Alkabo	61.3	79	68	335	13.8	50	7.6	3.5	good
Alzada	59.1	79	72	462	14.6	83	6.9	4.0	good
Carpio	61.7	74	79	447	14.0	93	7.9	3.8	good
Divide	61.4	81	71	439	14.0	80	7.8	3.5	good
Joppa	61.5	84	61	420	13.9	83	8.4	3.6	good
Maier	60.9	85	64	371	14.7	51	7.6	3.7	good
Mountrail	60.5	87	60	393	14.4	22	6.7	3.3	fair
ND Grano	61.4	86	66	418	14.3	69	8.1	3.6	good
ND Riveland	61.1	88	71	437	14.6	85	7.8	3.8	good
Strongfield	60.4	88	70	403	15.3	66	7.0	3.8	good
Tioga	60.7	79	77	352	14.3	78	7.0	3.7	good
Average	60.9	83	69	407	14.4	69	7.5	3.7	

¹ Wheat protein is reported on a 12 percent moisture basis.

² Gluten index is unitless. Numbers less than 15 = very weak and greater than 80 = very strong gluten proteins.

³ Pasta Color Score: Higher number indicates better color, with 8.5+ typically considered good.

⁴ Work required to cut through a strand of spaghetti.

⁵ Overall Quality is determined based on agronomic, milling and spaghetti processing performance.



Minnesota Wheat Council Seeking Candidates for Board of Directors

The Minnesota Wheat Research and Promotion Council is seeking candidates for three positions on its board of directors. Members of the Minnesota Wheat Research and Promotion Council are elected to direct Minnesota wheat checkoff dollars to benefit wheat producers.

Board members must be wheat producers willing to serve as leaders and advocates for the Minnesota wheat industry and to work to improve industry profitability and viability.

To be considered, a person must have shared in the profits and risk of loss from

producing wheat during the current or preceding marketing year.

Directors are elected to serve three-year terms, and the board meets approximately six times throughout the year.

The following positions are open:

Area 1 Representative:

Two (2) Positions open
One (1) Incumbent: Rhonda K. Larson, East Grand Forks
Area 1 includes the counties of Beltrami, Clearwater, Kittson, Koochiching, Lake of the Woods, Marshall, Polk-West, Pennington, Red Lake and Roseau.

Area 2 Representative:

One (1) Position open
One (1) Incumbent: Scott Swenson, Elbow Lake
Area 2 includes the counties of Douglas, Grant, Otter Tail, Traverse, Wilkin, Aitkin, Becker, Carlton, Cass, Clay, Cook, Crow Wing, Hubbard, Itasca, Kanabec, Lake, Mahnommen, Morrison, Norman, Pine, Polk-East, St. Louis, Todd and Wadena.

To submit your name as a candidate, please visit <https://mnwheat.org/council/2020-candidate-election/>. Here you will find the necessary forms to complete. Completed candidate forms can be emailed to cberdahl@mnwheat.com

mnwheat.com by Wednesday, December 2, 2020. Minnesota Wheat Research & Promotion Council elections will be held via mail ballot. To ensure you receive a mail ballot, eligible producers can verify they are on the mailing list by calling MN Wheat at 218-253-4311 ext 7 or request a ballot by emailing Christina Iliev, Minnesota Department of Agriculture, at christina.iliev@state.mn.us. Ballots must be requested by December 3, 2020.

Ballots need to be returned to MDA with a postmark by January 27, 2021.



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21st Century Genetics (TCG) Hard Red Spring Wheat (HRS) Trials in 2020

2020 was a great comeback year for HRS after a wet dreary 2019. Harvest conditions were generally good in August and great in September. Yields were down a bit most places due to late spring field work and/or above average temperatures in June, but still respectable. Grain quality was generally good, a welcome relief after sprout damage with low falling numbers (FN) in 2019, with much of the crop left in the field due to cool wet conditions at harvest. FN was

mostly a non issue in 2020 as it has been most years with some small pockets in NW MN, still something to watch. Bacterial leaf streak (BLS) continues to be a real yield killer as it was in 2019, especially in wet areas often associated with poorly drained heavy clay soils. It can not be controlled with fungicide. Generally scab was not a big issue in 2020. The 2020 HRS variety performance is reported in Table 1 with the 3-year summary in Table 2.

TCG-Spitfire continues to be an outstanding performer across years and environments for yield and standability, with medium protein. It has good tolerance to moisture stress and BLS which helps account for its wide adaptability. TCG-Spitfire is slightly susceptible to preharvest sprouting (PHS), so it should be harvested in a timely fashion. It is our most widely adapted variety.

TCG-Heartland performed very well in 2020 as an early, very high protein, high TW, good standing, high yielding variety. It performed best on well drained and medium to lighter soils. It stood up well to PHS pressure with good FNs in the areas affected in both 2020 and 2019. TCG-Heartland is a certified seed only (CSO) variety

TCG-Wildcat, our newest variety, performed very well

continued on page 58



21ST CENTURY GENETICS

TCG-SPITFIRE	NEW TCG-HEARTLAND CSO	NEW TCG-WILDCAT CSO	TCG-WILDFIRE	TCG-GLENNVILLE
Top yield and standability region - wide	Excellent combination of Standability, Protein, TW and Yield	Management Wheat for the RRV's heavy clay soils	Good Yields with consistent Protein on Tough Alkali Ground	Very early and short
Medium Protein	Adapted to well drained, light-medium texture soils	Excellent combination of Yield, Standability, TW, and Protein		High protein and test weight
Good tolerance to BLS	Tolerance to pre-harvest sprouting	Good Tolerance to preharvest sprouting		Strong yield north of US Highway 2

Visit tcgwheat.com to find a TCG seed associate near you.

All TCG wheat varieties are PVPA 1994 or pending. TCG-Heartland is Patent pending.

from page 57

as a high yielding, high protein, high TW, management wheat for the RRV. It has an MS-S scab reaction but responds well to fungicide for scab. TCG-Wildcat is much like TCG-Spitfire,

but has higher protein and TW, with earlier maturity, and quicker dry down and good tolerances to PHS. It has a good coping reaction to BLS, producing good yields and seed quality in the presence of BLS, but it

does not have TCG-Spitfires BLS tolerance level. In its first year of limited commercial production it performed very well, both in and outside the RRV. TCG-Wildcat is a certified seed only (CSO) variety.

TCG-Wildfire continues to look very good as a high yielding, medium high protein option on water impacted alkali ground. Its tolerance to BLS has also been noted in these environments.

