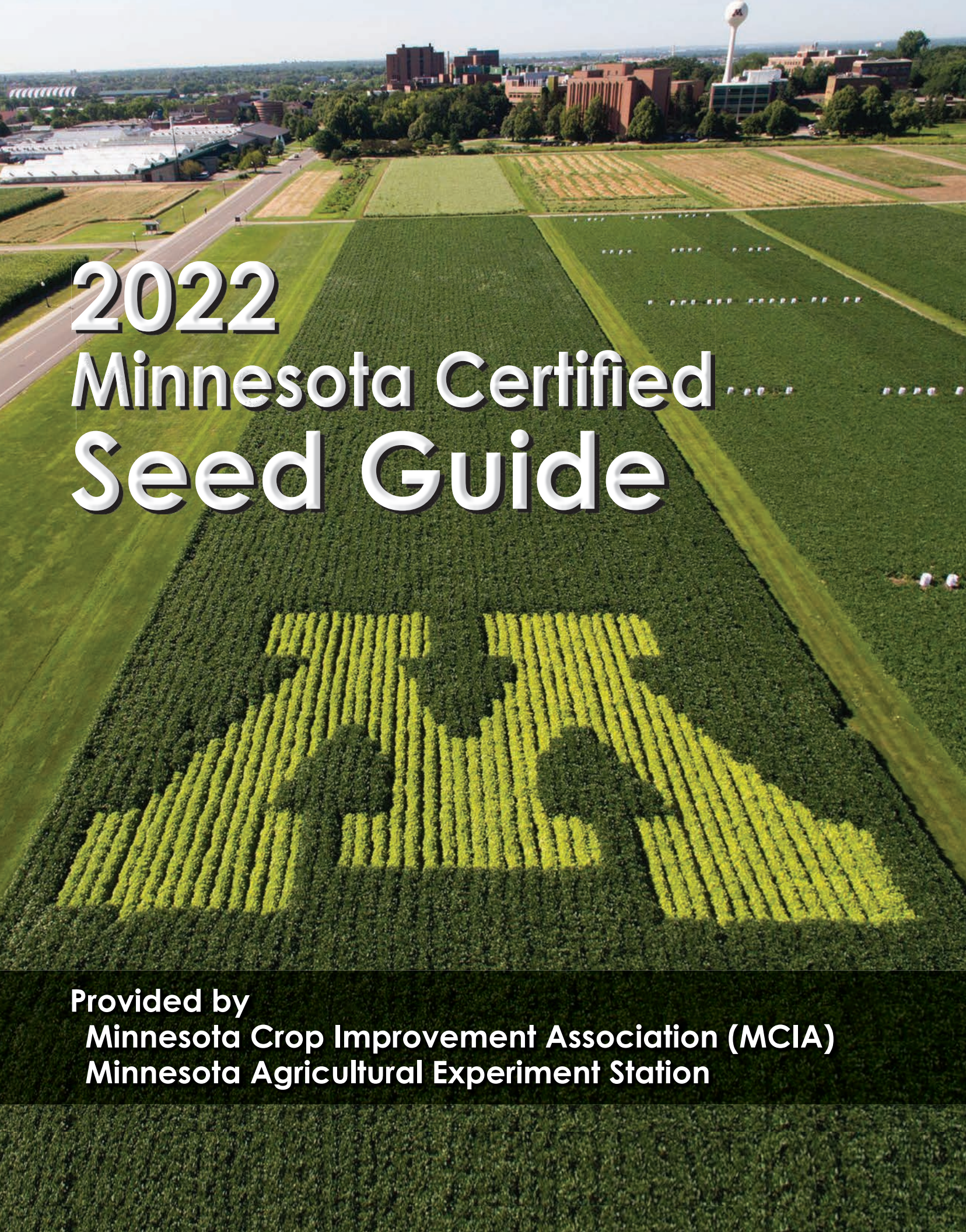
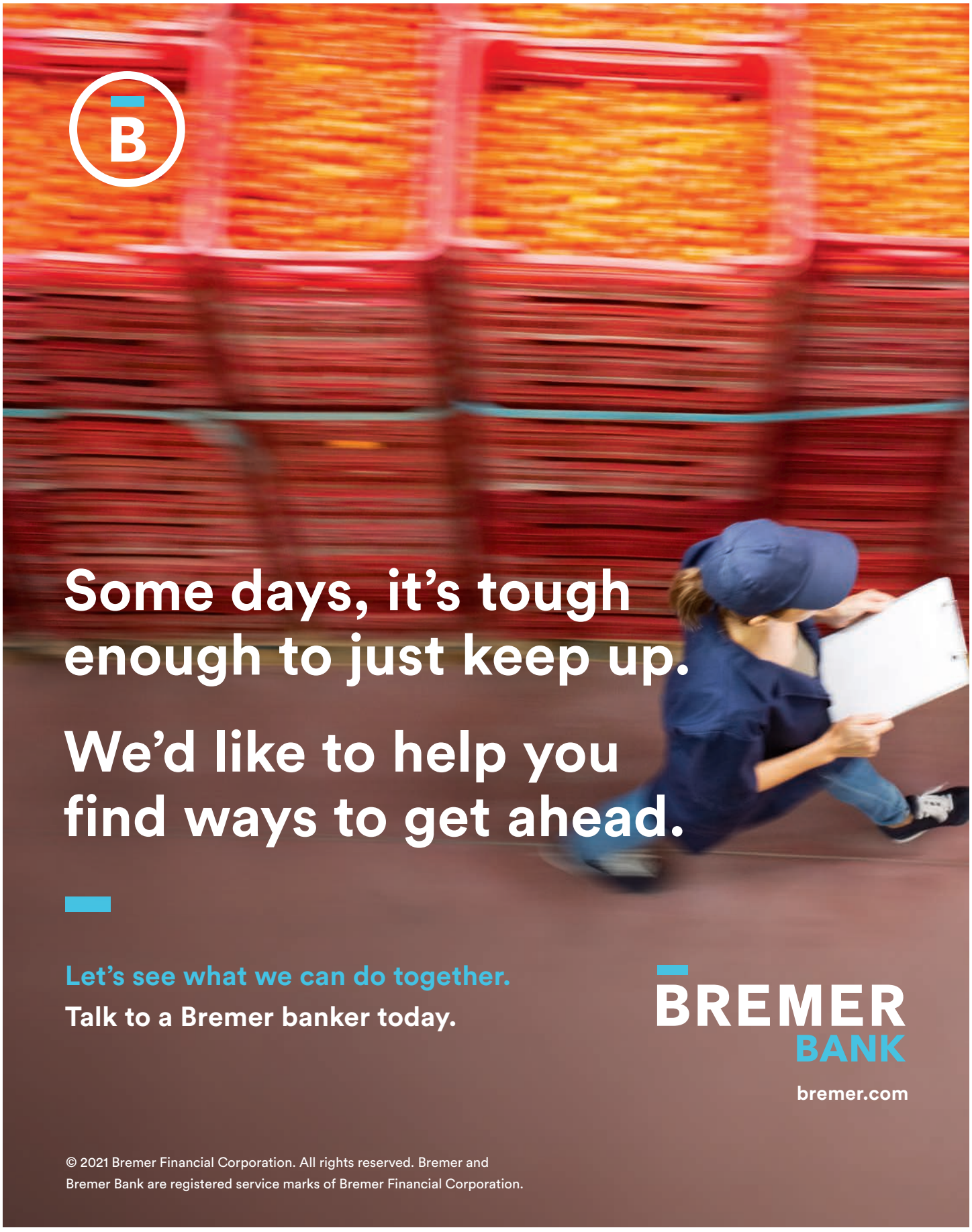


2022 Minnesota Certified Seed Guide

Provided by
Minnesota Crop Improvement Association (MCIA)
Minnesota Agricultural Experiment Station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Welcome to the 2022 Minnesota Seed Guide

Fawad Shah
President/CEO
Minnesota Crop Improvement Association

To say we are living in the most challenging of times is an understatement. Ongoing hardships caused by the pandemic coupled with high infection rates reported in Minnesota make things quite difficult for people and businesses. Then came the drought!

Insufficient and untimely rains during the 2021 crop production season took a heavy toll on seed and crop production. For many growers, the cropping season was a total disappointment. Due to the unrelenting drought, many growers could only rely upon the moisture the soil was holding. Such growing conditions resulted in extreme variations in yield for small grains, soybeans, and corn, depending upon moisture-holding capacity of the soil or where rain showers may have occurred. Low to average yields at best, combined with a heavy cleanout percentage of shriveled and shrunken wheat seed, presented a new challenge – a tight seed supply for the next growing season.

Minnesota Crop Improvement Association (MCIA) staff members working with officials from the Minnesota Department of Agriculture, seed growers, and seed companies anticipated seed yields to be below average. We reached out to growers and encouraged them to apply for all eligible certification acres, even well after the application deadline. This resulted in several thousand additional wheat acres to be entered into the certification program; this will certainly add certified seed into a tight seed market for the 2022 production year. MCIA deeply cares about the health and resiliency of the Minnesota seed industry, and this is just one of the many examples that demonstrates MCIA has its finger on the pulse, understands the needs and challenges of seed production, and stands ready to help wherever we see an opportunity.

The *Minnesota Certified Seed Guide* is a result of the joint efforts of the Minnesota Agricultural Experiment Station, Minnesota Farm Guide, and MCIA. It includes informative articles most relevant to Minnesota agriculture, as well as variety testing data on a range of crops. Furthermore, the *Minnesota Certified Seed Guide* provides information about where to purchase certified seed. Please visit our website, www.mncia.org, to find more information about MCIA's programs and services, and to learn how our staff can assist your efforts to increase your profitability and enhance your competitiveness in the marketplace.

We hope you find the *2022 Minnesota Certified Seed Guide* enjoyable and informative. Please let us know your suggestions to further improve this annual publication.

Best wishes for a successful and profitable 2022! ✻

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Volume 19

Produced by Minnesota Farm Guide — Partners in Agriculture

Donald Wyse

Wyse receives Achievement in Crop Improvement Award

University of Minnesota Professor Dr. Donald Wyse was the recipient this past year of the Minnesota Crop Improvement Association's Achievement in Crop Improvement Award. The award is MCIA's highest honor. It recognizes individuals who have contributed to the betterment of agriculture through their work and service to MCIA and the seed industry. Presented annually since 1972, the award was sponsored by *The Farmer* magazine.

It all began in 1974, when Don Wyse came to Minnesota to begin a weed science research and teaching position at the University of Minnesota. Northern Minnesota's grass seed industry and MCIA had lobbied to create the position, which was to focus on perennial weed management. Quackgrass was a particular problem.

When he began his work, Don partnered with a host of MCIA seed producers and processors. Many of them were family-owned businesses with a tradition of working with MCIA and the University of Minnesota to produce high quality, certified grass seed.

Under Dr. Wyse's leadership, his research team made numerous discoveries that would help a relatively new seed industry prosper in Minnesota. One of their efforts led to an herbicide-resistant form of perennial ryegrass. Collaboration with Nancy Ehlke's turf breeding program led to the development of perennial ryegrass varieties suitable for seed production in Minnesota.

Today, perennial ryegrass is key part of agriculture in the Roseau and Lake of the Woods area, where a cool, wet microclimate offers favorable growing conditions. Approximately 55,000 acres of grass seed is produced and processed annually in region.

Dr. Wyse has taken the collaborative philosophy that helped the grass seed industry flourish and applied it to other initiatives in which he has been involved – and there have been many. A recent example is the Forever Green Initiative. This program is focused on the development of new perennial and winter annual crops that will augment Minnesota agriculture. Prominent among them is the intermediate wheatgrass Kernza.

Dr. Wyse has played a leadership role in many efforts that have contributed to the success of the seed industry and agriculture in Minnesota. Expressing his appreciation for the recognition, Don said, "It really does take a village, from the grass seed producers and processors, the MCIA staff, my university cohorts, and many others that have led to the success of the grass seed industry in Minnesota."

Today, Dr. Wyse continues to make a difference, working to improve agriculture and to make Minnesota a better place. ✻

Ehlers, Kringlen, Ternings receive Premier Seedsman Awards

The Premier Seedsman Award has been presented annually since 1929 to recognize individuals or partners involved in quality seed production, active in the Minnesota Crop Improvement Association, and who provide excellent service to the seed industry. This past year, MCIA recognized Bob Ehlers, Clyde Kringlen, and Dean and Dennis Terning as Premier Seedsmen.

Bob Ehlers

Bob Ehlers

Bob Ehlers owns and operates Red River Marketing Company, near Elbow Lake. Forty-five years ago, Bob and his brother began producing registered and certified seed. For many years, nearly the entire farm was in seed production. They grew wheat, oats, barley, and soybeans and worked with Adams Seed for conditioning. Today, in addition to producing certified public wheat varieties, Red River Marketing is also a Pioneer dealer.

Bob's entry into the seed business was based on the belief that, "The farm economy cycles up and down, but farmers need quality seed every year." He states that one of the reasons he enjoys the seed industry is the positive, quality people he has met and worked with over the years.

With a degree in agricultural engineering from the University of Minnesota, Bob built his own approved seed conditioning facility in 1994. He was also a partner in building a second seed facility in Thompson, North Dakota.

With a philosophy of helping others and finding blessings in every situation, Bob has been active in various local organizations, including his church and the area school board. An active MCIA member, he is currently vice chair of the board of directors and serves on various committees.

Clyde Kringlen

Clyde Kringlen, a native of Churches Ferry, N.D., has been associated with certified seed since he and his father purchased McIntosh Farm Service in 1981. His father taught him that they needed to keep the farmers in business. Clyde quickly took over management of the facility, which included an MCIA-approved seed plant.

Over the years, Clyde developed a passion for wheat seed production. In 2004, following the sale of the McIntosh facility, Clyde began working for Triangle Ag. There, working with private seed companies, he explored ways to enhance wheat production and improve profitability. Today he manages the wheat seed operations for West Central Ag Services.

Clyde is an optimist and is described as a generous mentor to other seed producers. He affirms the value of wheat in the rotation and enjoys seeing advances made in wheat production, saying, "I like to be involved in the changes and progress we see in agriculture."

Clyde has been involved in the Minnesota Wheat Growers organization, the Polk County Crop Improvement, and the Larry Sing golf tournament to support ALS research. In service to his community, he has served on the McIntosh Fire and Rescue, the local school board and church council, and he even found time to be a girls' basketball coach.

Clyde Kringlen

Dean and Dennis Terning

The Terning family has been producing seed corn since the 1960s. Ralph, father of Dean and Dennis, built his own seed plant in 1974 and began growing certified seed of small grains and soybeans. His boys grew up doing all the jobs necessary for seed production: detasseling and rogueing, sewing and stacking bags, and cleaning equipment. All the while they were learning the importance of quality and attention to detail.

In the spring of 1985, with support from their dad, Dean and Dennis decided to produce hybrid seed corn for their own retail brand, Terning Seeds. Those first two hybrids have grown into a large-scale seed corn production operation.

Terning's continued to grow and condition soybean seed. They have also mixed in some sweetcorn seed for Green Giant, popcorn, blue corn seed, and oats for export to Japan. Today, their seed corn production facility has the capacity to produce, harvest, and dry production from over 6,000 acres. Early in 2020, they sold their retail brand and entered into a production agreement with Western Integrated Seed.

Dennis manages the business side and Dean the production part of the operation. They both acknowledge that their success is due in part to longtime employees who take pride in producing high quality seed. In addition, Dean and Dennis have learned and worked with neighboring seed producers and truly value those relationships. ✻

The Terning family.

Krzmarzick, Vellekson receive Honorary Premier Seedsman Award

The Honorary Premier Seedsman Award, presented annually since 1930, recognizes individuals not directly involved in the seed industry but who have actively supported the seed industry, the Minnesota Crop Improvement Association, and their local community. This past year, MCIA recognized Randy Krzmarzick and Donn Vellekson as Honorary Premier Seedsmen.

Randy Krzmarzick

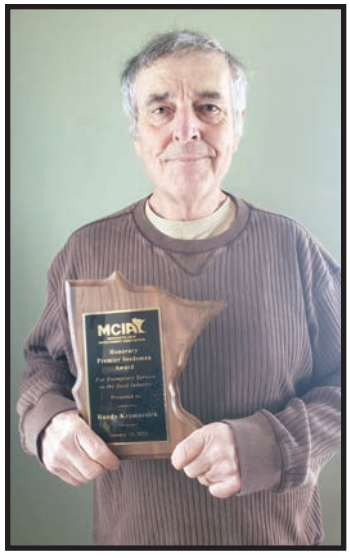
Randy Krzmarzick has been a reliable MCIA field inspector for 22 years. From his home farm near Sleepy Eye, he has walked thousands of acres across southwest Minnesota.