Table 1. 2020 TCG HRS Wheat trial results in 6 environments

	Site Yield bu/a						Average Across 6 sites		
	North Dakota			Minnesota			Yield	Protein	Test Weight
Variety	Casselton	Thompson ¹	Crystal ¹	Crookston ¹	Fisher	Fisher ¹	bu/a	%	lbs/bu
TCG-Spitfire	36.1	87.5	61.6	85.0	62.1	77.8	68.3	13.6	58.0
WB-Mayville	32.5	81.0	65.7	73.9	67.3	78.0	66.4	15.6	59.4
TCG-Wildcat	35.5	89.0	72.8	71.7	59.3	68.5	66.1	15.3	59.8
LCS Cannon	27.2	74.9	75.0	71.6	69.5	75.5	65.6	14.6	60.3
TCG-Wildfire	32.2	68.9	73.7	74.1	61.7	73.3	64.0	14.8	59.0
LCS Rebel	33.7	73.0	78.7	63.8	60.8	73.5	63.9	15.3	60.9
SYValda	33.1	72.9	71.4	68.7	60.3	74.2	63.4	13.7	58.6
TCG-Heartland	29.8	81.0	70.4	73.2	50.1	70.8	62.6	16.0	59.4
LCS Trigger	38.8	71.7	75.0	72.6	45.5	70.7	62.4	12.6	59.1
TCG-Cornerstone	29.0	76.5	69.1	75.1	53.0	68.9	61.9	14.9	59.8
SY McCloud	28.4	82.2	69.9	74.7	50.5	60.2	61.0	14.6	60.7
SY Ingmar	29.3	72.5	67.7	67.8	55.2	68.6	60.2	14.7	59.8
TCG-Climax	30.2	70.0	67.7	79.0	53.2	60.6	60.1	15.8	60.7
Shelly	25.8	55.4	77.9	76.6	58.1	65.6	59.9	15.5	59.3
TCG-Glennville	26.4	73.4	60.8	62.1	56.0	69.5	58.0	16.0	59.4
Linkert	25.4	72.0	66.3	62.0	51.2	67.0	57.3	15.7	59.2
Boost	40.9	59.5	64.3	66.6	52.1	57.8	56.9	14.9	58.5
Caliber	27.7	52.1	54.8	71.0	63.3	71.5	56.8	16.0	59.2
Prosper	24.9	53.1	68.6	63.6	56.9	62.6	55.0	14.8	58.6
Surpass	37.3	54.0	65.4	53.2	45.5	68.9	54.1	15.3	57.3
ND VitPro	37.6	62.7	50.1	45.7	55.3	58.1	51.6	15.3	61.0
Barlow	24.1	60.1	68.7	40.1	47.7	64.3	50.8	15.6	60.3
Bolles	29.5	45.0	61.0	58.2	37.4	45.5	46.1	17.0	57.6

¹ Sites treated with fungicide

² 0 = least, 10 = most

³ Bacterial Leaf Streak

TCG-Glennville, as in 2019, continues to perform as a short, very early, good standing management HRS for good environments north of Highway 2. It can get pushed further south.

All the TCG HRS varieties are good standing management wheats in their areas of adaptation, with MS scab ratings of varying strengths. They are meant to be treated with fungicide at least once, at flowering.

Data on the TCG durum varieties is presented in the NDSU Trials. TCG-Bright is a high quality, high HVAC durum for Western ND, Minot west, where it has performed well in production fields. Our newest

variety TCG-Webster is a very early, short, good standing management durum with very rapid dry down, it comes off about the same time as barley, allowing for very timely harvest, preserving grain quality.

Average across 4 impacted sites	
Lodging	BLS ³
Score ²	Score ²
0.1	1.8
0.3	2.6
0.0	3.3
1.4	1.9
1.1	1.1
6.1	0.3
3.8	3.1
0.0	1.8
4.4	0.6
0.0	1.9
0.6	1.1
1.1	1.8
2.4	1.8
3.5	2.5
0.0	1.4
0.0	2.8
4.2	0.1
0.0	1.1
4.4	2.1
6.1	3.1
3.9	1.4
5.3	1.7
4.7	2.5

Table 2. Three year average performance of TCG varieties and checks across 6-7 sites

Variety	Average yield bu/a			3 year averages				
	2018	2019	2020	Yield	Protein	Test Weight	Lodging	BLS ¹
				bu/a	%	lbs/bu	Score ²	Score ^{2,3}
TCG-Spitfire	77.3	71.8	68.3	72.5	14.3	58.0	0.1	1.7
TCG-Wildcat	72.6	64.3	66.1	67.7	15.3	60.1	0.0	3.3
Shelly	76.6	63.1	59.9	66.5	14.9	59.5	2.3	4.0
SY Valda	70.1	65.4	63.4	66.3	14.6	58.7	1.8	3.3
WB-Mayville	66.0	63.6	66.4	65.3	15.7	59.4	0.1	3.7
TCG-Heartland	69.5	60.9	62.6	64.3	16.0	59.9	0.0	2.9
TCG-Cornerstone	66.3	62.8	61.9	63.7	15.4	59.1	0.0	2.9
SY Ingmar	70.8	59.4	60.2	63.5	15.4	60.1	0.4	2.3
TCG-Wildfire	65.4	60.4	64.0	63.3	15.1	58.7	1.2	2.2
Prosper	72.6	62.0	55.0	63.2	14.7	58.9	3.4	2.7
TCG-Climax	68.8	58.6	60.1	62.5	15.9	61.1	0.9	3.5
Boost	70.9	58.3	56.9	62.0	14.8	59.0	2.6	0.4
Linkert	64.3	58.4	57.3	60.0	16.0	59.6	0.0	3.0
Caliber	67.0	56.0	56.8	59.9	16.0	59.1	0.0	1.6
Surpass	69.8	52.7	54.1	58.9	14.9	58.4	3.8	2.2
Bolles	69.9	59.8	46.1	58.6	16.6	58.5	2.6	3.6
Barlow	66.9	56.7	50.8	58.2	15.5	60.3	2.9	3.2
TCG-Glennville	59.6	56.5	58.0	58.0	16.0	60.2	0.0	1.9
ND VitPro	64.8	53.4	51.6	56.6	15.2	60.9	2.3	2.4
¹ Bacterial Leaf Streak								
² 0 = least, 10 = most								
³ Average of 2 years: 2019 & 2020								

2020 South Dakota Spring Wheat Performance Trial Highlights

The 2020 small grain growing season in South Dakota was characterized by a relatively early spring planting followed by good growing conditions in many areas of the state. Yields at some trial locations, especially Volga, were negatively impacted by heat during flowering and grain fill. Harvest progressed fairly rapidly and produced average to above-average yields in most areas of the state. There were no widespread disease outbreaks in the spring wheat crop.

PLEASE NOTE: ONLY TABLES 3 & 4 ARE SHOWN. The remaining tables and individual trial locations can be found at <https://extension.sdstate.edu/spring-wheat-variety-trial-results>

Spring wheat variety characteristics and disease ratings are reported in Tables 1 & 2. Multi-year yield results for eastern, central, and western South Dakota are reported in Tables 3-5, respectively. Wheat is somewhat unique as the total revenue received by the producer is a combination of yield and a protein premium

(discount). In some years high-protein varieties may actually provide more revenue than high-yielding varieties. An effort to quantify this is presented in Table 6. Spring wheat yields from the South Dakota State University Crop Performance Testing (CPT) program averaged 61 bu/acre in eastern SD (Claire City, Frankfort, South Shore, and Volga), ranging from 52 bu/acre at Volga to 68 bu/acre at Claire City. Varieties yielding in the top 1/3 of the eastern SD trials over the past three years were **CP3530, LCS Trigger, Prevail, SY Ingmar, SY Rustler, SY Valda, WB9590, and WB9719.**

Promising varieties with a good two-year yield average include **AP Murdock** and **MN-Torgy**. Yields in central South Dakota (Aberdeen, Agar, Miller, and Selby) averaged 67 bu/acre, ranging from 61 bu/acre at Agar to 75 bu/acre at Aberdeen. Varieties yielding in the top 1/3 of the central SD trials over the past three years were **Advance, CP3530, Driver, LCS Cannon, LCS Trigger, Shelly, SY Valda, and WB9719.** Promising varieties in central SD with a good

two-year yield average include **AP Murdock, MN-Torgy, SY 611 CL2, and CP3915.** The trials in western SD averaged 49 bu/acre, ranging from 33 bu/acre at Wall to 65 bu/acre at Sturgis. Varieties yielding in the top 1/3 over three years in western SD were **CP3530, LCS Cannon, LCS Rebel, LCS Trigger, MN-Washburn, Shelly, Surpass, and SY Valda.** The protein content of the crop averaged 15.0%, 16.5%, and 15.1% in eastern, central, and western SD, respectively. Detailed trial results, including height and lodging notes for each location are available at: <https://extension.sdstate.edu/spring-wheat-variety-trial-results>.

Consider as much performance information as possible when selecting a variety and give more weight to information from trials close to home, as some varieties may be better suited to certain geographic areas. Also pay close attention to relative performance over many locations. This type of performance is an indication of “yield stability”. Good yield stability refers to the ability of a variety to exhibit high yield potential at many locations over years. For example, a variety that ranks in the upper 40% at all locations exhibits better yield stability than a variety that is number one for yield at one location but ranks in the lower 40% at some other locations. Performance over multiple years is also very important. Growing conditions in a single

season may favor certain varieties, providing a poor representation of yield potential over time. A good rule of thumb is to plant 65%-75% of your acres to varieties with a proven track record (i.e. a good multi-year average) and plant the remaining 25%-35% to a promising new variety.

It is important to remember that varieties may differ by 5 bu/acre or even more and still be statistically similar. This is due to inherent variability in the environment and the yield testing process. Varieties that are statistically similar to the top performing variety at each location can be calculated by subtracting the least significant difference (LSD) value from the top performing variety. The LSD is a statistic used to determine if varieties are truly different from one another. The coefficient of variation (CV) listed at the bottom of each data column, which is often expressed as a percentage of a given trait mean, is a relative measure of the amount of test variation for that trait. Generally, in yield trials, a CV of 15% is considered acceptable and a CV of 10% or less indicates good quality data. Higher variability (and thus higher CVs) can be caused by several environmental factors, such as stand loss due to residue cover or heavy precipitation, and reduces the ability to detect true varietal differences.



2020 South Dakota Spring Wheat Variety Trial Results Central Summary

Table 3. 2018-2020 spring wheat variety performance trial results for testing sites in eastern South Dakota. Varieties ranking in the top 1/3 of each trial category are shaded light blue.