Randy has spent a lot of time inspecting fields and writing reports. Modestly, Randy says that he is "glad to be a small cog in the seed industry." When hired, his mother-in-law wanted to know if the job was safe. To date, outside of a couple of close encounters with skunks, and dogs with uncertain intentions, he has found it to be a great part-time job.

He has inspected fields for family-owned farms as well as multinational corporations. He enjoys the interactions with people across the industry. As Randy said, "Farmers know it all begins with a seed."

The years of inspecting oats, wheat, soybeans, and occasionally corn has provided him the opportunity to see some of the best farmland on the planet. As a farmer himself, he enjoys looking at fields and seeing up close the different practices and techniques farmers use.

Randy is involved in the Brown County Farmers Union, the area food shelf, and other local organizations. He also writes a column in the *New Ulm Journal*.



Randy Krzmarzick

Donn Vellekson

Donn Vellekson

Donn Vellekson's long and productive career at the University of Minnesota began in 1975. Most of his time has been devoted to research of turf grass and forage seed production. The results of his work have helped the grass seed industry prosper in Minnesota.

Donn grew up on a crop and livestock farm near Dawson in southwest Minnesota. He studied at the University of Minnesota, Crookston, graduating with a degree in crop science.

In the early years, much of the work at the University was focused on seed production management of Kentucky bluegrass, timothy, and birdsfoot trefoil. Now, perennial ryegrass is a primary emphasis.

The location of much of Donn's work is near Roseau. He appreciates the cooperation he has received, stating, "The farmers, local coops, and folks in northern Minnesota have been great to work with through the years." Today, Donn manages research on the University's Magnusson Research Farm. The farm plays a critical role in the University's turf, forage, and cover crop research, as well as its grass breeding programs.

On the St. Paul campus, Donn has maintained a good relationship with MCIA, as well, producing and cleaning breeder seed of perennial crops and conducting ryegrass growouts. ✻

MCIA – Adding value for agriculture

The Minnesota Crop Improvement Association (MCIA) has served agriculture for over 100 years. Founded in 1903 to promote the breeding, growing, and distribution of improved field crop varieties, MCIA now offers a host of programs and services that add value to agricultural products.

MCIA provides certification and quality assurance services to producers of a wide range of products. Goods certified by MCIA include field crop and turf seed, sod, native plant seeds, noxious weed seed–free forage and mulch, and identity preserved grains, as well as various organic crops, livestock, and foodstuffs.

MCIA also produces and distributes foundation seed of publicly developed crop varieties and serves as the marketing agent for varieties developed at the University of Minnesota (UMN). As well as its partnership with the UMN, MCIA maintains a collaborative relationship with the Minnesota Department of Agriculture and the Minnesota Department of Transportation.

In addition, MCIA offers an array of customized services such as field inspections, grain traceability, laboratory testing, and facility evaluations, as well as other third-party assessments and audits. As an independent third party, MCIA strives to provide superior programs and services to meet the needs of today's agricultural world.

MCIA Service and Programs

Seed Certification

Seed certification is an internationally recognized system developed to preserve the genetic identity and purity of field crop, turf, and other crop seeds. The variety and origin of certified seed has been verified by a certification agency and can be traced back to its producer through the information on the label.

Seed certification is a limited generation system based on three seed classes: foundation, registered, and certified. Field inspection of the growing crop, seed conditioning, sampling, laboratory analysis, and proper labeling are requirements for certification. Seed certification procedures provide the best possible assurance of good quality seed of known identity and purity.

Foundation Seed

Foundation seed is the initial generation in seed certification. The Foundation Seed Program produces and distributes foundation seed for crop varieties developed by the Minnesota, and other, Agricultural Experiment Stations.

Variety Licensing Services

MCIA has been engaged by the University of Minnesota Technology Commercialization office as its marketing agent. MCIA works with the UMN's College of Food, Agriculture, and Natural Resource Sciences (CFANS) plant breeding faculty and Technology Commercialization staff to identify customers interested in licensing agronomic crop varieties. CFANS has breeding programs in grasses, wheat, oats, barley, soybeans, and wild rice.

Seed Testing Laboratory

The MCIA laboratory offers a wide variety of tests that help determine seed quality: germination, physical purity—including other crop and weed contaminants, varietal verification, vigor, seed-count, herbicide tolerance, and other tests specific to certain crops. Crops tested include small grains, corn, soybeans, sunflowers, and other annual crops, as well as perennial grasses and forages. The MCIA laboratory is accredited by the USDA's Accredited Seed Laboratory (ASL) Program and participates in the USDA Canadian Seed Grader Program. It follows rules established by the Association of Official Seed Analysts. Test results are

MCIA:
Continued on page 8

New conventional soybean varieties

The University of Minnesota Agricultural Experiment Station recently released three new general purpose soybean varieties. All three varieties offer soybean cyst nematode (SCN) resistance and provide good options for farmers looking for conventional, non-GMO soybean varieties.

MN0811CN

MN0811CN is a 0.8 maturity conventional soybean with SCN resistance. In addition to its early maturity, it has excellent yield, good tolerance to iron chlorosis, and good lodging resistance. The SCN resistance for MN0811CN is derived from the PI88788 source. It has average protein content, with white flowers, grey pubescence and black hilum.

MN1807CN

MN1807CN soybean is a 1.8 maturity high yielding, SCN-resistant conventional variety. It carries the *Rps1c* gene for Phytophthora resistance, good standability and average tolerance to iron chlorosis. The SCN resistance for MN1807CN is derived from the PI88788 source. It has purple flowers, grey pubescence, as well as a buff hilum and average protein content.

MN1901CN

MN1901CN is a 1.9 maturity, high yielding, SCN-resistant conventional variety. MN1901CN has good lodging resistance and average tolerance to iron chlorosis. The SCN resistance for MN1901CN is derived from the PI88788 source. It has average protein content with purple flowers, grey pubescence, and imperfect black hilum.

Field trial performance information on these and many other varieties can be found in this issue of the Minnesota Seed Guide or on the Minnesota Agricultural Experiment Station website at www.maes.umn.edu. Contact MCIA for additional information on seed availability of these three varieties. ✻

MCIA: Continued from page 7

used to verify that certification standards for a particular crop and seed class have been met.

Native Seed Certification

MCIA's Native Seed Certification Program is designed to assure that the identity of native grasses and forbs (wildflowers) is maintained through all phases of seed production. Certified seed is often required by government agencies for re-vegetation of roadsides and construction sites. It is also used for wildlife habitat and other projects to ensure that planting materials are adapted to Minnesota's diverse climatic conditions.

Identity Preserved Grain Certification

MCIA's Identity Preserved (IP) Program provides certification of a product's specific traits or characteristics through the growing, processing, and marketing channels. The purpose of this program is to preserve the genetic and/or physical identity of a product to the end consumer. MCIA offers AOSCA*-approved IP programs including:

- 99.5 percent Non-GMO Soybean Grain
- Japan Positive List Compliance

MCIA can also develop customized IP programs designed to meet market demands.

**Association of Official Seed Certifying Agencies*

Non-GMO Grain Traceability

MCIA's audit-based Non-GMO Grain Traceability Program is designed to review and confirm that the processes used for grain production and handling, from planting to final sale, meet customer requirements for 'non-GMO' labeling. Developed in cooperation with the Minnesota Department of Agriculture, this program meets a growing demand for an unbiased, third-party verification of non-GMO grain production and distribution.

Noxious Weed Seed–free Forage and Mulch Certification Program

This certification program is designed to limit the spread of noxious weeds. Forage (hay, cubes, and pellets) and mulch that meets program standards, and has proper certification markings attached, is eligible for shipment into restricted areas in the United States and Canada. Mulch is also used in various revegetation projects around the state.

Quality Assurance Services

MCIA's Quality Assurance (QA) Program provides an unbiased, third-party quality control system for seed merchandised as varieties, hybrids, brands, or blends. QA guidelines enable the seed producer to market seed to each customer with the assurance that the seed is of known purity and quality. Inspection services can be customized to meet the particular needs of a seed company or producer. This customization may include:

- Customized field and varietal increase inspections
- Product quality control inspections
- Non-GMO soybean seed verification programs
- Quality management consultation and auditing services

Organic Certification Services

MCIA is a USDA National Organic Program-accredited certification agency. MCIA Organic Services provides prompt, high-quality service to organic producers, handlers, and processors located primarily in Minnesota and the Upper Midwest. Operations certified by MCIA include food processors, distributors, retailers, agricultural handling facilities, wild crop collectors, livestock producers, and field crop, vegetable, and fruit producers.

Approved Facilities

MCIA's Approved Facility Program provides an evaluation and approval process for facilities processing and selling seed and identity-preserved grain products. Facilities processing and/or handling products sold under the seed certification, QA seed, and IP grain programs must be inspected and approved by MCIA. Approved facilities are issued Certificates of Approval annually, which are prominently posted in their place of business.

Sod Quality Assurance

The Sod Quality Assurance Program establishes high-quality standards for the production and ongoing improvement of sod types suitable for installing in challenging environments. The program is a collaborative effort of the Minnesota Turf Association, the University of Minnesota, the Minnesota Department of Transportation, and MCIA.

Stewardship Assessment and Audit Services

MCIA's experienced field inspection team covers the entire state of Minnesota, delivering on-site inspection, audits, and assessment services to the agricultural industry. Services are customized to meet client and regulatory compliance requirements. As an unbiased third party, MCIA performs a variety of stewardship services including:

- Trait stewardship requirement assessments
- Compliance monitoring and audits of non-approved traits
- Processing facility evaluations

MCIA's Governance and Operation

The Minnesota Crop Improvement Association is a not-for-profit organization governed by a board of directors elected from the membership. The organization's membership consists of seed producers, conditioners, and others interested in high-quality seed and agricultural products, including organic producers, handlers, and processors. The organization operates on fees charged for the services and products it provides.

MCIA maintains an affiliation with The Association of Official Seed Certifying Agencies and several other state, national, and international organizations.

Contact Information

For more information about MCIA and its services and programs, call 1-800-510-6242 or visit the MCIA website, www.mncia.org. ✻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University of Minnesota researchers release first-ever winter barley variety

Researchers from the Department of Agronomy and Plant Genetics at University of Minnesota announced in late November the release of a new six-row winter barley variety called MN-Equinox. Available for planting in fall of 2022, MN-Equinox is facultative, meaning it can be planted in either the spring or fall, giving growers flexibility in planning their rotations and adapting to weather conditions.

MN-Equinox is the latest crop to be launched with support from the UMN Forever Green Initiative (FGI), a College of Food, Agricultural, and Natural Resource Sciences (CFANS) research platform with leadership housed in the Department of Agronomy and Plant Genetics focused on developing winter annual and perennial crops and cropping systems that protect soil and water while also providing new economic opportunities for growers and industry. Other crops in the FGI portfolio include the perennial grain Kernza, new winter-hardy oilseeds, hybrid hazelnuts, winter peas and a dozen other crops.

"MN-Equinox is the result of several years of breeding efforts, focused on developing a winter-hardy barley variety for Minnesota and Upper Midwest growers that will protect the soil and also provide a harvestable yield for market," states Kevin Smith, UMN barley breeder and research lead for winter barley. "We anticipate this is the first in a series of releases of improved winter barley varieties in the upcoming years. The initial market for MN-Equinox is for feed, but research is underway to assess and breed for potential food and beverage applications."

Growers will be able to purchase MN-Equinox through Albert Lea Seed starting in the summer of 2022.

"We are excited about MN-Equinox because we believe it gives farmers a new winter cereal that creates opportunities for them, " explains Mac Ehrhardt, president of Albert Lea Seed. "First of all, barley makes great feed, and if you can plant it in the fall you don't have to worry about the narrow spring planting window. Second of all, winter barley matures very early, and may allow double-cropping with soybeans."

Smith agrees and notes that providing growers with more options for rotation planning and diversifying their market opportunities are key reasons why researchers continue to breed for improved winter barley varieties.

"Small grain production in Minnesota, and specifically, barley production, has declined precipitously since the 1970s. Yet, small grains can play an important role for growers to build soil health and reduce weed and pest pressure in their rotations." Smith adds, "We are excited about the potential for winter barley in Minnesota and are pleased to help farmers realize that potential with MN-Equinox."

Companies or individuals interested in producing and selling certified seed of MN-Equinox should contact the Minnesota Crop Improvement Association to obtain a license for seed production. Released by the Minnesota Agricultural Experiment Station, Plant Variety Protection (PVP94) is pending. ✻

Hold the dates for small grain workshops

By JARED GOPLEN
Extension Education

If you're a farmer or crop consultant already producing small grains or are looking for another crop to add to your rotation, these workshops are for you. Ten small grain management events will be offered across Minnesota in January and February of 2022. They'll focus on production agronomics, variety selection, and economics, and include an open-forum discussion for related topics and on-farm experiences.

Thanks to the generous support of the Minnesota Wheat Research and Promotion Council, registration is free and lunch is included at all sites.

Workshop details

Dates, locations, times and contacts follow:

• Monday, Jan. 17, 9 a.m.-12 p.m., Morris

West Central Research and Outreach Center, lunch after meeting (contact Jared Goplen at 507-829-0614)

• Monday, Jan. 31, 1-3 p.m., Roseau

Roseau City Center, lunch prior to meeting (contact Angie Peltier at 218-281-8692)

*Private Pesticide Applicator Training will precede the small grains program from 9 a.m.-12:30 p.m.

• Tuesday, Feb. 1, 1-3 p.m., McIntosh

McIntosh Community Center, lunch prior to meeting (contact Heather Dufault at 218-280-1129)

*Private Pesticide Applicator Training will precede the small grains program from 9 a.m.-12:30 p.m.

• Monday, Feb. 14, 9-11:30 a.m., New Prague

New Prague American Legion Clubroom, lunch after meeting (contact Shane Bugeja at 515-708-3486 or Colleen Carlson 507-521-3640)

• Monday, Feb. 14, 1-3:30 p.m., Rochester

Rochester Regional Extension Office, lunch prior to meeting (contact Ryan Miller at 507-529-2759)

• Tuesday, Feb. 15, 1-3:30 p.m., Floodwood

Downtown Fair Center (107 W 7th Ave.), lunch prior to meeting (contact Troy Salzer at 218-749-7120)

• Thursday, Feb. 17, 1-3:30 p.m., Slayton

Murray County 4H-Building, Event Hall (contact Melissa Runck at 507-836-6927)

*AM crops program will run from 9 a.m.-12:30 p.m. and includes lunch.

• Friday, Feb. 18, 9-11:30 a.m., Cold Spring

Great Blue Heron, lunch after meeting (contact Nathan Drewitz at 608-515-4414)

• Friday, Feb. 18, 1-3:30 p.m., Benson

McKinney's on Southside, lunch prior to meeting (contact Scott Lee at 320-760-6129)

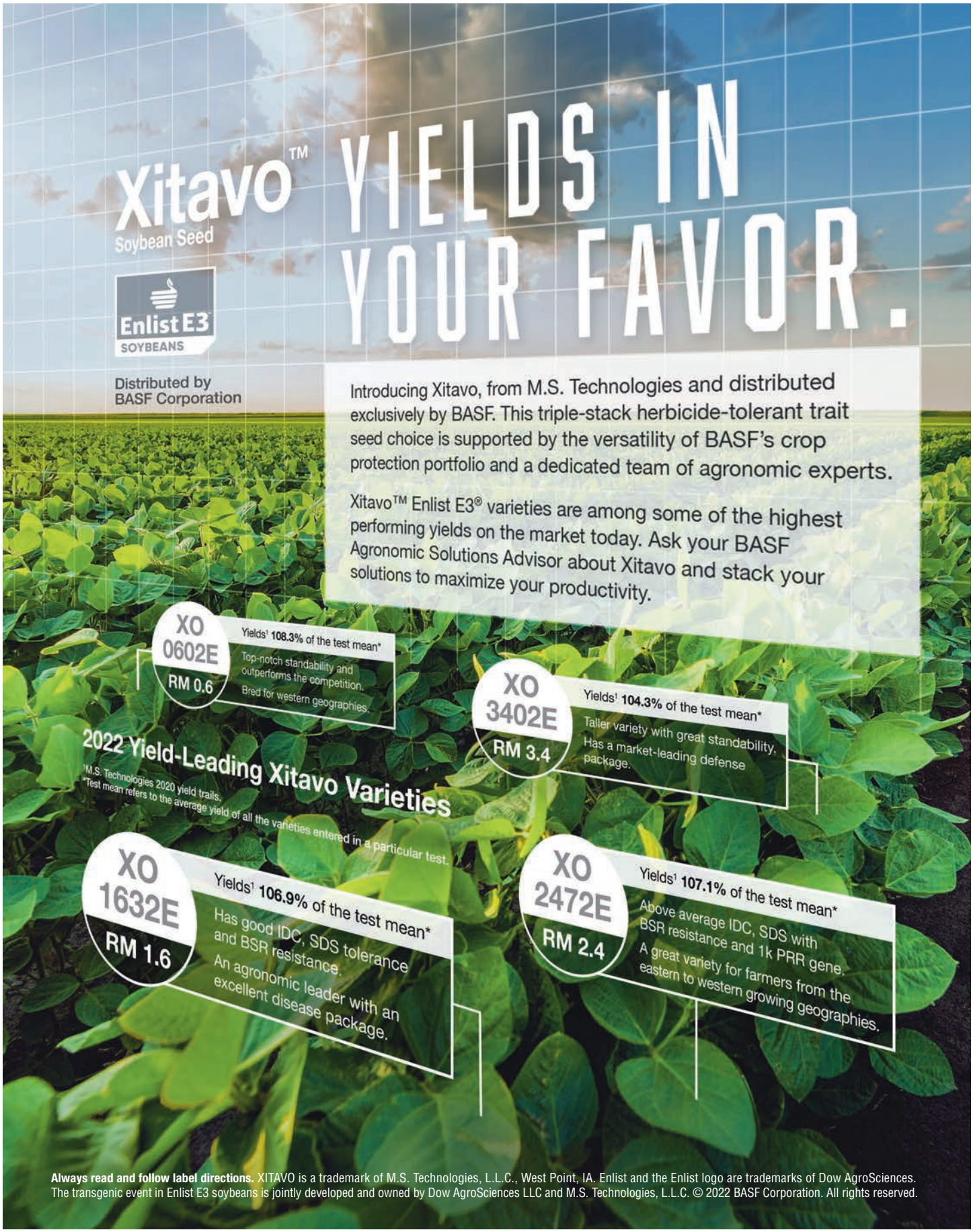
• Wednesday, Feb. 23, 9-10 a.m., Strategic Farming: Small Grains Webinar

Virtual Zoom workshop (z.umn.edu/strategic-farming)

Presenters may vary by location, but include Jochum Wiersma, Extension small grain specialist, and Jared Goplen, Extension crops educator.