Variety	2018	2019	2020			2-year			3-year		
	Yield (bu/a)	Yield (bu/a)	Yield (bu/a)	Test Wt (lbs)	Protein %	Yield (bu/a)	Test Wt (lbs)	Protein %	Yield (bu/a)	Test Wt (lbs)	Protein %
LCS Trigger	60.6	46.3	72.3	60.7	13.2	59.3	57.0	13.6	59.7	57.4	13.9
CP3530	54.2	48.7	65.9	60.7	14.9	57.3	57.5	15.8	56.3	57.0	16.3
SY Valda	51.9	49.8	63.8	60.9	14.9	56.8	56.9	15.5	55.2	57.2	15.9
SY Ingmar	53.1	50.9	58.6	60.8	15.7	54.8	57.6	16.1	54.2	58.0	16.3
Prevail	50.9	47.0	61.5	59.8	14.4	54.3	57.6	14.9	53.1	57.4	15.3
WB9590	53.1	46.1	58.9	59.3	16.1	52.5	56.4	16.5	52.7	56.1	16.8
WB9719	52.9	43.6	61.1	61.6	15.1	52.3	58.1	15.4	52.5	58.1	15.7
SY Rustler	49.2	48.6	59.2	59.5	15.0	53.9	56.8	15.7	52.3	56.7	16.1
Driver	49.0	40.9	65.1	61.5	14.9	53.0	57.1	15.6	51.7	57.1	15.9
Surpass	47.8	47.0	59.1	58.9	15.5	53.1	56.5	16.0	51.3	56.1	16.4
Advance	45.6	43.6	64.6	61.0	14.5	54.1	57.4	15.1	51.2	57.0	15.5
Forefront	47.8	47.0	58.6	60.5	15.3	52.8	58.0	15.8	51.1	57.6	16.2
Shelly	48.3	38.4	65.6	60.1	14.2	52.0	56.3	15.2	50.8	56.2	15.5
Boost	47.8	43.7	58.5	60.6	15.4	51.1	57.4	16.0	50.0	57.3	16.2
CP3888	48.9	39.1	62.0	58.8	15.3	50.5	55.5	16.0	50.0	56.1	16.3
LCS Cannon	51.4	38.0	60.2	61.5	14.6	49.1	58.0	15.5	49.8	58.0	16.0
WB9479	47.8	44.8	56.1	59.4	16.5	50.5	56.3	16.9	49.6	56.1	17.2
MN-Washburn	48.8	37.6	61.4	59.5	14.5	49.5	56.0	15.3	49.2	56.2	15.7
Focus	47.5	41.2	58.7	60.7	15.6	50.0	58.0	16.2	49.1	57.8	16.7
Lang-MN	47.7	39.6	59.4	60.9	15.4	49.5	57.7	16.1	48.9	57.4	16.5
MS Chevelle	49.5	36.2	58.9	59.5	14.3	47.5	55.9	14.9	48.2	56.1	15.2
Bolles	46.9	36.3	59.0	59.8	16.6	47.7	56.1	17.6	47.4	55.8	18.0
MS Barracuda	48.5	35.3	56.8	59.5	15.7	46.0	56.2	16.8	46.9	55.9	16.9
LCS Rebel	47.9	37.0	54.9	60.7	15.8	45.9	57.8	16.4	46.6	57.9	16.7
AP Murdock	-	48.3	63.4	59.5	14.7	55.8	57.0	15.1	-	-	-
MN-Torgy	-	46.2	63.4	59.9	15.3	54.8	56.9	16.0	-	-	-
SY 611 CI2	-	44.6	60.8	60.9	15.2	52.7	57.5	15.8	-	-	-
CP3915	-	43.8	60.0	60.7	15.0	51.9	57.6	15.6	-	-	-
LCS Buster	-	-	68.8	59.1	13.3	-	-	-	-	-	-
WB9606	-	-	62.4	59.9	13.6	-	-	-	-	-	-
ND Frohberg	-	-	58.2	60.6	15.2	-	-	-	-	-	-
CP3903	-	-	57.1	59.7	15.4	-	-	-	-	-	-
CP3099A	-	-	56.9	55.5	13.2	-	-	-	-	-	-
MS Ranchero	-	-	56.9	58.0	14.9	-	-	-	-	-	-
CP3910	-	-	56.5	60.2	15.3	-	-	-	-	-	-
Trial Average#	49.5	43.7	60.8	60	15	52.1	57.1	15.8	51.2	56.9	16.1
LSD(0.05)†	3.0	6.6	1.9	0.6	0.2	7.9	1.5	0.7	5.8	1.1	0.4
C.V.%‡	8.8	7.7	4.8	1.4	1.6	6.5	1.7	2.4	7.0	1.8	2.2

Trial averages may include values from experimental lines that are not reported.

† Value required (\geq LSD) to determine if varieties are significantly different from one another.

‡ C.V. is a measure of variability or experimental error, 15% or less is considered acceptable.

» 2020 South Dakota Spring Wheat Variety Trial Results Central Summary

Table 4. 2018-2020 spring wheat variety performance trial results for testing sites in central South Dakota. Varieties ranking in the top 1/3 of each trial category are shaded light blue.

Variety	2018	2019	2020			2-year			3-year		
	Yield (bu/a)	Yield (bu/a)	Yield (bu/a)	Test Wt (lbs)	Protein %	Yield (bu/a)	Test Wt (lbs)	Protein %	Yield (bu/a)	Test Wt (lbs)	Protein %
LCS Trigger	60.1	64.3	81.5	59.6	14.3	72.9	58.9	14.3	68.6	58.7	14.4
SY Valda	57.9	55.8	72.1	58.8	16.5	64.0	57.7	16.4	61.9	57.9	16.3
CP3530	52.3	58.0	72.7	58.3	16.6	65.3	58.1	16.9	61.0	57.8	16.8
WB9719	55.7	54.3	70.4	59.2	16.3	62.3	58.6	16.1	60.1	58.6	16.3
Shelly	52.4	53.5	70.5	58.8	15.5	62.0	58.4	15.6	58.8	58.1	15.7
Advance	52.6	52.3	70.3	60.0	15.8	61.3	58.5	15.9	58.4	58.6	15.9
Driver	52.4	51.9	70.8	59.7	16.3	61.4	58.9	16.3	58.4	58.6	16.3
LCS Cannon	51.4	55.4	68.3	60.4	16.5	61.8	60.0	16.2	58.4	59.6	16.3
MS Chevelle	54.2	49.6	68.8	58.7	15.6	59.2	57.9	15.6	57.5	58.0	15.7
MN-Washburn	51.7	47.8	70.4	58.7	16.1	59.1	58.1	16.1	56.6	58.0	16.2
WB9590	51.4	53.7	64.6	57.7	17.3	59.2	57.6	17.2	56.6	57.4	17.4
Prevail	52.3	54.1	63.3	58.5	15.9	58.7	58.4	15.7	56.6	58.7	15.9
SY Rustler	52.4	53.2	63.9	57.9	16.8	58.5	57.5	16.6	56.5	57.7	16.6
SY Ingmar	52.6	52.0	64.5	59.6	16.9	58.2	59.3	16.9	56.4	59.1	16.9
CP3888	52.6	49.1	67.1	58.2	16.4	58.1	57.1	16.6	56.3	57.4	16.6
LCS Rebel	52.7	50.7	64.2	59.0	17.2	57.4	58.8	17.2	55.9	58.7	17.2
Surpass	51.3	52.6	63.3	57.7	16.8	57.9	57.5	16.8	55.7	57.4	16.7
Lang-MN	51.0	52.3	62.5	58.4	17.3	57.4	58.1	17.0	55.3	58.7	17.1
MS Barracuda	47.6	51.9	62.2	58.5	17.1	57.0	58.1	17.0	53.9	58.2	17.0
Boost	49.3	47.7	63.0	58.5	16.6	55.3	57.9	16.7	53.3	57.9	16.8
Focus	48.5	50.5	60.2	58.8	17.4	55.3	58.6	17.1	53.1	58.8	17.1
WB9479	50.1	48.6	59.8	57.5	18.0	54.2	57.0	17.8	52.8	57.3	17.9
Forefront	48.4	50.0	58.5	58.4	16.9	54.3	58.7	16.8	52.3	58.7	16.8
Bolles	46.7	46.6	61.9	57.5	18.1	54.3	56.7	18.3	51.7	56.5	18.5
AP Murdock	-	60.6	67.5	58.5	16.2	64.0	58.5	16.1	-	-	-
MN-Torgy	-	57.6	69.3	59.2	16.9	63.5	58.9	16.7	-	-	-
SY 611 CI2	-	54.1	70.0	60.0	16.3	62.1	59.2	16.4	-	-	-
CP3915	-	54.2	69.8	59.9	16.4	62.0	59.4	16.4	-	-	-
LCS Buster	-	-	81.1	57.9	14.4	-	-	-	-	-	-
CP3099A	-	-	74.4	56.7	14.7	-	-	-	-	-	-
WB9606	-	-	70.3	58.7	15.4	-	-	-	-	-	-
CP3910	-	-	68.3	59.1	16.5	-	-	-	-	-	-
MS Ranchero	-	-	64.9	57.4	15.9	-	-	-	-	-	-
ND Frohberg	-	-	63.4	59.1	16.7	-	-	-	-	-	-
CP3903	-	-	62.5	58.4	16.6	-	-	-	-	-	-
Trial Average#	51.0	51.8	67.2	58.7	16.5	59.9	58.3	16.5	56.9	58.2	16.5
LSD(0.05)†	3.9	2.1	1.8	0.5	0.3	6.2	1.3	0.5	4.2	0.9	0.4
C.V.%‡	6.7	5.1	3.8	1.1	2.4	4.1	1.7	2.2	4.9	2.1	2.4