Registration

Registration is required to assist with meal planning. Please register by visiting z.umn.edu/SGWorkshop or contact Jared Goplen at 320-589-1711, extension 2128, or gople007@umn.edu for more information. ✻



Wippler improves seed value through quality and promotion

By ANDREA JOHNSON
Contributing Writer

For over 30 years, Roger Wippler has managed the Foundation Seed program at Minnesota Crop Improvement Association (MCIA).

He oversees production and distribution of Foundation Seed varieties developed by the Minnesota Agricultural Experiment Station. He also coordinates licensing activities and manages private seedstock increase services on a contractual basis.

He's driven thousands of miles and walked hundreds more to see each season's fields of Foundation Seed production, which is sold to MCIA members to produce Registered or Certified Seed.

In addition, Wippler has served as an important colleague to every one of the MCIA staff and its producer-members.

He's helped MCIA through three decades of rapid change by understanding the importance of developing relationships, publicizing new varietal releases, and being available to lend a helping hand.

"One of the things we've done, that's in cooperation with the University of Minnesota (U of M), is promote the University-developed varieties," Wippler said in a recent interview. "We've worked with U of M plant breeders and the communications team to develop promotional materials – advertisements, brochures, posters. So, you can go to trade shows, and you have images of MN-Torgy, or Linkert, or Deon oats."

He's also helped open windows into niche markets and specialty services when doors closed due to genetic engineering and the repositioning of private companies that now dominate the seed industry.

Perseverance personified

Wippler's story starts out near Randall, Minn., on a 30-acre farm. His dad was a heavy equipment operator while his mom was a nurses' aide.

His dad always said, "If you're going to do a job, do it well."

The Wipplers had 9 children – Roger was smack-dab in the middle. When the kids were old enough, his mom would "farm" out the children to help neighbors pick rocks, stack bales, or milk cows. The kids also farrowed sows and sold feeder pigs as FFA projects.

Very involved in FFA in high school, Wippler attended Central Lakes College in Brainerd, Minn., studying Landscape and Horticulture. His next step was to attend the U of M, St. Paul, and study Ag Education.

A top-notch student in the grain grading and crop seed identification course, Wippler was tapped on the shoulder by advisor John Gooding to join U of M's Crops Judging Team.

Each year, the team began practice in September and followed a grueling schedule through November. Study and practice occurred during the week and weekends leading up to the competitions. All the work was worth it, as the team became national champions.

It was excellent training for Wippler's work with MCIA.

After graduating from the U of M, Wippler taught one year of high school agriculture in Glencoe before returning to campus to pursue a master's degree. He'd also met his future wife, Cindy Salber, who attended U of M, Waseca before transferring to the U of M, St. Paul, to finish her bachelor's degree. As a student, Cindy worked in the MCIA seed lab, and when she earned her bachelor's in 1985, she was offered an administrative position.

Roger Wippler

While working on his master's in 1989, Wippler was offered the Foundation Manager position with MCIA.

The Wipplers provided stability, knowledge, and experience for decades.

"I always say, 'They hired me so they could keep her around,'" Wippler joked. Cindy retired in 2019.

Foundation Seed

The Foundation Seedstocks Project was transferred from the U of M Department of Agronomy and Plant Genetics to MCIA in June 1967. The MCIA manager was Ward Marshall, at that time, with Foundation Seedstocks managed by Robert Bieter.

Marshall was succeeded in 1975 by Harley J. Otto.

Bieter left in 1978, and MCIA hired Steven A. Clarke to manage Foundation Seed. Following Clarke's departure in 1984, John Van de Crommert served as Foundation Seedstocks manager.

With Van de Crommert leaving in 1989, Wippler was hired as Foundation Seed manager that same year.

Otto ran MCIA by the book, and that was a great way to learn the systems, Wippler said.

"(Otto) had very tight control over things," he said. "I was primarily working just with Foundation Seed and seed producers. That was a big program and enough diversity."

Foundation Seed sold to MCIA members in the early 1990s totaled about 25,000 bushels of wheat, 10,000 bushels of barley, and another 20,000 bushels of soybeans.

The overall certification program at the time was close to 300,000 acres of soybeans, small grains, and other crops.

At that time in southern Minnesota, there were nearly 200 seedsmen producing Certified Sturdy soybeans. The number of wheat and barley producers in the northwest was comparable.

"Much of the seed grown in the state was coming through the MCIA Foundation Seed programs," he said. Private seed was becoming more popular, although there wasn't a lot of private varieties.

In 1995, Gary M. Beil, Ph.D., took over as MCIA Executive Vice President. Beil appreciated suggestions and recommendations from staff, but he also expected that the person making the recommendation would help carry out the plan.

"It was really a quite different transition between what Harley had done and Gary's management style – Harley being very involved, and Gary being less directly involved," Wippler explained.

Wippler's duties had included overseeing and managing small grain and soybean Foundation programs, but in 1995 that changed. Biotechnology was about to change the world.

Glyphosate-tolerant soybeans allowed growers to clean up fields easily and were quickly accepted by most soybean producers. MCIA played a key role in forming NorthStar Genetics, which at its beginning was comprised of MCIA members.

The MCIA realized a reduction in the production of conventional soybean varieties, even though they continued to offer very high-quality products. MCIA staff worked with U of M soybean breeder Jim Orf as he developed soybean varieties appropriate for niche markets.

"It was under Gary that we started the variety licensing," Wippler said. "We began licensing food grade soybeans to companies on an exclusive basis, because they were going to invest time, effort, and money to develop that market."

Variety licensing continues to be a key part of the Foundation Seed program.

Small grains were about to take a terrible hit. Fusarium headblight became a serious problem in the early 1990s. Farmers quickly moved away from barley production as well as wheat.

Breeders worked as fast as they

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could to develop FHB resistant varieties to keep small grain production intact. Their efforts proved fruitful and wheat production remained strong; but barley acres would never reach the levels of the 1980s.

Following Beil was Ben Lang in 2008. The current president and CEO of MCIA is Fawad Shah, who started in 2015.

Seeing the tremendous amounts of private seed company advertising, Wippler realized that promotion was very important to the future of MCIA.

He began stressing communications through the Seed Grower publication, and other internal and cooperative Seed Guides.

"I've enjoyed helping promote the University-developed varieties," he said. "For a while the breeders would release a new variety, and the seed growers would say, 'It's a good variety, but no one knows about it.'"

Promotion and performance worked – especially with Linkert wheat, which for several years made up 20-30 percent of Minnesota's wheat production.

Wippler enjoys visiting with farmers who ask about new varieties because they read about it in a publication or hear about it at a meeting.

Naming varieties after places or influential members of the seed community has been a great way to build recognition among farmers.

Foundation manager today

On a July day in 2021, Wippler went out to Jim Falk's farm, near Sunburg, Minn., to look at some Deon oats. Despite significant drought, it looked as though the Foundation crop received enough rain for a good crop.

An independent inspector made the official inspection of the field, but Wippler needed to visit the field to see the quality and potential quantity of seed available.

He later traveled to Fergus Falls and up to Crookston to look at more Foundation Seed fields.

Checking fields is an important part of Wippler's responsibilities, especially the first year a new variety is increased. He likes to see the variety in a large field, checking the purity and agronomic traits.

He also talks with the grower to get their impression, as well as any concerns about the new variety.

There continues to be interest in public seed varieties, especially in wheat and other small grains. The public's interest in organic and non-GMO hasn't waned, and specialty crops like Kernza hold the potential for future Foundation Seed advancements.

The world of seed: seed testing, seed promotion, seed demand, and seed supply – remains very important in 2022 and beyond.

The MCIA Foundation Seed program will continue to have an important role in crop production –serving as a conduit between the U of M seed breeders, Certified Seed producers, and farmers. ✻

Frequently asked questions about Seed Laboratory Services

What is the purpose of the seed laboratory?

The MCIA seed laboratory tests seed for quality. The lab conducts germination, physical purity (including inert, other crop, and weed contaminant percentages) and noxious weed seed exams, varietal verification, vigor, tetrazolium (TZ), and herbicide bioassay tests, as well as other crop-specific tests.

Who determines how seed is tested?

The seed laboratory follows testing rules established by the Association of Official Seed Analysts (AOSA). The *AOSA Rules for Testing Seeds*, used by regulatory agencies and commercial labs throughout the U.S., standardizes seed testing procedures for numerous species. Other rules may be applied when testing seed intended for export to foreign markets, such as Canada.

Why should my seed be tested?

Seed testing is one of the final steps in the seed certification process. Test results will be used to verify that standards have been met for a particular crop and seed class. Seed lots certified by MCIA are required to be tested at the MCIA seed laboratory, except for native species, which may be tested at an authorized lab. Testing information can also be used for labeling and/or quality assurance. Service testing is also available for seed that is not in the certification program. A host of tests offered, including germination, vigor, purity, and moisture, can help a seed producer, seller, or buyer assess seed quality.

How do I submit samples?

Sample bags are available from the MCIA office for submitting your samples. Fill the bag with a representative sample to the top line for large seeded agronomic crops, and to the middle line for most natives, grasses, and small-seeded legumes. If requesting a moisture test, please provide an additional 500 grams. Include an MCIA Sampling Report, available on our website or from the MCIA office, providing seed lot information and indicating the tests to be conducted on your sample.

What should I look for after testing?

Seed tested as part of certification will receive a Seed Certification Report, indicating

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Frequently asked questions about Certified Seed

What is seed certification?

Seed certification is an internationally recognized system to preserve the genetic identity and purity of crop varieties.

How is seed certified?

Seed certification requires planting eligible seedstocks, field inspection of the growing crop, proper conditioning, representative sampling, thorough laboratory analysis, and proper labeling.

Who produces certified seed?

Certified seed is produced by careful, conscientious growers, according to seed certification standards. Seed certification standards and procedures are available from MCIA.

Why buy certified seed?

Seed certification procedures provide the best possible third-party assurance of good quality seed of known identity and purity.

What should I look for?

For certification to be valid, buyers must be provided proof of certification. Seed containers must bear an official certification label. Bulk seed sales must be accompanied by a Bulk Seed Sales Certificate. ✻

Frequently asked questions about Quality Assured Seed

What is quality assured seed?

Quality assured (QA) seed has met standards designed to preserve the purity and identity of a crop variety. Standards, similar to those applied in seed certification, enable a company to produce and market seed according to sound quality management practices.

How is seed quality assured?

The quality assurance process includes field inspections, laboratory testing, audits of production records, and on-site evaluations of conditioning and treatment facilities. Seed meeting all requirements is eligible to be labeled with the Association of Seed Certifying Agencies (AOSCA) QA logo.

Who produces quality assured seed?

Seed producers of all crop types may use a QA program to access a complete service for seed sold as varieties, hybrids, brands, or blends. QA programs can be customized to support an existing quality management system or as part of an AOSCA program.

Why buy quality assured seed?

Quality assured seed provides assurance to seed buyers that the seed is of known purity and quality as verified by an unbiased third party.

What should I look for?

Seed meeting QA standards may bear a quality assurance label or be marked with a QA logo. Buyers of bulk quality assured seed may be provided with a QA Bulk Sales Certificate. ✻

SEED LAB SERVICES:

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the test results and a passed or failed lot status. Preliminary samples, carryover seed, and non-certified seed will receive a Laboratory Report of Analysis, which will indicate the results of the tests requested. You can receive preliminary and final results by e-mail, and a final report will be mailed to you. ✻

QUALITY ASSURED SEED DIRECTORY

Crop	Variety	County	Grower	City	Phone
Soybeans	BG 06L16N Brand	Becker	Hein Farms, Inc	Audubon	218-439-6621
Soybeans	BG9071E3 Brand	Becker	Hein Farms, Inc	Audubon	218-439-6621
Soybeans	IA3054RA12	Freeborn	Albert Lea Seed House, Inc.	Albert Lea	507-373-3161
Soybeans	MSOY 141 Brand	Mower	Meadowland Soy	Grand Meadow	507-754-5013
Soybeans	MSOY 373 Brand	Mower	Meadowland Soy	Grand Meadow	507-754-5013
Soybeans	Viking 2188AT12N Brand	Freeborn	Albert Lea Seed House, Inc.	Albert Lea	507-373-3161
Soybeans	Viking 0.2188AT12N Brand	Freeborn	Albert Lea Seed House, Inc.	Albert Lea	507-373-3161

Frequently asked questions about Approved Facilities

What is the Approved Facility Program?

MCIA's Approved Facility Program provides an evaluation and approval process for facilities processing seed and identity-preserved (IP) grain products. Facilities processing and/or handling products sold under MCIA's seed certification, Quality Assured seed, and IP grain programs must be inspected and approved by MCIA staff.

How is a facility approved?

To be approved, facilities must meet equipment and labeling requirements appropriate for the seed or grain to be processed. Approval is granted on an annual basis for conditioning, handling, and labeling specific seed types, or for processing grain products for specified end uses.

Why use an approved facility?

Approved facilities are inspected annually to determine their ongoing conformance to requirements necessary to preserve product identity and quality and to assure proper labeling.

What should I look for to verify that a facility is approved?

Approved facilities are issued Certificates of Approval annually that are to be prominently posted in their place of business. MCIA also provides Approved Facility signs. ✻

Noxious Weed Seed-free Forage and Mulch

What is noxious weed seed–free forage and mulch?

The intention of this certification program is to limit the spread of noxious weeds. MCIA is designated under Minnesota law as the state's official Noxious Weed Seed–free Forage and Mulch Certification Agency. MCIA's program conforms to standards developed by the North American Invasive Species Management Association (NAISMA), which allows properly labeled forage (hay, cubes, and pellets) and mulch certified by MCIA to be shipped into restricted areas of the United States and Canada.

NOXIOUS WEED SEED-FREE FORAGE & MULCH

Product	County	Name	Address	Phone
Alfalfa/Grass mix	Olmsted	Rafter F Ranch (Dale A Fleming)	10821 County Rd 129 SE, Eyota MN 55934	507-254-5294
Barley	Mahnomen	Dave & Beth Eiynck Partnership	2884 120th Ave, Mahnomen MN 56557	218-473-3223
Big bluestem	Clay	MNL, Inc.	8740 77th St NE, Otsego MN 55362	763-295-0010
Big bluestem/Indiangrass	Isanti	Green Barrie Farms/Dale Barrett	8569 Tennyson Dr NW, Princeton MN 55371	763-389-3351
Grass Mix	Clay	MNL, Inc.	8740 77th St NE, Otsego MN 55362	763-295-0010
Grass Mix	Wright	Todd W Tyson	17426 Cty Road 50 SE, Big Lake MN 55309	763-263-1939
Indiangrass	Clay	MNL, Inc.	8740 77th St NE, Otsego MN 55362	763-295-0010
Little bluestem	Clay	MNL, Inc.	8740 77th St NE, Otsego MN 55362	763-295-0010
Oats	Freeborn	Theron Gjersvik	70353 255th St, Alden MN 56009	507-826-3373
Oats	Itasca	Northland Farm Supply Inc.	5685 County Road 4, Cromwell MN 55726	218-821-1627
Oats	Olmsted	Stokes Farms, LLP	9729 190th Ave SE, Chatfield MN 55923	507-273-7759
Oats	Red Lake	David Svendson	18716 330th Ave SE, Oklee MN 56742	218-416-0157
Oats/Barley	Mahnomen	Dave & Beth Eiynck Partnership	2884 120th Ave, Mahnomen MN 56557	218-473-3223
Orchardgrass	Anoka	Hammer Hay	19420 Cleary Rd NW, Anoka MN 55303	763-438-1980
Rye	Anoka	Hammer Hay	19420 Cleary Rd NW, Anoka MN 55303	763-438-1980
Rye	Mahnomen	Howard Dickey	24213 470th St, Leonard MN 56652	218-968-2381
Rye	Renville	Dean Schroeder	74543 270th St, Renville MN 56284	320-826-2415
Rye	Renville	Macius Schroeder	1313 Chestnut Ave West, Olivia MN 56277	320-522-1397
Rye	Waseca	Russell Farms (Curt/Dave Russell)	26704 120th St, New Richland MN 56072	507-317-4865
Rye	Wilkin	Stuart Nichol	1924 140th St, Wolverton MN 56594	701-238-2681
Rye	Wilkin	Richard Scheffler	2673 130th St, Barnesville MN 56514	218-493-4456
Wheat	Beltrami	Alan Killian	24257 Beltrami Line Rd, Bemidji MN 56601	218-751-0408
Wheat	Carver	River Bluff Ranch (Robert Olson)	16785 Halsey Ave, Carver MN 55315	952-836-5219
Wheat	Clearwater	Howard Dickey	24213 470th St, Leonard MN 56652	218-968-2381
Wheat	Clearwater	Mark G Gunning	17282 510th St, Clearbrook MN 56634	218-280-6005
Wheat	Grant	B&J Landscaping	417 3rd St SE, Elbow Lake MN 56531	320-815-0758
Wheat	Hennepin	Leuer Farms/Steve Leuer	3312 Red Fox Dr, Hamel MN 55340	763-478-9583
Wheat	Hubbard	Alan Killian	24257 Beltrami Line Rd, Bemidji MN 56601	218-751-0408
Wheat	Marshall	Blawat Farms	21370 290th St NW, Viking MN 56760	218-684-0750
Wheat	McLeod	Scott Wagner	2475 Highway 15, Brownton MN 55312	320-510-1782
Wheat	Pennington	Tom Pribyl	21607 165th St SE, Plummer MN 56748	218-465-4005
Wheat	Pennington	Trontvedt Farms	27500 120th St SE, Oklee MN 56742	218-686-8921
Wheat	Polk	Ben Weiland	1509 Saint Marys Dr, Crookston MN 56716	218-280-1490
Wheat	Red Lake	Mike Cemensky	40952 Buffalo Ln, Le Center MN 56057	507-380-3158
Wheat	Red Lake	David Svendson	18716 330th Ave SE, Oklee MN 56742	218-416-0157
Wheat	Scott	Jean Petsch	6695 Flemming Rd, Prior Lake MN 55372	952-491-3961
Wheat	Traverse	Lee Sykora	14653 Hwy 27, Hoffman MN 56339	320-815-7534
Winter Wheat	Carver	Glenn Schmidt	18980 Cty Road 40, Belle Plaine MN 56011	612-386-4554
Winter Wheat	Le Sueur	DS Construction & Packaging LLC	44357 Kilkenny Rd, Kilkenny MN 56052	507-595-3331
Winter Wheat	Renville	Brian Greenslit	37350 660th Ave, Franklin MN 55333	507-829-8909

Why buy certified noxious weed seed–free forage and mulch?

Buyers using certified noxious weed seed–free forage and mulch help minimize the spread of noxious weeds onto private and public lands. In Minnesota, certified mulch is often used by government agencies for roadside and other revegetation projects. Most public lands in the western United States require that hay transported into those areas be certified noxious weed seed–free.

How is noxious weed seed–free forage and mulch certified?

Certification requires that fields and storage sites to be inspected by MCIA within 10 days of harvest. If the fields and sites conform to standards for freedom from noxious and undesirable weeds, the harvested crop will be eligible for certification labels. Producers should apply for field and storage site inspection no later than 30 days prior to crop-cut date.

What should I look for to verify that forage and mulch is noxious weed seed–free?

MCIA issues tags with unique serial numbers for the labeling of certified forage and mulch production. For certification to be valid, an official certification label (tag) must be securely attached to the eligible product (bale) prior to delivery to the buyer.

Where can I find a list of certified noxious weed seed–free forage and mulch producers?

MCIA surveys eligible producers every spring and fall to determine availability. You will find the results of those surveys on the MCIA website, www.mncia.org/where-to-buy. ✻

APPROVED SEED CONDITIONING PLANTS

NAME	ADDRESS, CITY, ZIP CODE	COUNTY	PHONE
A			
Ada Feed & Seed, Inc	12 W Thorpe Ave, Ada, 56510	Norman	218-784-7158
Adams Seed	29245 300th St, Wendell, 56590	Grant	218-458-2151
Agassiz Seed & Supply Inc	3660 Kennebec Dr, Eagan, 55122	Hennepin	651-287-3400
Agassiz Seed & Supply Inc	445 7th St NW, West Fargo, 58078	ND-Cass	701-282-8118
AgReliant Genetics LLC	PO Box 190, Wadena, 56482	Wadena	218-631-2954
AgriMAX	23917 350th Ave SW, Fisher, 56723	Polk	218-891-2211
Albert Lea Seed House, Inc	PO Box 127, Albert Lea, 56007	Freeborn	507-373-3161
Alforex Seeds	16690 Greystone Lane, Jordan 55352	Scott	952-492-2990
American Crystal Beet Seed Products	PO Box 1227, Moorhead, 56560	Clay	218-236-4773
Anderson Seeds	74151 CSAH 5, Dassel, 55325	Meeker	320-286-2700
Anderson Seeds of St. Peter	37825 Cty Rd 63, Saint Peter, 56082	Nicollet	507-246-5032
Angell Seed Farm	86381 320th St, Blooming Prairie, 55917	Freeborn	507-339-2334
B			
Backman Seeds, Inc	13045 310th Ave, Herman, 56248	Grant	320-677-2231
Bayer Northern Production	PO Box 46, Redwood Falls, 56283	Redwood	507-637-2204
Bayer Northern Production	PO Box 530, Redwood Falls, 56283	Redwood	507-644-2108
Beyer Seed Farm	1730 230th St, Kent, 56553	Wilkin	701-640-2222
Bloomquist Farms, Inc	1737 130th St, Drayton, 58225	Kittson	218-455-3863
Bonanza Bean LLC	PO Box 164, Morris, 56267	Stevens	320-585-2326
Brad Barth Farms	14701 250th Ave NE, Goodridge, 56725	Pennington	218-681-4236
Brushvale Seed, Inc	1656 280th St, Breckenridge, 56520	Wilkin	218-643-2311
Burkel Grain	20463 State Hwy 11, Greenbush, 56726	Roseau	218-782-2121
C			
C&S Habstritt Inc	PO Box 148, Roseau, 56751	Roseau	218-463-1193
Capistran Seed Company	19380 270th St SW, Crookston, 56716	Polk	218-891-7840
CHS, Inc	PO Box 39, Winger, 56592	Polk	218-938-4126
CHS, Inc – M Pieske	2712 County Rd 6, Marshall, 56258	Lyon	507-532-3246
CHS Northland Grain – Greenbush	PO Box 246, Greenbush, 56726	Roseau	218-782-2111
Cummings Ag Inc	PO Box 152, Buxton, 58218	ND-Traill	701-636-5463
D			
Dahlco Seeds Inc	14730 15th St SW, Cokato, 55321	Wright	320-286-5982
Dahlman Seed Co	73504 200th St, Dassel, 55325	Meeker	320-275-2527
Deer Creek Seed, Inc	PO Box 105, Ashland, 54806	WI-Ashland	715-681-0899
DK Farms, Inc	23316 Cty Road 23, Greenbush, 56726	Roseau	218-782-2767
DS Construction & Pkging LLC	44357 Kilkenny Rd, Kilkenny, 56052	Le Sueur	507-595-3331
E			
Enestvedt Seed Company	75802 Cty Road 12, Sacred Heart, 56285	Renville	320-765-2728
F			
Falk's Seed Farm	1170 Highway 9 NE, Murdock, 56271	Swift	320-875-4341
Farmers Co-op Grain & Seed	PO Box 525, Thief River Falls, 56701	Pennington	218-681-6281
Faust, Kevin	26270 202nd St, Long Prairie, 56347	Todd	320-732-3361
Finish Line Seed, Inc	PO Box 277, Bird Island, 55310	Renville	320-365-3674
Fosston Tri-Coop	PO Box 88, Fosston, 56542	Polk	218-435-6222
Fosston Tri-Coop – McIntosh	PO Box 88, Fosston, 56542	Polk	218-563-3735
Friederichs Seed Farm	2847 390th St, Foxhome, 56543	Wilkin	218-205-8759
Friederichs Seed Inc	PO Box 99, Foxhome, 56543	Wilkin	218-739-3366
G			
Gertens Whse/Professional Turf Sply	1980 Seneca Rd, Eagan, 55122	Dakota	651-239-1318
Grain Millers/Specialty Prod Div	1502 Gault St, Saint Peter, 56082	Nicollet	507-934-0210
Grass & Sons Seed, Inc	77249 125th St, LeRoy, 55951	Mower	507-324-5820
Gro Alliance, LLC	520 5th St S, Breckenridge, 56520	Wilkin	218-643-1892
H			
Haas Seed Farm	37459 Ottawa Rd, Le Sueur, 56058	Le Sueur	612-327-5385
Haugrud Seed Plant	3331 130th St, Rothsay, 56579	Wilkin	218-493-4275
I			
Integrated Ag Services	490 29th St NE, Northwood, 58267	ND-Grand Forks	701-620-1762
J			
Jensen Seed Co	41439 330th Ave NW, Stephen, 56757	Marshall	218-478-3397
Joliette Ag Systems	15866 Highway 5, Pembina, 58271	ND-Pembina	701-454-6221
JSF, Inc (Johnson Seed Farm)	85380 180th St, Sacred Heart, 56285	Renville	320-765-2225
K			
Knewtson Soy Products	17303 State Hwy 22, Good Thunder, 56037	Blue Earth	507-278-4087
Krabbenhoft Seed & Sply LLC	PO Box 16, Sabin, 56580	Clay	218-789-7219
Kukowski, Jim	17485 Cty Road 6, Strathcona, 56759	Roseau	218-781-2478
L			
La Crosse Seed, LLC	2541 Commerce St, La Crosse, 54603	WI-La Crosse	608-783-9560
Lake Bronson Elevator, Inc	PO Box 40, Lake Bronson, 56734	Kittson	218-754-4200
Lee's Seed Farm	670 50th Ave NE, Benson, 56215	Swift	320-843-2857

NAME	ADDRESS, CITY, ZIP CODE	COUNTY	PHONE
M			
Magnusson Farms	PO Box 28, Roseau, 56751	Roseau	218-463-2374
Meadowland Soy	25333 710th Ave, Grand Meadow, 55936	Mower	507-754-5013
Meyer's Seeds, Inc	7813 Hwy 247 NE, Elgin, 55932	Olmsted	507-876-2482
Midway Sales	PO Box 285, Argyle, 56713	Marshall	218-820-5587
Midway Seed, LLC	10095 Highway 18, Cavalier, 58220	ND-Pembina	701-265-4224
MNL, Inc.	8740 77th St NE, Otsego, 55362	Benton	763-295-0010
N			
Newfolden Co-op Elev Assn	PO Box 157, Newfolden, 56738	Marshall	218-874-7465
Nietfeld Farm, Inc	34253 Cty Road 31, Melrose, 56352	Stearns	320-987-3442
Norfarm Seeds, Inc	104 Minnesota Ave SW, Bemidji, 56601	Beltrami	218-751-8617
Norfarm Seeds, Inc	31154 430th Ave, Roseau, 56751	Roseau	218-463-2119
Northern Excellence Seed LLC	PO Box 186, Williams, 56686	Lake of the Woods	218-783-2228
Northern Tier Seed Company	PO Box 132, Thompson, 58278	ND-Grand Forks	701-599-9065
Northland Farm Sply Inc.	5685 Cty Road 4, Cromwell, 55726	Carlton	218-821-1627
P			
Pazdernik Farms, Inc	1657 290th St, Waubun, 56589	Mahnomen	218-766-9531
Petermann Seeds, Inc	3008 210th St N, Hawley, 56549	Clay	218-483-3302
Petersen, Ron (Kennedy Plant)	1919 320th Ave, Lake Bronson, 56734	Kittson	218-754-4631
Petersen, Ronald L	1919 320th Ave, Lake Bronson, 56734	Kittson	218-754-4631
Pioneer Hi-Bred Int'l Inc	182 Industrial Pkwy, Jackson, 56143	Jackson	800-582-0107
Pioneer Hi-Bred Int'l, Inc	PO Box 93, Wahpeton, 58074	ND-Richland	701-642-5300
Pipeline Foods	PO Box 128, Hope, 56046	Steele	507-451-3316
Prairie Bean Co, LLC	PO Box 249, Bird Island, 55310	Stevens	320-795-2468
Prescher-Willette Seeds	41721 160th St, Delavan, 56023	Faribault	507-854-3595
R			
Radium, Inc	26188 241st St NW, Warren, 56762	Marshall	218-745-5556
Ramy Turf Products	1329 N Riverfront, Mankato, 56001	Blue Earth	507-387-4091
Ramy Turf Products – Saint Paul	731 Prior Ave N, Saint Paul, 55104	Ramsey	651-917-0939
Red River Marketing Co	20145 240th St, Elbow Lake, 56531	Grant	218-685-6100
Remington Seeds, LLC	19160 Lillehei Ave, Hastings, 55033	Dakota	651-480-3416
Remington Seeds, LLC	2222 W Lincoln, Olivia, 56277	Renville	320-523-1331
Remington Seeds, LLC	PO Box 118, Olivia, 56277	Renville	320-523-5965
Remington Seeds, LLC	PO Box 605, Grafton, 58237	ND-Walsh	701-379-1000
Remington Seeds, LLC	302 4th Ave SE, Mapleton, 58059	ND-Cass	701-282-8400
Richland IFC, Inc	100 10th St N, Breckenridge, 56520	Wilkin	218-643-1797
Rivard's Turf & Forage Inc	3150 27th Ave N, Grand Forks, 58203	ND-Grand Forks	701-330-3699
S			
Sawvell's Seed, Inc	211 Pine St, Clements, 56224	Redwood	507-692-2240
Schwitters Bros Partnership	4040 160th Ave SE, Raymond, 56282	Chippewa	320-894-5006
Shooting Star Native Seeds	PO Box 648, Spring Grove, 55974	Houston	507-498-3944
Soyko International, Inc	2493 380th St, Gary, 56545	Norman	218-356-8214
Spronk & Sons Seed Farm, Art	84 130th Ave, Edgerton, 56128	Pipestone	507-442-5334
Star of the North	303 Main Street, Gary, 56545	Norman	218-356-8300
Storden Seed & Chem Serv, Inc	PO Box 87, Storden, 56174	Cottonwood	507-445-3217
Swenson Seed Farm	29667 State Hwy 92 SE, Brooks, 56715	Red Lake	218-796-5285
Syngenta Seeds, LLC	PO Box 38, Amboy, 56010	Blue Earth	507-674-3320
Syngenta Seeds, LLC	4915 Reardon Ave SW, Cokato, 55321	Meeker	320-286-5511
Syngenta Seeds, LLC	PO Box 59, Danvers, 56231	Swift	320-567-2141
T			
Terning Seeds, Inc	15365 60th St SW, Cokato, 55321	Wright	320-286-2168
Thalmann Seeds, Inc	2275 80th St, Plato, 55370	McLeod	320-238-2185
Thiel Seed Service	30232 320th St, Wendell, 56590	Grant	218-458-2415
Thunderbird Commodities, Inc	PO Box 217, Mahnomen, 56557	Mahnomen	218-935-2772
Tobolt Seed	1334 50th St S, Moorhead, 56560	Clay	218-287-2904
Trilogy Ag Group	PO Box 952, Alvarado, 56710	Marshall	218-965-4942
Trilogy Ag Group – Argyle	PO Box 146, Alvarado, 56710	Marshall	218-437-6426
Triple J Seed	15 10th St N, Wheaton, 56296	Traverse	320-563-4509
True Seed & Supply	14940 28th Ave N Ste B, Plymouth, 55447	Hennepin	612-670-4590
Twin City Seed Company	7265 Washington Ave S, Edina, 55439	Hennepin	952-944-7105
W			
Weinlaeder Seed Company	7162 160th Dr NE, Drayton, 58225	Kittson	701-454-6427
Werner Seed Company	3080 Millersburg Blvd E, Dundas, 55019	Rice	507-645-7995
West Central Ag Services	PO Box 8, Beltrami, 56517	Polk	218-926-5522
Western Integrated Seed	15403 US Highway 12, Cokato, 55321	Wright	320-286-5982
Wigen Seed Farm	200 N Holcombe Ave Apt 306, Litchfield, 55355	Meeker	320-221-8830
Z			
Zabel Seeds	53295 282nd Ave, Plainview, 55964	Wabasha	507-534-2498

CERTIFIED ORGANIC SEED CONDITIONERS AND SELLERS

Producer/Conditioner, Address/Phone, Email/Website, Services Provided, Seed Sold

Albert Lea Seed, Inc.
1414 W Main St, PO Box 127, Albert Lea MN 56007 / 800-352-5247
www.alseed.com
Organic seed conditioner.
Full line of organic and non-GMO farm seed including: Viking corn, Viking soybeans, Viking alfalfa, small grains, clovers, grasses, cover crops, forages, and garden seed.