Trial averages may include values from experimental lines that are not reported.

† Value required (\geq LSD) to determine if varieties are significantly different from one another.

‡ C.V. is a measure of variability or experimental error, 15% or less is considered acceptable.

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AgriPro Brand Spring Wheat Performance Review and Outlook

Syngenta Data, 2018-2020

Three-Year Northeast Summary, Northern Plains

Ranked by Three-Year Yield Average



Variety	Yield (bu/ac)			Protein %	3-Year Economic Return ¹		Agronomics and Disease				
	3-yr Avg	2-yr Avg	2020	3-Year Avg	Gross \$/A	\$/Bu	Heading 1-9	Height 1-9	Lodging 1-9	BLS 1-9	FHB 1-9
Faller	83.7	81.0	76.6	14.2	\$401.52	\$4.80	6	6	6	4	3
SY Valda	81.2	78.7	74.2	14.3	\$394.81	\$4.86	5	5	5	4	4
AP Murdock	80.0	76.9	73.5	14.5	\$399.85	\$5.00	4	4	3	4	4
HRS 3530	79.3	77.4	75.1	15.2	\$434.25	\$5.48	6	6	6	4	4
WB9590	79.0	75.6	71.2	15.3	\$437.81	\$5.54	4	4	3	6	6
SY 611 CL²	75.8	74.3	72.0	14.9	\$399.56	\$5.27	5	4	4	5	4
Shelly	75.3	72.6	68.7	14.4	\$371.28	\$4.93	6	5	6	4	3
SY Ingmar	75.2	71.9	69.1	15.2	\$411.58	\$5.48	5	5	3	4	3
SY McCloud	73.4	69.4	63.5	15.2	\$401.99	\$5.48	5	5	4	5	4
Linkert	70.7	67.8	67.4	15.4	\$396.82	\$5.61	5	5	3	4	3
ND VitPro	68.0	65.6	61.5	15.5	\$386.07	\$5.68	4	5	6	3	3
Bolles	66.5	63.2	58.1	16.8	\$400.39	\$6.02	6	6	6	4	3

2018 Locations: Argusville, Glyndon, McVile, Park River, ND; and Crookston, MN 2019 Locations: Cando, Hillsboro, Glyndon, McVile, Park River, ND; and Crookston, MN
2020 Locations: Cando, Glyndon, McVile, Park River, ND; and Crookston, MN

Three-Year West Summary, Northern Plains

Ranked by Three-Year Yield Average

Variety	Yield (bu/ac)			Protein %	3-Year Economic Return ¹		Agronomics and Disease		
	3-yr Avg	2-yr Avg	2020	3-Year Avg	Gross \$/A	\$/Bu	Heading 1-9	Height 1-9	BLS (2020) 1-9
WB9719	78.3	81.6	89.9	13.9	\$361.53	\$4.62	6	5	3
Faller	76.3	82.9	93.0	13.9	\$351.97	\$4.62	6	6	4
SY Valda	74.2	81.1	84.2	14.0	\$345.77	\$4.66	5	5	4
Shelly	73.8	79.2	83.0	14.1	\$349.07	\$4.73	6	5	4
Elgin-ND	73.1	77.7	83.5	14.8	\$380.15	\$5.20	4	7	4
SY 611 CL²	71.3	75.1	76.5	14.5	\$356.70	\$5.00	5	4	4
AP Murdock	68.5	72.6	75.3	14.5	\$342.35	\$5.00	4	4	5
Reeder	68.3	72.1	74.5	15.1	\$369.58	\$5.41	4	6	5
SY Rockford	68.2	71.8	68.0	14.6	\$345.74	\$5.07	6	6	6
SY Ingmar	68.1	72.4	76.8	15.1	\$368.39	\$5.41	5	5	4
SY McCloud	67.8	72.4	74.8	14.9	\$357.18	\$5.27	5	5	5
SY Longmire	67.7	71.7	74.0	14.7	\$347.71	\$5.14	5	5	4
Bolles	65.2	68.6	68.3	16.3	\$392.62	\$6.02	6	6	4
Barlow	65.1	68.2	71.0	15.0	\$347.42	\$5.34	3	6	4
ND VitPro	64.5	68.4	70.0	15.6	\$370.98	\$5.75	4	5	4

2018 Locations: Richardton, Coleharbor, Kenmare, ND 2019 Locations: Richardton, Coleharbor, Kenmare, Hettinger, ND; and Scobey, MT
2020 Locations: Richardton, Coleharbor, and Kenmare, ND

Numerical ratings: Heading: 1= early; Height: 1 = short; Lodging: 1 = no lodging; Disease 1 = tolerant

¹ Economic return calculated using Sept. local cash grain price of \$4.66 for 14% protein and 10-year average MGE protein premium/discounts (Mendota Wheat & Milling Associates).

These agronomic assessments are made by Syngenta scientists and reflect each variety's relative performance within these characteristics through the 2020 crop year. Specific conditions may cause variations within those characteristics. These relative protection values are based on current pest and disease populations. These have been known to shift periodically and may cause changes in specific evaluations. Resistance to many other diseases and pests is sensitive to environmental conditions, plant development stages and the presence and intensity of other diseases which may result in specific evaluation inconsistencies. This chart is updated annually to reflect the most current trends.