Baird Seed Company
1122 Knox Hwy 18, Williamsfield IL 61489 / 309-639-2248
bsc@mymctc.net
Organic seed conditioner.

C3 Seeds
11025 M-140, Niles MI 49120 / 269-362-2059
www.c3seeds.com
Organic seed conditioner.

Capistran Seed Company
19380 270th St SW, Crookston MN 56716 / 218-891-7840
Organic seed conditioner.

Chippewa Valley Bean
N2960 730th St, Menomonie WI 54751 / 715-664-8342
www.cvbean.com
Organic seed conditioner.

Falk's Seed Farm
1170 Hwy 9 NE, Murdock MN 56271 / 320-875-4341
www.falkseed.com
Organic seed conditioner.
Full line of organic seed.

Hanson Seeds
68276 County Road 16, Fairfax MN 55332 / 507-828-3728
Organic seed conditioner.
Blue River line of corn, soybeans, silage corn, alfalfa, and grass seed.

Harrington Seeds, Inc.
2586 Bradleyville Rd, Reese MI 48757 / 989-868-4750
Organic seed conditioner.
Adams and Zenith black bean seed and edible soybeans.

Meadowland Soy
25333 710th Ave, Grand Meadow MN 55936 / 507-459-5151
meadowlandsoy@gmail.com / www.meadowlandsoy.com
Organic seed conditioner. Buyer of food-grade, non-GMO and organic soybeans. Licensed handler/conditioner for organic commercial grain hemp. Supplier of food-grade, non-GMO soybean seed.

Michigan Crop Improvement Association
2905 Jolly Rd, Okemos MI 48864 / 517-332-3546
www.michcrop.com
Organic seed conditioner. BRC Global Standard for Food Safety certified.

Olson, Jonathan
3415 County Rd 9, Cottonwood MN 56229 / 507-829-1225
jofairviewfarms@gmail.com
Bolles, Lang-MN, and Shelly wheat; Viking and IA1029 soybeans; yellow corn; and alfalfa.

Sawvell's Seed, Inc.
211 Pine St, Clements MN 56224 / 507-692-2240
sawvellseed@hotmail.com
Organic seed conditioner.
Can obtain organic seed for growers.

Soyko International, Inc.
2493 380th St, Gary MN 56545 / 218-356-8214
www.soykointernational.com
Organic seed conditioner.
AC Greenfix chickling vetch, soybeans, wheat, barley, and rye.

Organic seed use requirements

There are often questions regarding the requirement for the use of organic seed and other planting stocks in organic production systems. NOP §205.204 states that an organic "producer must use organically grown seeds, annual seedlings, and planting stock, *Except*, That, (1) Nonorganically produced, untreated seeds and planting stock may be used to produce an organic crop when an equivalent organically produced variety is not commercially available," and "(4) Nonorganically produced planting stock to be used to produce a perennial crop may be sold, labeled, or represented as organically produced only after the planting stock has been maintained under a system of organic management for a period of no less than 1 year."

Most certifiers require organic producers to conduct thorough and diligent searches for organic seed before authorizing the use of non-organic seed. Consult the list of producers in this publication to locate seed and to identify seed conditioners that have been certified to process organic seed. However, not all sources of organic seed are listed. It must be understood that seed availability changes throughout the season and year-to-year. If you need assistance locating organic seed, call MCIA toll-free at 855-213-4461.

It is important to remember that producing high quality seed (whether conventional or organic) requires planning, use of effective production practices, and proper handling and conditioning methods. MCIA provides certification, quality assurance, and other services for seed producers and conditioners and can provide assistance to those interested in getting started in organic seed production. Contact MCIA for information on seed production practices and requirements. MCIA's website, www.mncia.org, contains information on MCIA programs and services available to seed producers.

Those wishing to offer organic seed for sale must understand and meet federal and state seed law labeling and other requirements pertaining to seed in addition to the organic requirements. For information about selling seed in Minnesota, please refer to the following Minnesota Department of Agriculture web page: https://www.mda.state.mn.us/plantsinsects/buying-and-selling-seedminnesota. ✻

Six steps to Organic Certification with MCIA

1) Apply
Contact MCIA Organic Services for an application packet or download the *Organic Certification Handbook* and application forms from our web site, www.mciaorganic.org.

2) Read and Submit
Read the *Organic Certification Handbook* and, when ready, submit the application and fees to MCIA. The application will become your Organic System Plan (OSP). Contact MCIA if you have any questions.

3) Review
MCIA Organic Services will review the application and may contact you for additional information.

4) Inspection
MCIA Organic Services will arrange for an inspector to conduct an on-site inspection. You or a person knowledgeable about your operation must be present. The inspector will complete an inspection report, which will be sent to MCIA and to you.

5) Review
MCIA Organic Services will review the inspection report to ensure compliance with National Organic Program standards. There may be additional questions for you or for the inspector.

6) Certificate
After all final issues are satisfied and all fees are paid, MCIA Organic Services will issue an Organic Certificate for the products grown or processed. ✻

MCIA Board of Directors

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Native Seed Certification

What is native seed certification?
Native plants are often used for re-vegetation of roadsides, construction sites, wildlife plantings, and other projects. MCIA's Native Seed Certification Program verifies that the genetic identity of native grasses and forbs (wildflowers) has been maintained through all phases of seed production.

How is native seed certified?
The certification process consists of several steps, including seed source verification, inspection of seed production sites, and seed conditioning and testing. MCIA issues seed labels or certificates to producers whose production has met all certification standards.

Who produces native certified seed?
Native seed is produced by careful, conscientious growers according to certification standards designed to preserve the genetic identity of native plant species.

Why buy certified native seed?
Certified native seed provides seed buyers with third-party assurance that the genetic identity or source of native grasses and forbs is accurately described on the label.

What should I look for?
Three different germplasm types are possible based on the amount of intentional selection that has taken place. They are:

- Source Identified – yellow certification tag
- Selected – green certification tag
- Tested – blue certification tag

Alternatively, a Certification Certificate may be provided as proof of certification to buyers of certified native seed. ✻

Native Seed Producers

Name/Address	*Phone*
Carlson Prairie Seed Farm, Inc. 2077 360th Ave, Lake Bronson MN 56734	218-754-2693
Gerald Lorenz 571 165th St, Sherburn MN 56171	507-236-5392
MNL, Inc. 8740 77th St NE, Otsego MN 55362	763-295-0010
Shooting Star Native Seeds 20740 County Rd 33, Spring Grove MN 55974	507-498-3944

Plant Variety Protection Act requirements

The developer of a new distinct variety may obtain protection for that variety, provided the variety meets the requirements of the Plant Variety Protection Act (PVPA). A certificate is provided to the developer of a variety that grants exclusive rights for reproducing and marketing the seed. The PVPA is administered by the United States Department of Agriculture.

Many of the varieties listed in this publication have either been issued a Certificate of Plant Variety Protection (PVP) or an application has been made for Plant Variety Protection. PVP Title V specifies seed be sold by variety name only as a class of certified seed. If a variety is not protected with the Title V option, the owner of the variety still has the exclusive right to determine who can produce and market the variety as a seed product.

PVP-protected varieties may be saved for your own planting only; you may not provide/sell/barter/exchange seed to a neighbor or another party without specific permission of the certificate holder. The export of PVP-protected varieties out of the U. S. is not permitted without the owner's permission.

Varieties listed on the table here were commonly grown in Minnesota in the last few years. Additions or deletions may occur at any time. It is the responsibility of the buyer and seller to confirm the PVP status of a crop variety before buying or selling a specific variety. It is illegal for anyone to purchase "grain" of a protected variety and use it for planting purposes.

Illegal transactions involving PVP-protected varieties may violate federal and state seed laws. In addition, the owner of a protected variety may bring civil action against persons infringing on their rights. ✻

CROP VARIETIES UNDER PLANT VARIETY PROTECTION ACT

Varieties listed in the following tables were commonly grown in Minnesota in the last two years. The status of the varieties listed below is current as of October 15, 2021. This is not an all-inclusive list! Check a variety's PVP status at the following web page: https://www.ams.usda.gov/services/plant-variety-protection/application-status.

PLANT VARIETY PROTECTED – TITLE V

To be sold by variety name only as a Class of Certified Seed

BARLEY
- Conlon
- Lacey
- ND Genesis
- Pinnacle
- Quest
- Rasmusson
- Thoroughbred
- Tradition

FIELD BEANS
- Eclipse Black
- ND Falcon*
- ND Palomino
- ND Twilight Black*
- ND Whitetail*
- Red Cedar*
- Red Hawk
- Rosie
- Talon
- Zorro

FIELD PEAS
- Agassiz
- Matrix
- Viper

OATS
- BetaGene™

OATS, Continued
- Colt
- Deon
- Goliath
- Hayden
- Horsepower
- MN-Pearl
- Natty
- Reins
- Rushmore*
- Saber
- Saddle
- Shelby 427
- Stallion
- Streaker
- Sumo
- Warrior

RYE
- KWS Serafino*
- KWS Tayo*
- ND Dylan
- ND Gardner

SOYBEANS
- Ashtabula
- ND1100S
- ND1406HP

Soybeans, Continued
- ND17009GT
- ND Benson
- ND Bison
- Traill

TRITICALE
- 141
- Forage FX 1001

WHEAT, DURUM
- Alkabo
- Carpio
- Divide
- Joppa

WHEAT, SPRING
- 122010W
- 7995104*
- Advance
- Albany
- AP Murdock
- AP Smith*
- Barlow
- Bolles
- Elgin-ND
- Faller
- Focus

WHEAT, SPRING, Continued
- Forefront
- Glenn
- Lang-MN
- LCS Breakaway
- LCS Powerplay
- Linkert
- MN-Washburn
- MN-Torgy*
- ND Frohberg*
- ND Vitpro
- Prevail
- Prosper
- RB07
- Rollag
- Shelly
- SY 611 CL2
- SY Ingmar
- SY McCloud
- SY Rowyn
- SY Soren
- SY Valda
- TCG-Climax
- TCG-Cornerstone
- TCG-Glennville

WHEAT, SPRING, Continued
- TCG-Heartland
- TCG-Spitfire
- TCG-Wildcat*
- TCG-Wildfire
- TW Starlite*
- Velva
- WB9479
- WB9483
- WB9590
- WB9719

WHEAT, WINTER
- Branson
- Darrell
- Emerson
- Expedition
- Ideal
- Kaskaskia
- Keldin
- Lyman
- NE01643
- Oahe
- Redfield
- SY Wolf
- Thompson

PLANT VARIETY PROTECTED

Unauthorized seed multiplication prohibited

FIELD PEAS
- Jetset

OATS
- 126
- Antigo
- Badger
- Beach
- Esker
- Esker2020
- Morton
- Newburg
- Rockford

OATS, Continued
- Souris

TRITICALE
- 815
- 618491724
- 641512175
- 934271498

WHEAT, SPRING
- 122001W
- Cannon
- Chevelle

WHEAT, SPRING, Continued
- Edge
- LCS Buster
- LCS Iguacu
- LCS Nitro
- LCS Prime
- LCS Rebel
- LCS Trigger
- MS-Stingray
- Samson

WHEAT, SPRING, Continued
- SY Longmire
- Vantage
- WB9507
- WB9653
- WB-Digger
- WB-Mayville

WHEAT, WINTER
- CDC Falcon
- WB-Matlock

**** Plant Variety Protection application contemplated/applied for.***

MnDOT Seed Vendor Program

What is the MnDOT Seed Vendor Program?

The MnDOT Seed Vendor Program is a quality assurance program that ensures seed supplied to the Minnesota Department of Transportation (MnDOT) for use on its roadside revegetation projects meets the specifications of state and federal audit programs.

What is MCIA's role in the MnDOT Seed Vendor Program?

MCIA is the official entity that provides an evaluation and approval process, with concurrence from MnDOT, for seed vendors producing its seed mixes.

How is a MnDOT Seed Vendor approved?

MnDOT Seed Vendors are audited and inspected annually to determine their conformance with MnDOT's seed supplier requirements. To be approved, seed vendors must meet minimum requirements for equipment, seed procurement, records, packaging, and labeling appropriate for seed to be sold for MnDOT projects.

As a buyer, what should I look for?

Approved MnDOT Seed Vendors are issued "Certificates of Approval" that are to be prominently posted in their place of business. MCIA also provides Approved Facility signs. Approved MnDOT seed mixes must be labeled with an Approved Seed Vendor Tag.

Where do buyers find a list of MnDOT seed vendors?

A current list of approved MnDOT Seed Vendors can be found on the Where to Buy page of the MCIA website. ✻


TEXAS
Grow your legacy from the roots up.
You work to build a legacy for the future. We share that drive. Poncho® Votivo® 2.0 Seed Treatment System's active ingredients helps grow stronger roots, increase yield potential and helps to build healthier soil for growing seasons to come. Give your crops a legacy that lasts with Poncho Votivo 2.0.
BASF
We create chemistry
Poncho Votivo 2.0
Seed Treatment System
Poncho Votivo 2.0 is a seed treatment system composed of the federally registered Poncho Votivo and state registered TWO.0.
Always read and follow label directions. Poncho and Votivo are registered trademarks of BASF. ©2021 BASF Corporation. All rights reserved.

Planting Rate and Date

Rates are based on seed of normal size and good quality and normal seedbed. Actual rates used will vary widely, depending on seed cost, desired stand, expected mortality, emerging ability, seed weight, seed germination, seedbed condition, depth of planting and planting equipment.