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Three-Year South Dakota Summary, Northern Plains Ranked by Three-Year Yield Average

Variety	Yield (bu/ac)			Protein % 3-Year Avg	3-Year Economic Return ¹		Agronomics and Disease				
	3-yr Avg	2-yr Avg	2020		Gross \$/A	\$/Bu	Heading 1-9	Height 1-9	Lodging 1-9	BLS 1-9	FHB 1-9
Prevail	59.2	63.8	63.7	14.9	\$311.89	\$5.27	4	6	5	4	3
Faller	58.2	60.0	58.2	14.8	\$303.08	\$5.20	6	6	6	3	3
SY Valda	56.0	58.8	59.8	15.4	\$314.38	\$5.61	5	5	5	4	4
WB9719	56.0	58.0	56.9	15.4	\$314.05	\$5.61	5	5	5	4	6
LCS Trigger	55.8	56.3	50.6	15.1	\$301.71	\$5.41	6	6	6	3	2
HRS 3504	55.4	55.6	54.8	15.3	\$306.86	\$5.54	5	5	4	3	5
AP Murdock	54.2	56.2	53.4	15.6	\$311.48	\$5.75	4	4	3	4	3
HRS 3530	53.3	54.9	54.5	16.1	\$320.63	\$6.02	6	7	7	4	3
SY 611 CL²	52.8	54.4	52.1	15.5	\$299.85	\$5.68	5	4	4	4	2
SY Rustler	52.5	54.8	51.8	16.0	\$315.99	\$6.02	3	5	5	4	3
SY Ingmar	51.2	52.9	51.8	16.1	\$308.04	\$6.02	5	5	3	3	2
WB9590	50.4	52.4	53.1	16.1	\$303.23	\$6.02	4	4	3	6	5
Surpass	50.3	51.5	51.5	15.9	\$299.15	\$5.95	3	5	7	4	2
Boost	50.0	51.6	50.9	16.1	\$301.00	\$6.02	5	7	6	3	2

Numerical ratings: Heading: 1 = early; Height: 1 = short; Lodging: 1 = no lodging; Disease 1 = tolerant

2018 Locations: Agar, Northville, and Selby, SD 2019 Locations: Northville and Selby, SD 2020 Locations: Agar, Northville, and Selby, SD

¹ Economic return calculated using Sept. local cash grain price of \$4.66 for 14% protein and 10-year average MGE protein premium/discounts (Mendota Wheat & Milling Associates).

These agronomic assessments are made by Syngenta scientists and reflect each variety's relative performance within these characteristics through the 2020 crop year. Specific conditions may cause variations within those characteristics. These relative protection values are based on current pest and disease populations. These have been known to shift periodically and may cause changes in specific evaluations. Resistance to many other diseases and pests is sensitive to environmental conditions, plant development stages and the presence and intensity of other diseases which may result in specific evaluation inconsistencies. This chart is updated annually to reflect the most current trends.

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The CoAXium® Wheat Production System for Annual Grassy Weed Control in Spring Wheat

By Zach Gaines and Hannah Kammeyer, CoAXium / Limagrain Cereal Seeds

In 2021, the CoAXium® Wheat Production System will enter its fourth year of availability at the farm level across the United States. During the 2019-20 season, thousands of winter wheat acres were planted with CoAXium varieties and sprayed with Aggressor® brand herbicides. The response we have both seen and heard is that for tough and even “unfarmable” acres, historically choked out by grassy weeds, there isn’t a better solution on the market. CoAXium wheat varieties have given farmers a powerful new tool.

For those unfamiliar with the CoAXium Wheat Production System, it is an extremely effective solution for controlling grassy weeds in wheat. Three partnering companies have worked together for the better part of a decade to bring CoAXium to your farm: Limagrain Cereal Seeds (LCS), Colorado Wheat Research Foundation (CWRP) and Albaugh.

This new technology combines elite varieties and a patented non-GMO herbicide tolerance trait known as AXigen® with Aggressor brand herbicides. This combination helps protect fields from weeds that not only rob yield through inter-crop competition, but also reduce overall quality of the crop.



At the heart of CoAXium is the **AXigen trait**. Inspired by Colorado farmers searching for a new way to take control over their grassy weed problems, this non-GMO herbicide tolerance trait was developed by Colorado State University. AXigen confers tolerance to Aggressor herbicide and has been introduced into elite public and private germplasm across the U.S.



Aggressor is a highly effective and fast-acting broad-spectrum Group 1 herbicide, and the only legal and registered use of quizalofop-P-ethyl (QPE) that can be applied to CoAXium wheat. Aggressor has proven control on volunteer cereals, such as wild oats, cheatgrass and feral rye. Future Aggressor herbicide brands will include formulations with broadleaf weed control tailored to regional production needs.



CoAXium combines AXigen and Aggressor with elite varieties and an industry-leading stewardship program. Stewardship is absolutely critical in prolonging this valuable new tool. The effectiveness of this system on target weed species and volunteer cereals is so strong that it will be lost in the future without a firm and clear plan for managing its use.

The developers of CoAXium are actively focused on protecting the integrity of each component of the wheat production system through the following critical **stewardship guidelines**.

Growers must:

- Use Certified seed.
- Use only labeled rates of Aggressor herbicides by weed species.

- Prevent grassy weed escapes from going to seed.
- Rotate herbicide modes of action between crop cycles.
- Use CoAXium no more than two years in a row.
- Sign a CoAXium Wheat Production System grower stewardship agreement for retail sales.