Crop	Bushel Weight (Pounds)[1]	Seeds / Pound (Number)	Rate / Acre (Pounds)	Rate (Seeds)	Planting Date
Barley	48	14,300	85	28 / sq. ft.	Early spring
Corn	56	—		33,000 / acre	April 15 / May 5
Fieldbean					
Black turtle soup	60	2,300	45	105,000 / acre	May 20 / June 15
Great northern	60	1,000	100	90,000 / acre	May 20 / June 15
Kidney	60	900	90-115	90,000 / acre	May 20 / June 15
Navy	60	2,500	42	105,000 / acre	May 20 / June 15
Navy, rows 6 to 14 in.	60		60	150,000 / acre	May 20 / June 15
Pinto	60	1,300	80	90,000 / acre	May 20 / June 15
Small red	60	1,400	75	100,000 / acre	May 20 / June 15
Small white	60	3,000	35	105,000 / acre	May 20 / June 15
Flax	56	88,000	42	85 / sq. ft.	April 15 / May 15
Forage grasses, perennial					
Bromegrass alone	14	136,000	16	50 / sq. ft.	Early spring or late summer
Bromegrass in mixtures			5	15 / sq. ft.	Use date for legumes
Orchardgrass, alone	14	653,000	10	150 / sq. ft.	Early spring or late summer
Orchardgrass, in mixtures			3	45 / sq. ft.	Use date for legumes
Reed canarygrass alone	46	526,000	7	85 / sq. ft.	Early spring or late summer
Reed canarygrass, in mixtures			5	60 / sq. ft.	Use date for legumes
Tall fescue, alone	25	229,000	15	75 / sq. ft.	Early spring or summer
Tall fescue, in mixtures			5	20 / sq. ft.	Use date for legumes
Timothy	45	1,234,000	3	85 / sq. ft.	Use date for legumes
Forage legumes, perennial					
Alfalfa alone	60	220,000	13	65 / sq. ft.	Late April-early May / Late June-early August
Alfalfa with grass			5 to 10	25 to 50 / sq. ft.	Late April-early May / Late June-early August
Alsike clover	60	653,000	2	30 / sq. ft.	Early spring to August 10
Birdsfoot trefoil alone	60	372,000	8	70 / sq. ft.	Early spring or summer
Birdsfoot trefoil in mixtures			6	50 / sq. ft.	Early spring or summer
Cicer milkvetch	60	122,000	18	50 / sq. ft.	Early spring or summer
Ladino clover	60	784,000	1	18 / sq. ft.	Early spring to August 10
Red clover alone	60	272,000	9	55 / sq. ft.	Early spring to September 1
Red clover with grass			5	30 / sq. ft.	Use date for legumes
Oat	32	16,200	80	28 / sq. ft.	Early spring
Rye	56	18,200	60	25 / sq. ft.	September 1
Sorghum, rows 18 to 40 in.	56	15,000	10	150,000 / acre	May 20 to June 5 for grain
Sorguhum, rows 6 to 14 in.			15	5 / sq. ft.	
Soybean, 7-in. rows	60	2,800	56	2 / ft. of row	May 1 to May 10
10-in. rows				3 / ft. of row	
20-in. rows				6 / ft. of row	
22-in. rows				7 / ft. of row	
30-in. rows				9 / ft. of row	
Sunflower, nonoilseed	24	4,300	4	17,000 / acre	May 1-June 15
Sunflower, oilseed	27	7,700	3	23,000 / acre	May 1-June 15
Wheat, durum	60	12,100	90	25 / sq. ft	Early spring
Wheat, hard red spring[2]	60	14,000	113	28 / sq. ft	Early spring
Wheat, hard red winter	60	14,500	75+	25 / sq. ft	August 20 / September 20
Other Crops					
Annual canarygrass	50	58,000	30	40 / sq. ft.	Early spring
Buckwheat	48	14,900	50	17 / sq. ft.	June 15 / July 20
Canola, *B napus*	50	80,000 to 160,000	3 to 5	6 to 9	Early spring
Crambe	22	65,000	15	23 / sq. ft.	Late April / early May
Fieldpea	60	2,300	180	9 / sq. ft.	Early spring
Fieldpea with 1-1/2 to 2 bu. oat			70	4 / sq. ft.	Early spring
Fababean, medium size	60	1,300	180	5 / sq. ft.	Early spring
Fababean, with 2 bu. oat			60	2 / sq. ft.	Early spring
Lentil, small	60	15,600	55	20 / sq. ft.	Early spring
Millet, foxtail	48	218,000	15	75 / sq. ft.	June 15 / July 15
Millet, proso	56	65,000	20	30 / sq. ft.	June 15 / July 15
Sudangrass, rows 6 to 14 in.	40	44,000	25	25 / sq. ft.	May 20 / June 10
Sweetclover	60	240,000	10	55 / sq. ft.	Early spring
Wildrice (wet)	25	7,900	35	6 / sq. ft.	Late fall

1 U.S. legal bushel weight or, if not established, the weight most widely accepted.
2 See wheat section for best way to calculate hard red spring wheat planting rate.

ALFALFA: Continued from page 23

lium wilt, and Aphanomyces root rot (races 1 and 2). Variety resistance ratings for each disease are available at https://www.alfalfa.org/varietyratings.php.

While moderate resistance (MR) to a disease will provide protection to a variety under most conditions, either resistance (R) or high resistance (HR) is required for protection under severe disease conditions.

Winter injury can be the result of a combination of injury from cold temperatures and from root and crown diseases. Under some conditions, disease resistances can compensate for lesser levels of cold tolerance. While all varieties can benefit from improved disease resistance, it is especially important that varieties with less than Very Good (2.0) Winter Survival have at least (R) levels of disease resistance to produce more than two years after the seeding year under intensive management (4 cuts/season) in the east central and southeastern areas of Minnesota.

Blends

Some companies sell blends, a mixture of two or more varieties, at a reduced price from named varieties. Blends may perform as well as the best varieties or may do very poorly. Disease resistance, yield, winter survival, and other characteristics may change within a blend from lot to lot or year to year as blend composition changes. Therefore, using certified seed of adapted, high-yielding varieties best assures trueness to name.

How to Interpret the Data

Yield performance of varieties is presented as a percentage of check variety yields (avg. for Vernal, Oneida VR, and 5312). Within the table, varieties are ranked according to their yield. Yield values are separated using a least significant difference statistical test (LSD). The least significant difference or LSD is a statistical method to determine whether the observed yield difference between any two varieties is true. If the difference in yield between two varieties equals or exceeds the LSD value, the higher-yielding one is 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 5 percent value indicates that, with 95 percent confidence, the observed difference is indeed a true difference in performance.

Trial Design

A multi-year yield trial is concluding at Rosemount in 2021 (Dakota Co.). Alfalfa was established in 2018 and was harvested twice in the seeding year and four times at bud in subsequent years. The final harvest each year was about Sept. 1. The experimental design was a randomized complete block with four replications. We followed UMN guidelines for recommended soil fertility levels and pest control practices to optimize alfalfa yield and persistence. This is a voluntary, fee-based trial. All alfalfa variety developers and marketers are welcome to participate, and entry into the trial is the decision of the alfalfa companies.

Planting Rate and Date

60 pounds per bushel, 220,000 seeds per pound

Plant alone at 12-15 pounds of pure live seed per acre or with grass at 5-10 pounds of pure live seed/acre seed in late April-early May or late July-mid August. Optimum seeding dates are affected by regional climate conditions.

For a web version of this report, go to varietytrials.umn.edu/alfalfa.

Authors and Researchers

Author of this alfalfa report is Craig Sheaffer. ✻

Table 1. Alfalfa variety yields as a percentage of check varieties at Rosemount (Dakota County) seeded in 2017 and 2018.

		Rosemount							
		2017 Seeding				2018 Seeding			
Variety[1]	Marketer	2018	2019	2020	3-Yr Total	2019	2020	2021	3-Yr Total
AFX 469	Alforex	120	130	124	124	—	—	—	—
SW 3407	SW	120	116	118	118	—	—	—	—
HybriForce-4400	Alforex	124	129	114	122	118	108	117	114
AFX 460	Alforex	119	103	103	109	125	121	112	119
AFX 429	Alforex	120	113	114	116	—	—	—	—
Finch	Blue River	—	—	—	—	115	114	125	118
SW 5210	SW	124	115	106	115	112	112	134	119
SW 4107	SW	125	114	101	114	110	115	139	121
Quail	Blue River	115	108	109	111	—	—	—	—
FSG 415 BR Alfalfa	La Crosse	115	108	100	108	—	—	—	—
Viking 372 HD	Albert Lea	109	106	106	107	—	—	—	—
Robin	Blue River	114	102	103	107	—	—	—	—
Swift	Blue River	—	—	—	—	103	105	127	112
Skylark	Blue River	—	—	—	—	106	98	105	103
Lukal Alfalfa	Albert Lea	98	101	99	99	—	—	—	—
Luzelle Alfalfa	Albert Lea	102	95	101	100	—	—	—	—
King Bird	Blue River	108	91	97	99	—	—	—	—
5312	Check	104	106	101	104	112	106	103	107
Oneida VR	Check	97	94	97	96	96	99	102	99
Vernal	Check	99	100	102	100	92	95	95	94
Checks, ton/acre as hay		**6.7**	**5.3**	**5.3**	**17.4**	**5.2**	**6.1**	**4.6**	**15.9**
LSD 5%		**13**	**23**	**16**	**15**	**13**	**13**	**18**	**16**

[1]Varieties are ranked according to their performance across all current trials.

Table 2. Sources of forage seed for 2018 trials.

Marketer	Company	Web URL
Albert Lea	Albert Lea Seed	www.alseed.com
Alforex	Alforex Seed	www.alforexseeds.com
Blue River	Blue River Hybrids	www.blueriverorgseed.com
La Crosse	LaCrosse Forage and Turf	www.lftseed.com
SW	S & W Seed	www.swseedco.com
U of MN	University of Minnesota Forages	www.extension.umn.edu/forages

Alfalfa

Planting Rate and Date

Bushel Weight, Pounds.....60

Seeds/Pound.....220,000

Planting Rate, Pounds/Acre

Alone.....12-15

With Grass.....5-10

Planting Rate, Seeds/Sq. Ft.

Alone.....65

With Grass.....25-50

Planting Date....Late April-Early May or Late July-Mid August

2021 Barley field crop trial results

Spring barley varieties were evaluated in 2021 in replicated trials at Crookston, Hallock, Oklee, Perley, Stephen, Roseau and Strathcona in the northern part of the state, and Becker, Fergus Falls, Lamberton, Le Center, New Ulm, Rochester and St. Paul in the south. Yield is reported for 2021 and multi-year averages as percent of the mean of the trial. Data collected from these trials should be used to make comparisons only among those varieties included in the trials. The average yield across the 14 testing locations was 80 bushels per acre in 2021. The highest yields this year were recorded in Stephen (114 bushels per acre) while the lowest grain yields were recorded in Becker (29 bushels per acre). LSD numbers beneath the yield columns indicate whether the difference between yields is due to genetics or to other factors, such as variations in environment. If yield difference between two entries equals or exceeds the LSD value, the higher-yielding entry probably was superior in yield. A difference less than the LSD value was probably due to environmental factors.

Variety Selection Criteria

Most barley producers in the region grow barley for malt and select varieties approved by the American Malting Barley Association (AMBA). The most important industry specifications for making malting grade are low grain protein (11.5-13.5 percent), kernel plumpness (>80 percent) and low deoxynivalenol or DON content (<2 ppm). DON is the toxin produced by the Fusarium Head Blight (FHB) pathogen. Additional information about FHB can be found at https://scabsmart.org. Please consult

the AMBA recommended varieties for the most current information about industry acceptance of malting barley varieties at www.ambainc.org. Variety selection will also be influenced by contracts made available by malting and brewing companies and these vary from year to year.

In addition to yield and acceptable malt quality, disease resistance plays an important role in variety selection. Disease evaluations are carried out in inoculated field and/or greenhouse experiments. Disease ratings are based on the results of two or more experiments and are scored on a 1-9 scale where 1 = most resistant and 9 = most susceptible. For most producers the disease FHB and the presence of DON in harvested grain are the two most important factors limiting production of malting barley in the region. The two-rowed variety Conlon and the six-rowed variety Quest have the lowest DON score (the mycotoxin produced by the Fusarium head blight pathogen) compared to the other varieties grown in the region. The varieties AAC Connect and KWS Fantex also had low ratings, but they are based on a single year (2020) and should be interpreted cautiously.

The other diseases listed in the disease reactions table are leaf diseases that can be a problem in Minnesota. Pinnacle is very susceptible to net blotch (data not shown). All varieties have resistance to the dominant race of stem rust

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Table 1. Agronomic characteristics of malting barley varieties, 2019-2021.

Entry	Origin[3]	Year of Release	PVP Status	Heading (DAP)	Height (inches)	Stem Breakage (%)	Plump (%)[4]	Protein (%)[4]
2-row								
AAC Connect[1]	AAFC	2017	Yes	59	28	13	-	-
AAC Synergy	AAFC	2012	Yes	60	28	16	92	11.4
ABI Cardinal[2]	ABI	2021	Yes	61	28	9	-	-
BC Ellinor[2]	LCS/BC	NA	NA	61	29	11	-	-
BC Leandra[2]	LCS/BC	NA	NA	62	26	22	-	-
BC Lexi[2]	LCS/BC	NA	NA	61	27	22	-	-
Conlon	ND	1996	Yes	56	27	56	92	12.3
KWS Fantex[1]	KWS	NA	Pending	62	26	25	-	-
ND Genesis	ND	2015	Yes	59	29	20	96	11.2
6-row								
Lacey	MN	2000	Yes	57	30	0	92	12.4
Quest[1]	MN	2010	Yes	57	30	63	-	-
Rasmusson[1]	MN	2008	Yes	57	28	0	92	11.3
Robust	MN	1984	Expired	57	32	7	92	11.8
Tradition	ABI	2003	Yes	56	30	0	91	12.9
No. of Environments				**8**	**8**	**6**	**3**	**3**

[1]Line tested in 2020 and 2021.
[2]Line tested in 2021 only.
[3]Agriculture and Agri-Food Canada (AAFC), Anheuser-Busch InBev (ABI), Limagrain Breun (LCS/BC), North Dakota State University (ND), KWS Lochow GmbH (KWS), University of Minnesota (MN).
[4]Data available from 3 locations in 2019 only.

Table 2. Disease reactions of barley varieties in multiple-year comparisons.

Entry	DON[3,4]	Spot Blotch[3,4]	Stem Rust[3,5]	Bacterial Leaf Streak[3]
2-row				
AAC Connect[1]	3	1	4	3
AAC Synergy	8	1	5	3
ABI Cardinal[2]	-	-	4	4
BC Ellinor[2]	-	-	7	3
BC Leandra[2]	-	-	7	4
BC Lexi[2]	-	-	6	2
Conlon	1	7	3	5
KWS Fantex[1]	3	9	4	6
ND Genesis	4	2	6	5
6-row				
Lacey	5	0	5	5
Quest[1]	3	4	4	5
Rasmusson[1]	7	0	6	5
Robust	7	0	4	4
Tradition	2	1	4	6
No. of Environments	**4**	**2**	**3**	**3**

[1]Line tested in 2020 and 2021.

[2]Line tested in 2021 only.

[3]Trait measured on a scale from 0-9 where 1=resistant and 9=susceptible, NA=not available. Deoxynivalenol (DON) is the mycotoxin produced by the Fusarium head blight pathogen.

[4]Data for 2019 and 2020 only.

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

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(MCCF) and are susceptible to the QCCJ race also known as African stem rust or Ug99. FHB severity and DON can be reduced with fungicides, but they are not always effective. Bacterial leaf streak disease has become more prominent in recent years and tends to become more severe following heavy rain events. This disease cannot be controlled with fungicides.

PVP Status

All varieties shown in tables except Robust, Conlon, and AC Metcalf are covered by the Plant Variety Protection Act, PVP (94). Growers can save seed of PVP protected varieties for their own planting only; it cannot be sold to anyone else, not even a relative or a neighbor without specific permission of the

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Table 3. Relative grain yield of barley varieties in northern Minnesota locations in single-year (2021) and multiple-year comparisons (2019-2021).

	Crookston		Hallock			Oklee			Perley			Roseau		Stephen			Strathcona		
Entry	2021	3 Yr[3]	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	3 Yr[3]	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr
2-row																			
AAC Connect[1]	102	-	108	113	-	98	98	-	116	109	-	95	-	99	97	-	104	130	-
AAC Synergy	96	102	100	107	106	95	106	102	103	103	101	104	104	112	110	103	93	123	127
ABI Cardinal[2]	109	-	114	-	-	98	-	-	97	-	-	106	-	98	-	-	92	-	-
BC Ellinor[2]	114	-	102	-	-	110	-	-	104	-	-	114	-	117	-	-	104	-	-
BC Leandra[2]	111	-	101	-	-	114	-	-	119	-	-	99	-	102	-	-	101	-	-
BC Lexi[2]	97	-	102	-	-	106	-	-	99	-	-	114	-	99	-	-	112	-	-
Conlon	82	92	97	97	99	101	92	94	87	91	89	105	99	99	110	104	102	67	67
KWS Fantex[1]	110	-	102	103	-	97	95	-	84	89	-	101	-	95	92	-	94	123	-
ND Genesis	105	112	97	94	103	111	110	109	116	115	109	104	104	97	101	100	106	88	108
6-row																			
Lacey	98	104	88	86	87	109	101	99	99	96	98	101	108	99	103	101	100	96	107
Quest[1]	92	-	91	87	-	92	97	-	91	94	-	78	-	93	95	-	96	100	-
Rasmusson[1]	102	-	114	108	-	102	100	-	104	97	-	109	-	83	87	-	99	109	-
Robust	92	92	90	94	97	79	92	93	85	95	96	80	91	101	102	95	95	78	92
Tradition	89	98	94	111	108	89	108	104	96	112	108	90	94	105	102	98	102	87	98
Mean (Bu/Acre)	**90**	**104**	**101**	**97**	**85**	**61**	**90**	**90**	**111**	**102**	**98**	**74**	**86**	**114**	**97**	**105**	**89**	**75**	**75**
LSD (0.05)	**14.7**	**12.4**	**20.7**	**21.5**	**19.3**	**17.5**	**20.4**	**16.1**	**14.3**	**26.1**	**17.8**	**18.9**	**16.2**	**24.4**	**16.7**	**13.5**	**8.8**	**55**	**35**

[1]Line tested in 2020 and 2021.
[2]Line tested in 2021 only.
[3]Trial data is from 2019 and 2021 only.