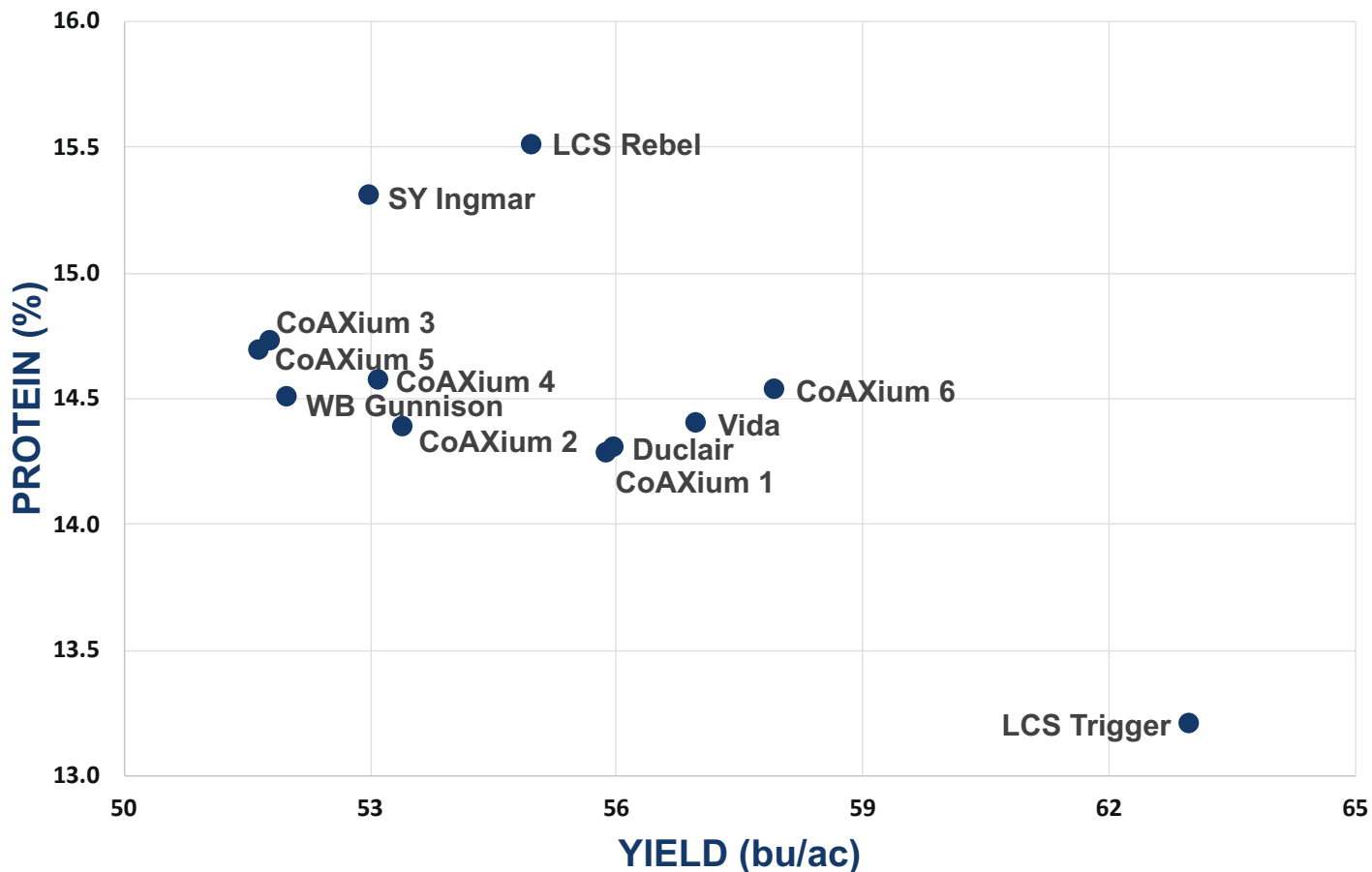
Until now, CoAXium wheat varieties have only been available in winter wheat backgrounds. In 2021, however, Foundation seed of several hard red spring wheat varieties will be planted, making CoAXium available for purchase at the farm level for spring wheat growers in the fall of 2021.

As one of three partners invested in bringing this new technology to the Northern Plains spring wheat region, LCS is very excited to be able to share performance data on HRSW CoAXium material for the first time ever.



Left: Untreated CoAXium wheat overtaken by feral rye. Right: Wheat treated with Aggressor.

HRSW Yield vs. Protein in All U.S. Trial Sites 2020



HRSW Yield and Protein Performance 2020

Bold

	Yield						Protein
	Conrad, MT	Glasgow, MT	Havre, MT	Minot, ND	Onida, SD	Thompson, ND	6 Site Avg.
CoAXium 1	48	43	29	80	78	57	14.3
CoAXium 2	47	43	29	74	74	53	14.4
CoAXium 3	48	39	26	69	73	56	14.7
CoAXium 4	47	43	29	74	75	52	14.6
CoAXium 5	47	41	27	70	72	53	14.7
CoAXium 6	48	46	30	82	80	61	14.5
Duclair	48	46	31	79	80	55	14.3
LCS Rebel	48	46	29	72	77	57	15.5
LCS Trigger	49	48	31	94	85	68	13.2
SY Ingmar	46	43	28	73	76	52	15.3
Vida	48	51	33	76	79	54	14.4
WB Gunnison	47	41	28	69	75	52	14.5



Limagrain Cereal Seeds (LCS) 2020 Spring Wheat Data and Season Review

By Russell Oberg, LCS Northern Plains Regional Commercial Manager

Much like 2019, the 2020 season presented a unique set of conditions and challenges for growers in the Northern Plains. Two consecutive seasons of later-than-normal planting scenarios for a good portion of this region is beginning to challenge our definition of what "normal" really is.

Many LCS seed dealers reported Certified sales into the first half of June this year, which prior to 2019, was nearly unheard of. With so many later-planted acres, our dealer network reported both high praise and demand for early maturing varieties like LCS Cannon and MS Barracuda. In LCS trials, LCS Cannon was the earliest variety in both heading date and overall maturity when compared against any released material currently available in the market. There were several reports of LCS growers in the valley who combined

their LCS Cannon before their barley.

A key focus for the LCS portfolio continues to be understanding the evolving market need for higher protein products versus higher yielding racehorse products like LCS Trigger and LCS Buster. While some areas of the Northern Plains can inherently "outrun" a modest protein discount with super high yields in many years, there is also a component of historical MGEX (Minneapolis Grain Exchange) activity that drives this demand. Discounts recorded during the peak selling season of 2015 are fading further into the memory of wheat growers who planted higher yielding products that spring, like Prosper, Fallar and LCS Albany. But, it is without question that the sudden jump in the discount that occurred in just one season hurt a lot of farmers. The Northern Plains region is currently sitting at five consecutive years of smaller premiums/discounts since the 2015

season, but our dealer network will tell you that their wisest customers continue to diversify their acres.

At LCS, our spring wheat variety portfolio is all about diversity. Whether you are looking for yield, protein or a solid combination of the two, we have a variety that fits your needs.

LCS Rebel not only offers the highest protein in our lineup, but also has the most desirable end-use quality. LCS Rebel has been used as a Wheat Council quality check since 2019, making it an industry standard for end users. In addition to excellent protein, we also receive acclaims on LCS Rebel's spring vigor. LCS Rebel gets out of the ground early and wastes no time to fill the canopy. LCS Rebel's straw is also great for bailing or ground cover.