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applicant for protection.

Authors and Researchers

This report is authored by: Kevin Smith, Ruth Dill-Macky, Jochum Wiersma, Brian Steffenson, Karen Beaubien and Ed Schiefelbein.

Test plot establishment and management are supervised by: Guillermo Velasquez, Curtis Reese, Joseph Wodarek, Mike Leiseth, Steve Quiring and Donn Vellekson. ✻

Barley

Planting Rate and Date

Bushel Weight, Pounds.....48
Seeds/Pound.....14,300
Planting Rate, Pounds/Acre.....85
Planting Rate, Seeds/Sq. Ft.....28
Planting Date.....Early Spring

Table 5. Relative grain yield of barley varieties in a single-year (2021) and multiple-year comparisons (2019-2021).

	State			North			South		
Entry	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr
2-row									
AAC Connect[1]	104	105	-	104	108	-	105	102	-
AAC Synergy	98	106	105	101	108	106	94	103	104
ABI Cardinal[2]	100	-	-	102	-	-	96	-	-
BC Ellinor[2]	107	-	-	109	-	-	104	-	-
BC Leandra[2]	108	-	-	107	-	-	110	-	-
BC Lexi[2]	104	-	-	103	-	-	105	-	-
Conlon	93	90	89	96	93	92	90	86	85
KWS Fantex[1]	93	98	-	97	101	-	87	94	-
ND Genesis	105	104	106	105	103	106	105	104	106
6-row									
Lacey	101	101	102	98	97	100	104	104	106
Quest[1]	97	97	-	91	94	-	105	100	-
Rasmusson[1]	104	105	-	101	101	-	108	110	-
Robust	90	93	94	90	92	94	89	93	94
Tradition	97	103	103	96	103	102	98	103	105
Mean (Bu/Acre)	**80**	**84**	**84**	**92**	**91**	**92**	**68**	**78**	**75**
LSD (0.05)	**6.1**	**6.6**	**4.8**	**7.8**	**10.6**	**7.5**	**9.5**	**7.9**	**6**
No. of Environments	**14**	**25**	**36**	**7**	**12**	**19**	**7**	**13**	**17**

[1]Line tested in 2020 and 2021.
[2]Line tested in 2021 only.

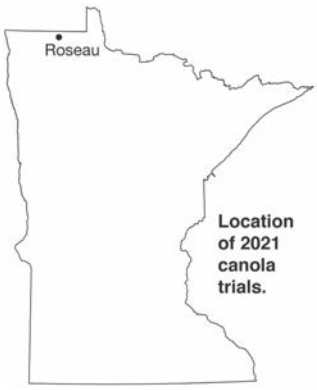
Table 4. Relative grain yield of barley varieties in southern Minnesota locations in single-year (2021) and multiple-year comparisons (2019-2021).

	Becker	Fergus Falls			Lamberton		Le Center			New Ulm		Rochester			St. Paul		
Entry	2021[3]	2021	2 Yr	3 Yr	2021[2]	2 Yr[4]	2021	2 Yr	3 Yr	2021	2 Yr[4]	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr
2-row																	
AAC Connect[1]	93	100	108	-	102	102	110	101	-	108	107	111	88	-	102	111	-
AAC Synergy	142	98	103	100	101	109	89	99	101	73	90	95	100	100	100	115	117
ABI Cardinal[2]	131	115	-	-	114	-	83	-	-	96	-	68	-	-	94	-	-
BC Ellinor[2]	112	105	-	-	96	-	101	-	-	103	-	96	-	-	123	-	-
BC Leandra[2]	113	107	-	-	120	-	108	-	-	101	-	101	-	-	130	-	-
BC Lexi[2]	106	95	-	-	88	-	104	-	-	108	-	111	-	-	122	-	-
Conlon	61	94	91	89	86	83	106	95	97	89	91	91	83	79	82	73	72
KWS Fantex[1]	88	85	97	-	68	77	82	99	-	76	88	85	81	-	137	125	-
ND Genesis	120	96	101	105	102	99	105	107	108	114	107	109	101	102	91	105	111
6-row																	
Lacey	96	104	98	99	109	111	103	99	99	116	109	107	110	112	77	100	107
Quest[1]	125	99	96	-	122	97	104	104	-	107	100	109	104	-	75	89	-
Rasmusson[1]	89	102	106	-	112	117	102	103	-	109	111	126	120	-	101	105	-
Robust	63	98	96	99	89	96	97	90	92	99	93	89	103	98	64	84	92
Tradition	60	101	104	108	90	108	104	105	103	100	104	104	109	108	101	94	102
Mean (Bu/Acre)	**29**	**81**	**96**	**79**	**58**	**62**	**70**	**88**	**86**	**99**	**84**	**84**	**95**	**90**	**57**	**71**	**66**
LSD (0.05)	**8.1**	**10.8**	**15.9**	**9.9**	**13**	**21.1**	**10.4**	**20.1**	**12**	**11.3**	**31.9**	**10.4**	**28.9**	**16.4**	**13.6**	**23.4**	**18.1**

[1]Line tested in 2020 and 2021.
[2]Line tested in 2021 only.
[3]Trial data is from 2021 only.
[4]Trial data is from 2021 and 2020 only.

2021 Canola field crop trial results

The 2021 Canola Production Center (CPC) was located just west of Roseau, Minn., on land owned by Northern Resources Cooperative. Primary tillage was done by Magnusson Farms.



Final seedbed preparation was done by University of Minnesota personnel. Previous crop was spring wheat. A spring fertilizer rate of 140-40-40-20s was applied and incorporated prior to final seedbed preparation. Soil moisture conditions at planting were dry and emergence was somewhat uneven but a rainfall event 2 weeks after planting created acceptable stands. Weather conditions during the season were very hot and dry, especially during the pollination and filling time frames.

The canola variety trial was seeded on May 12 with a Hege small plot seeder and double disk openers. Plots were rolled with a Brillion cultipacker after planting. Seeding rate was 12 pure live seeds (PLS)/ft.2 pure live seed (PLS) as provided by the seed company submitting the entry. Individual plots were seeded on 6 ft. x 27 ft. centers. Experimental design was four replications in a randomized complete block design. All plots were sprayed with Section 3 at 4oz. plus Grizzly Too at 1.5oz./acre on May 27 for grass weed and flea beetle control. General weed control was done with applications of either Roundup PowerMax at 16oz. to RR and TruFlex varieties or Liberty at 22oz. to LL varieties. Labeled adjuvants were combined with all of the herbicides. Proline at 5.7oz./

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acre was applied on July 1 targeting sclerotinia control. Plots were swathed on Aug. 7 and combined starting Aug. 22 and finished Aug. 31, 2021.

Authors and Researchers

Dave Grafstrom, Donn Vellekson and Nancy Ehlke supervised canola variety trial establishment, management, and data summary. ✻

Submitting companies and contact information.

Contact	Phone	Email
Jordan Varberg	(701) 740-3324	jordan.varberg@basf.com
Martin Hochalter	(701) 866-3303	mhochhalter@meridianseeds.com
Courtney Meduna	(701) 339-0238	courney.meduna@bayer.com
Rene Mabon	(204) 261-7932	rene.mabon@brettyoung.ca
Cameron Aker	(515) 356-4521	claker@landolakes.com
Alison Pokrzywinski	(701) 630-8122	alison.pokrzwinski@nuseed.com
Alan Scott	(507) 317-1046	alan.scott@corteva.com
Dave Gregerson	(701) 741-2915	dgregers@wilburellis.com
Jim Johnson	(701) 361-8958	jim.johnson.star@outlook.com
Aaron Aarestad	(701) 371-3083	aaron.aarestad@nutrien.com

2021 Spring canola variety trial.

Location: Northern Resources Cooperative — West Plant — Roseau, MN

Company	Entry	Herbicide Tolerance*	Maturity	Yield #/Acre[1]	Protein[2] (%)	Oil[2] (%)	Test Weight (#/bu)	% Ground Cover 21DAP	ESV[3] 21DAP	Flowering Begin Day	Flowering End Day	Flowering # of Days	Harvest Height (in.)
Winfield United	CP9978TF	TF	L	2329	22.3	44.6	52.6	63	6	23-Jun	11-Jul	18	49
Star Specialty Seed	StarFlex	RR	M	1978	22.1	45.5	52.6	60	5.5	23-Jun	12-Jul	19	48
Pioneer	45CM39	RR	M/L	1667	21.8	46.1	51.3	48	4.5	23-Jun	12-Jul	19	48
Nuseed	NC155 TF	TF	E	2139	22.8	43.5	53	78	7.5	21-Jun	11-Jul	20	48
Nuseed	NC471 TF	TF	L	1806	22.2	44.7	52.9	70	7	23-Jun	10-Jul	17	52
Nuseed	NC527CR	TF	L	1911	22.2	44	51.3	55	5.5	24-Jun	12-Jul	18	48
BrettYoung	BY 6211TF	TF	M	2137	22.6	44.5	52.7	63	5.5	23-Jun	11-Jul	18	50
Meridian Seeds	CS3000TF	TF	M	1909	21.4	45.8	52.7	50	5.5	21-Jun	9-Jul	18	45
Wilbur Ellis	Integra 7361RC	RR	M	2115	22.4	44.5	52.2	45	4.5	24-Jun	11-Jul	17	45
Meridian Seeds	CS4000 LL	LL	M	1518	22.4	43.5	53.1	61	6	24-Jun	12-Jul	18	48
BASF	InVigor L233P	LL	E	1819	21.7	42.9	52.7	73	6.5	26-Jun	11-Jul	15	47
BASF	InVigor L255PC	LL	L	1619	20.7	45.6	52.8	63	6	26-Jun	13-Jul	17	52
BASF	InVigor L345PC	LL	L	1947	20.8	43.3	52.9	73	7	26-Jun	13-Jul	17	55
BASF	InVigor L340PC	LL	E	1613	21.8	42.6	52.2	70	7	25-Jun	11-Jul	16	49
Winfield United	CP7130LL	LL	L	1781	21.5	43.6	52	78	7.5	24-Jun	10-Jul	16	52
Winfield United	CP7144LL	LL	L	1783	23.3	44.4	52	60	6	24-Jun	10-Jul	16	49
Dekalb	DKT-FLL21SC	LL/TF	M	1866	21.4	46.6	52.3	65	6	22-Jun	8-Jul	16	44
Dekalb	H19W94354	LL	M	1576	21.8	45.6	52.1	50	5.5	23-Jun	9-Jul	16	42
Dekalb	DKLL82SC	LL	E/M	1640	22.4	45.4	52.5	55	6	24-Jun	11-Jul	17	44
Pioneer	P506ML	LL	M/L	1446	21.9	43.9	51.7	53	5	24-Jun	12-Jul	18	53
Pioneer	P505MSL	LL	M/L	1735	21.8	42.9	51.7	58	6.5	24-Jun	11-Jul	17	55
		LSD @ 5% Level		**251**	**0.7**	**0.7**	**0.3**	**20**	**2**	**1**	**1**	**2**	**4**
		LSD @ 10% Level		**209**	**0.6**	**0.6**	**0.2**	**16**	**1.7**	**1**	**1**	**2**	**3**
		CV (%)		**9.7**	**2**	**1**	**0.3**	**23**	**23**	**3**	**9**	**4**	**6**

Seeding rate=12PLS/Ft.[2] (using company provided PLS/#).
Experimental Design: RCB w/ 4 reps.
Planting Date: 5/12/2021.

*Herbicide Tolerance: LL = Liberty Link, RR = Roundup Ready,and TF=TruFlex = Next level Roundup Ready. Trial was blocked by herbicide tolerance - 1-9 Roundup and 10-21 Liberty Link in each rep.

[1]Clean Seed. Yields corrected to 8.5% moisture. Varieties arranged in order of yield. Trial mean yield = 1825#/acre.
[2]Protein and oil reported on dry matter basis. All others on as is basis.
[3]ESV (early season vigor): 9 = best and 1 = least.
Fertilizer application: 140-30-30-20s applied PPI 5/7/21.

2021 Corn Grain field crop trial results

The Minnesota Corn Evaluation Program was conducted by the University of Minnesota Agricultural Experiment Station to provide unbiased information for use by corn growers when they choose which brand of corn to buy and grow. The program was financed in part by entry fees from private seed companies that chose to place their entries for testing.

Table 1. Companies participating in the 2021 corn grain trials.

Company	Website
AgriGold Hybrids	www.agrigold.com
Anderson Seeds	www.andersonseedsmn.com
Bayer Crop Science	www.dekalbasgrowdeltapine.com
BH Genetics	www.bhgenetics.com
Dairyland Seed	www.dairylandseed.com
DenBesten Brand	www.dakotasbestseedllc.com
Enestvedt Seed Company	www.enestvedtseeds.com
Federal Hybrids	www.federalhybrids.com
Hi Fidelity Genetics:	hifidelitygenetics.com
Legacy Seeds	www.legacyseeds.com
Peterson Farms Seed	www.petersonfarmsseed.com
REA Hybrids	www.rea-hybrids.com
Titan Pro SCI	www.titanprosci.com
Viking Seed	www.alseed.com

Test Locations

Test zones, locations and maturities are as follows:

Southern Zone:

Lamberton, Rochester and Waseca

Early Maturity Trial - 102 Relative Maturity (RM) and earlier entries.

Late Maturity Trial - 103 RM and later entries.

Central Zone:

Hutchinson, Morris and Rosemount

Early Maturity Trial - 97 RM and earlier entries.

Late Maturity Trial - 98 RM and later entries.

Northern Zone:

Crookston, Rothsay and Staples

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CORN GRAIN: Continued from page 30

Testing Procedure

Seed corn companies choose their entries for each zone. Entries in each trial were based on the relative maturity (RM) provided by the company. The University of Minnesota Corn Testing Committee could also choose entries in each test. All locations tested three replications for each entry.

Presentation of Data

Yields are given for individual locations along with yields and harvest moisture contents averaged across locations for 2021.

Reported yields are adjusted to 15.5 percent grain moisture. Entries are ranked within a maturity group by moisture content averaged across locations for 2021. The site at Rosemount suffered substantial wind damage late in the season and the corn could not be harvested. Therefore, yields from the Rosemount site are not reported this year.

Identification of Traits

Genetic modifications of entries will be identi-

CORN GRAIN: Continued on page 33

Table 3. Early maturity entries, southern locations, 2021.

Source	Entry	Traits	Relative Maturity	Yield, Bushels/Acre at: Lamberton	Rochester	Waseca	Average Across Locations Bu/Acre	% Moisture
98 and earlier RM entries								
Federal Hybrids	4680 VT2P RIB	Bt, GLY	96	145	253	229	209	15.8
Anderson Seeds	6909		98	140	259	230	209	16.1
Anderson Seeds	786R	GLY	95	140	267	239	216	16.1
Titan Pro	11-98 2P	Bt, GLY	98	154	287	224	222	16.2
Federal Hybrids	4820 VT2P	Bt, GLY	98	152	256	235	214	16.2
Anderson Seeds	726VT2P	Bt, GLY	98	168	292	259	240	16.2
Viking	52-96		96	149	274	231	218	16.3
Viking	44-98		98	156	268	234	220	16.4
Legacy Seeds	LC474-20	Bt, GLY	97	185	300	277	254	16.7
Legacy Seeds	LC484-20	Bt, GLY	98	145	280	231	219	16.9
Dairyland Seed	DS-3550AM	Bt,GLY,LL	95	159	263	233	219	16.9
Dekalb	DKC48-68	Bt, CRW, GLY, LL	98	152	267	238	219	17.0
Dairyland Seed	DS-3727AM	Bt,GLY,LL	97	184	279	246	236	17.1
Federal Hybrids	4800 SS RIB	Bt, CRW, GLY, LL	98	152	265	239	219	17.7
AgriGold	A628-16VT2RIB	Bt, GLY	98	187	299	270	252	18.1
98 and earlier RM averages:				**158**	**274**	**241**	**224**	**16.7**
99 to 102 RM entries								
Titan Pro	92-99 2P	Bt, GLY	99	129	291	212	210	15.5
Enestvedt Seed Co	E670		100	164	294	241	233	16.0
Anderson Seeds	681VT2P	Bt, GLY	100	165	304	254	241	16.6
Viking	52-00		100	174	270	245	230	16.7
Titan Pro	26-00		100	170	284	205	220	16.8
AgriGold	A630-10STXRIB	Bt, CRW, GLY, LL	100	162	301	258	240	17.0
Anderson Seeds	681SRC	Bt, CRW, GLY, LL	100	158	298	260	239	17.0
Viking	99-00		100	175	272	231	226	17.1
Dekalb	DKC51-98	Bt, CRW, GLY, LL	101	154	252	219	209	17.1
Dekalb	DKC50-87	Bt, CRW, GLY, LL	100	169	281	230	226	17.3
Titan Pro	22-00 2P	Bt, GLY	100	169	273	227	223	17.4
Legacy Seeds	LC5217	Bt, CRW	102	173	277	253	234	17.4
Federal Hybrids	5280 CONV		102	146	295	252	231	17.4
Viking	46-02		102	171	279	257	235	17.5
Dekalb	DKC52-99	Bt, GLY	102	170	291	275	246	17.7
Dairyland Seed	DS-4014Q	Bt, CRW, GLY, LL	100	181	269	241	230	17.7
Federal Hybrids	5120 SS	Bt, CRW, GLY, LL	101	185	269	253	235	17.9
Dekalb	DKC52-18	Bt, CRW, GLY, LL	102	170	282	256	236	18.0
Dairyland Seed	DS-3959Q	Bt, CRW, GLY, LL	99	175	284	259	239	18.1
AgriGold	A630-04		100	163	284	270	239	18.2
AgriGold	A631-90		101	165	261	269	232	19.7
AgriGold	A632-35-5222EZ	Bt, CRW, GLY, LL	102	161	271	252	228	19.9
99 to 103 RM averages:				**166**	**281**	**246**	**231**	**17.5**
Southern locations, early maturity averages:				**163**	**278**	**244**	**228**	**17.1**
LSD (0.20)				**15**	**14**	**19**	**9**	**0.4**

Table 2. Individual Trial Information, 2021.