LCS Cannon is continuing to grow in popularity. Initially favored because of its consistent protein and stable yield, LCS Cannon has

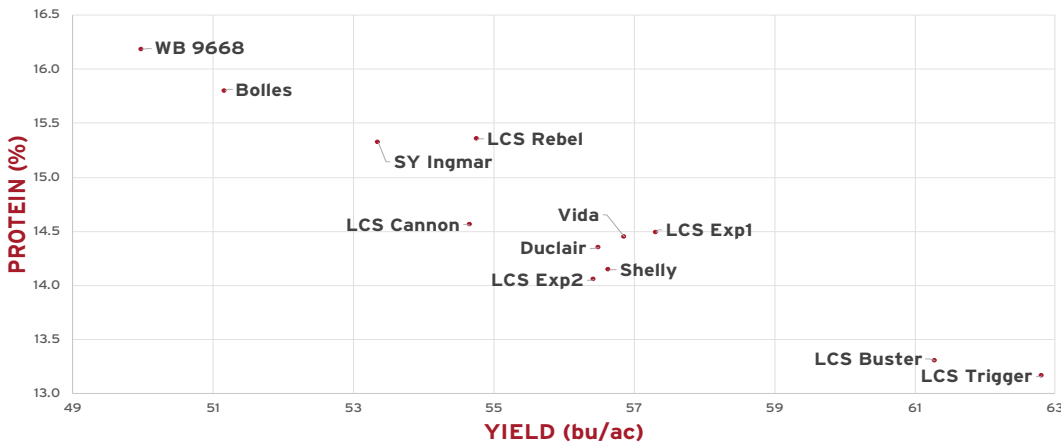
now earned a following for its early maturity. If you are a grower who wants to start wheat harvest early and move on to another crop, LCS Cannon will be one of the first varieties to get you in the field. In addition, LCS Cannon has excellent straw strength.

LCS Trigger is a two-time National Wheat Yield Contest winner and can be seen at the top of yield trials throughout University data sets. However, LCS Trigger offers more than just yield. This variety also has a comprehensive disease package, providing good tolerance to leaf rust, stem rust, tan spot, bacterial leaf streak and Fusarium head blight, and intermediate tolerance to stripe rust.

LCS Buster is our newest release. As another trialing performer, this variety is destined to have bin-busting yield potential. LCS Buster carries excellent tolerance to stem and leaf rust, plus intermediate tolerance to head scab and bacterial leaf streak. We are also extremely excited about the straw strength of LCS Buster. With this new release, there will be limited seed availability in 2021.

LCS offers a complete range of options to help growers meet their needs and diversify their acres. All LCS varieties are included in the following data tables, where you can dive in on protein, yield, agronomic and disease rankings based on LCS 2020 trials. In addition to the LCS data provided here, you can also find our varieties in University trials throughout the region.

YIELD VS. PROTEIN 2020



YIELD PERFORMANCE 2020

Red bold numbers are top 25%

	2-Year Avg.	2020 Avg.	2020 Yield					
	15 Sites	6 Sites	Conrad, MT	Glasgow, MT	Havre, MT	Minot, ND	Onida, SD	Thompson, ND
Bolles	36	51	47	38	21	69	71	60
Duclair	52	56	48	46	31	79	80	55
LCS Exp1	52	57	49	47	31	77	81	60
LCS Exp2	52	56	48	49	32	73	81	56
LCS Buster	52	61	49	47	30	93	82	66
LCS Cannon	47	55	47	46	29	72	77	56
LCS Rebel	48	55	48	46	29	72	77	57
LCS Trigger	54	63	49	48	31	94	85	68
Shelly	50	57	48	46	30	77	80	58
SY Ingmar	46	53	46	43	28	73	76	52
Vida	53	57	48	51	33	76	79	54
WB 9668	46	50	47	37	26	66	73	50

AGRONOMIC PERFORMANCE 2020

Red bold numbers are top 25%

	Protein	Test Weight	Height	Heading	Maturity	Lodging	Shattering
Bolles	15.8	59.9	Medium	Medium	Medium	None	Moderate
Duclair	14.3	60.6	Medium	Early	Early	Some	None
LCS Exp1	14.5	60.8	Med - Tall	Early-Med	Early-Med	None	Moderate
LCS Exp2	14.1	61.2	Medium	Early	Early	Some	Moderate
LCS Buster	13.3	60.2	Med - Tall	Late	Late	None	None
LCS Cannon	14.6	61.2	Short	Early	Early	Some	Some
LCS Rebel	15.4	60.5	Tall	Medium	Medium	Moderate	—
LCS Trigger	13.2	60.5	Med - Tall	Late	Late	Some	—
Shelly	14.1	60.9	Medium	Medium	Medium	None	Moderate
SY Ingmar	15.3	60.9	Medium	Medium	Medium	Some	Some
Vida	14.4	60.0	Tall	Late	Late	Some	None
WB 9668	16.2	59.6	Short	Early	Early-Med	None	None

DISEASE TOLERANCE 2020

Compiled LCS and university disease and insect data

R: resistant, MR: moderately resistant, I: intermediate, MS: moderately susceptible, S: susceptible, — insufficient data

	Stem Rust	Leaf Rust	Stripe Rust	Head Scab	BLS	Sawfly
Bolles	R	MR	MR	I	I	S
Duclair	R	I	MR	—	—	I
LCS Exp1	R	MR	MR	MR	—	MR
LCS Exp2	MR	R	R	MR	—	MS
LCS Buster	R	R	I	MR	MR	MS
LCS Cannon	R	I	MR	I	MS	I
LCS Rebel	R	MS	MR	I	MR	—
LCS Trigger	R	R	MR	MR	MR	—
Shelly	R	I	MR	I	MS	S
SY Ingmar	R	MR	I	I	MR	S
Vida	MS	MR	MR	MS	—	MR
WB 9668	—	MR	R	MS	MR	MR

2021

VIRTUAL

Small Grains Update Meetings *Wheat, Soybean & Corn*

More program details can be found at mnwheat.org



DR. JIM ANDERSON
U of MN
Extension



AMANDA BILEK
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CoAXium is driven by Aggressor® herbicide which is a Group 1 ACCase-inhibiting herbicide that brings systemic and selective broad-spectrum control to wheat growers. Aggressor is proven to control destructive wild oat that robs your young wheat crop of moisture, sunlight, and nutrients. And in the end, robs you of healthy, profitable wheat.

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