Location	Cooperators	Previous Crop	Planting Date	Harvest Date
Lamberton	Steve Quiring	Soybeans	April 28	Oct 8
Rochester	Ryan Miller	Soybeans	May 5	Nov 3
Waseca	Tom Hoverstad	Soybeans	April 26	Oct 8 (early maturities) Oct 15 (late maturities)
Hutchinson	School Dist # 423	Corn	May 7	Oct 19
Morris	Curt Reese	Soybeans	May 6	Nov 8
Rosemount	Gerry Holz	Soybeans	April 30	Abandoned
Crookston	Mike Leiseth	Wheat	May 10	Oct 6
Rothsay	Troy Larson	Soybeans	May 6	Sept 28
Staples	Ron Nelson	Soybeans	May 4	Nov 4

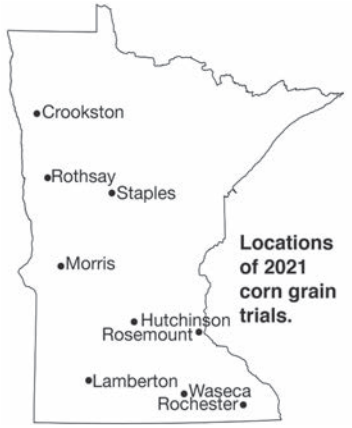


Table 4. Late maturity entries, southern locations, 2021.

Source	Entry	Traits	Relative Maturity	Yield, Bushels/Acre at: Lamberton	Rochester	Waseca	Average Across Locations Bu/Acre	% Moisture
103 to 105 RM entries								
Enestvedt Seed Co	E539		103	180	265	259	234	17.6
Viking	84-05		105	187	287	278	251	17.8
Titan Pro	82-04	Bt, Gly	104	173	292	245	237	18.0
Dairyland Seed	DS-4310Q	Bt, CRW, GLY, LL	103	168	253	256	225	18.2
Hi Fidelity Genetics	HFG1071		105	171	285	275	244	18.2
Federal Hybrids	5510 SS RIB	Bt, CRW, GLY, LL	105	150	274	256	227	18.3
Legacy Seeds	LC-5319	Bt, CRW, GLY, LL	104	169	281	251	234	18.4
Titan Pro	24-04		104	194	306	255	252	18.5
Titan Pro	84-03 2P	Bt, Gly	103	180	271	240	230	18.6
Federal Hybrids	5510 VT2P RIB	Bt, Gly	105	173	273	245	230	18.6
Dairyland Seed	DS-4510Q	Bt, CRW, GLY, LL	105	170	267	266	234	18.9
Titan Pro	26-03 5222	Bt, CRW, GLY, LL	103	163	274	228	222	19.3
AgriGold	A635-54VT2RIB	Bt, Gly	105	165	287	266	239	19.6
AgriGold	A633-14STX	Bt, CRW, GLY, LL	103	167	273	274	238	20.6
104 to 105 RM averages:				**172**	**278**	**257**	**236**	**18.6**
Later than 105 RM entries								
Titan Pro	23-06 SS	Bt, CRW, GLY, LL	106	155	277	192	208	17.7
Enestvedt Seed Co	E598		106	174	276	294	248	18.2
Viking	72-06		106	175	297	251	241	18.5
Anderson Seeds	472SRC	Bt, CRW, GLY, LL	106	175	278	281	245	18.7
DenBesten Brand	DB38-06		106	199	281	267	249	19.1
AgriGold	A638-74VT2RIB	Bt, Gly	108	177	281	264	241	19.2
AgriGold	A636-16		106	192	295	289	259	19.3
Dairyland Seed	DS-4878Q	Bt, CRW, GLY, LL	108	183	267	289	246	19.5
AgriGold	A636-11VT2RIB	Bt, Gly	106	191	286	278	252	19.6
Dairyland Seed	DS-4917AM	Bt, GLY, LL	109	177	303	272	250	19.8
Dekalb	DKC56-65	Bt, CRW, GLY, LL	106	183	302	259	248	19.8
Federal Hybrids	5700 SS RIB	Bt, CRW, GLY, LL	107	157	284	254	232	20.1
Dekalb	DKC59-81	Bt, CRW, GLY, LL	109	179	290	263	244	20.2
Legacy Seeds	LC564-20	Bt, GLY, LL	106	156	265	273	231	20.2
Dairyland Seed	DS-4910AML	Bt, GLY, LL	109	172	280	284	245	20.4
DenBesten Brand	DB31-11		111	144	289	278	237	20.7
Dekalb	DKC58-64	Bt, CRW, GLY, LL	108	171	298	309	259	20.9
AgriGold	A638-58STX	Bt, CRW, GLY, LL	108	138	290	262	230	21.5
DenBesten Brand	DB31-10		110	151	266	267	228	21.5
Later than 105 RM averages:				**171**	**284**	**270**	**242**	**19.7**
Southern locations, late maturity averages:				**166**	**273**	**256**	**232**	**18.7**
LSD (0.20)				**15**	**16**	**18**	**9**	**0.8**

CORN GRAIN: Continued from page 31

fied using generic terms to describe the trait without identifying the specific event for genetic modification.

For example, Bt will identify genetic modification for corn borer resistance but will not differentiate between the Bt 11 event, the YieldGuard corn borer event or the Herculex corn borer event.

Identifiers will be:

Bt = European corn borer resistance

CRW = Corn rootworm resistance

Gly = Glyphosate herbicide resistance

LL = Liberty herbicide resistance

Least Significant Difference

The LSD (Least Significant Difference) figures at the bottom of the yield columns in the tables are statistical measures of variability in the trials. These values may be used to determine whether the dif-

CORN GRAIN: Continued on page 34

Table 5. Early maturity entries, central locations, 2021.

Source	Entry	Traits	Relative Maturity	Yield, Bushels/Acre at: Hutchinson	Morris	Average Across Locations Bu/Acre	% Moisture
94 and earlier RM entries							
Federal Hybrids	4300 VT2P RIB	Bt, GLY	93	193	214	203	13.6
AgriGold	A620-82VT2RIB	Bt, GLY	90	207	224	215	13.8
Enestvedt Seed Co	E646		94	217	229	223	13.9
Peterson Farms Seed	88K93	Bt, CRW, GLY, LL	93	194	211	202	14.0
Legacy Seeds	LC451-21	Bt, GLY	94	206	245	226	14.0
Dairyland Seed	DS-3366AM	Bt, GLY, LL	93	185	235	210	14.0
Dairyland Seed	DS-3022AM	Bt, GLY, LL	90	175	209	192	14.1
BH Genetics	6218VT2PRIB	Bt, GLY	92	205	231	218	14.1
Anderson Seeds	742VT2P	Bt, GLY	92	201	227	214	14.1
AgriGold	A622-65		92	217	235	226	14.2
Dekalb	DKC44-97	Bt, CRW, GLY, LL	94	183	225	204	14.2
Legacy Seeds	LC431-20	Bt, CRW, GLY, LL	93	197	223	210	14.3
Peterson Farms Seed	72Q94	Bt, GLY	94	220	256	238	14.3
Dekalb	DKC42-64	Bt, CRW, GLY, LL	92	214	214	214	14.5
94 RM and earlier averages:				**201**	**227**	**214**	**14.1**
95 to 97 RM entries							
Enestvedt Seed Co	E658		96	178	227	203	13.8
Federal Hybrids	4680 VT2P RIB	Bt, GLY	96	200	227	213	13.9
Dairyland Seed	DS-3550AM	Bt, GLY, LL	95	182	231	207	14.1
Viking	O.45-97		97	216	225	220	14.1
AgriGold	A627-83VT2RIB	Bt, GLY	97	212	204	208	14.2
Titan Pro	86-96 2 P	Bt, GLY	96	214	220	217	14.2
Viking	52-96		96	186	217	201	14.3
Legacy Seeds	LC461-21	Bt, GLY	96	193	237	215	14.3
Dairyland Seed	DS-3727AM	Bt, GLY, LL	97	207	259	233	14.3
Titan Pro	82-95 2P	Bt, GLY	95	198	235	216	14.4
Legacy Seeds	LC474-20	Bt, GLY	97	228	255	241	14.5
Anderson Seeds	745SRC	Bt, CRW, GLY, LL	97	217	243	230	14.6
Anderson Seeds	786VT2P	Bt, GLY	95	211	196	204	14.6
AgriGold	A626-20-5122EZ	Bt, CRW, GLY, LL	96	201	215	208	14.8
DenBesten Brand	DB30-97		97	211	215	213	14.8
95 to 97 RM averages:				**204**	**227**	**215**	**14.3**
Central locations, early maturity averages:				**202**	**227**	**215**	**14.2**
LSD (0.20)				**20**	**21**	**14**	**0.4**

CORN GRAIN: Continued from page 33

ference between any two entries is likely to be a real difference or just natural variation.

If the yield difference between two entries is equal to or greater than the LSD, then one can be confident that the two entries probably differ in yield potential. We show LSD values with a 0.2 alpha level, which means that when two entries differ in yield by the LSD value or more one can be 80 percent confident that the two entries differ in yield potential. The higher-yielding one is the better entry from the yield standpoint. If the yield difference between two entries is less than the LSD, the two entries probably do not differ significantly in yield potential.

Authors and Researchers

Tom Hoverstad, Wade Ihlenfeld, Jeff Coulter, Curt Reese, Steve Quiring and Mike Leiseth. ✻

Corn Grain
Planting Rate and Date
Bushel Weight, Pounds.....56
Planting Rate, Seeds/Acre....35,000
Planting Date.....April 26-May 10

Table 6. Late maturity entries, central locations, 2021.

Source	Entry	Traits	Relative Maturity	Yield, Bushels/Acre at: Hutchinson	Yield, Bushels/Acre at: Morris	Average Across Locations: Bu/Acre	Average Across Locations: % Moisture
98 to 100 RM entries							
AgriGold	A630-95-5222EZ	Bt, CRW, GLY, LL	100	173	192	183	14.6
Anderson Seeds	609R	GLY	98	218	214	216	14.8
Hi Fidelity Genetics	HFG1002		100	212	266	239	14.9
Viking	44-98		98	230	237	233	14.9
Titan Pro	11-98 2P	Bt, GLY	98	237	238	238	15.0
Legacy Seeds	LC-4248	Bt, GLY	100	204	227	215	15.1
DenBesten Brand	DB32-00		100	220	206	213	15.1
Dekalb	DKC48-68	Bt, CRW, GLY, LL	98	204	215	209	15.2
Dekalb	DKC48-95	Bt, GLY	98	215	203	209	15.2
AgriGold	A630-10STXRIB	Bt, CRW, GLY, LL	100	193	218	205	15.4
Dairyland Seed	DS-4014Q	Bt, CRW, GLY, LL	100	217	238	227	15.5
Dekalb	DKC50-87	Bt, CRW, GLY, LL	100	168	216	192	15.6
Peterson Farms Seed	78P98	Bt, GLY	98	227	251	239	15.6
Anderson Seeds	6811		100	190	235	212	15.7
Peterson Farms Seed	85X98	Bt, CRW, GLY, LL	98	193	213	203	15.8
Legacy Seeds	LC484-20	Bt, GLY	98	210	238	224	15.8
AgriGold	A628-16VT2RIB	Bt, GLY	98	219	244	232	15.9
Dairyland Seed	DS-3959Q	Bt, CRW, GLY, LL	99	204	218	211	16.2
AgriGold	A630-04		100	226	215	220	16.8
98 to 100 RM and earlier averages:				**208**	**226**	**217**	**15.4**
Later than 100 RM entries							
Dekalb	DKC51-98	Bt, CRW, GLY, LL	101	202	214	208	15.2
Peterson Farms Seed	73P01	Bt, GLY	101	195	215	205	15.4
Dekalb	DKC52-18	Bt, CRW, GLY, LL	102	201	197	199	15.6
Dekalb	DKC52-99	Bt, GLY	102	248	229	238	16.0
Federal Hybrids	5120 SS	Bt, CRW, GLY, LL	101	221	220	221	16.0
Legacy Seeds	LC5217	Bt, CRW	102	231	250	241	16.1
Legacy Seeds	LC-5319	Bt, CRW, GLY, LL	104	202	222	212	16.1
Anderson Seeds	507R	GLY	102	241	277	259	16.3
Dairyland Seed	DS-4310Q	Bt, CRW, GLY, LL	103	206	202	204	16.3
Anderson Seeds	5072		102	221	246	234	16.3
Anderson Seeds	507SRC	Bt, CRW, GLY, LL	102	203	245	224	16.5
Dairyland Seed	DS-4510Q	Bt, CRW, GLY, LL	105	248	244	246	16.6
Hi Fidelity Genetics	HFG1071		105	227	247	237	16.7
DenBesten Brand	DB41-01-OR		101	177	167	172	16.8
Hi Fidelity Genetics	HFG1051		105	209	244	226	17.1
AgriGold	A633-14STX	Bt, CRW, GLY, LL	103	230	256	243	17.2
AgriGold	A631-90		101	180	224	202	17.4
Dekalb	DKC56-65	Bt, CRW, GLY, LL	106	226	252	239	17.6
Later than 100 RM averages:				**215**	**231**	**223**	**16.4**
Central locations, late maturity averages:				**212**	**228**	**220**	**15.9**
LSD (0.20)				**21**	**26**	**17**	**0.5**

Table 7. Northern locations, 2021.

Source	Entry	Traits	Relative Maturity	Yield, Bushels/Acre at: Crookston	Rothsay	Staples	Average Across Locations Bu/Acre	% Moisture
86 and earlier RM entries								
REA Hybrids	2B851	Bt, GLY	85	102	231	179	171	14.9
REA Hybrids	2B862	Bt, GLY	86	111	266	194	190	15.1
Peterson Farms Seed	75G85	Bt, GLY	85	98	229	193	173	15.2
Peterson Farms Seed	73S84	Bt, GLY	84	119	240	197	185	15.2
AgriGold	A615-35		85	123	232	189	181	15.4
REA Hybrids	2B863	Bt, GLY	86	115	290	198	201	15.5
Legacy Seeds	LC354-20	Bt, GLY, LL	85	116	261	161	180	16.5
Enestvedt Seed Co	E859		86	110	231	196	179	16.8
86 and earlier RM entry averages:								
87 to 91 RM entries								
AgriGold	A617-78VT2RIB	Bt, GLY	87	105	251	191	182	14.8
Peterson Farms Seed	73K90	Bt, GLY	90	106	236	151	164	15.1
Anderson Seeds	8289		89	131	251	175	186	15.2
Viking	80-89		89	117	244	240	200	15.5
REA Hybrids	3B903	Bt, GLY	90	123	266	180	189	15.5
Dairyland Seed	DS-3162Q	Bt, CRW, GLY, LL	91	114	305	185	201	15.6
Legacy Seeds	LC391-20	Bt, GLY	89	108	291	198	199	15.7
REA Hybrids	3B912	Bt, GLY	91	146	309	201	219	15.9
Legacy Seeds	LC-3048	Bt, CRW, GLY, LL	90	130	247	212	197	16.0
Dairyland Seed	DS-3022AM	Bt, GLY, LL	90	128	233	177	179	16.1
AgriGold	A620-82VT2RIB	Bt, GLY	90	136	266	134	179	16.3
DenBesten Brand	DB31-88		88	105	238	219	187	16.3
DenBesten Brand	DB41-87-OR		87	106	216	188	170	16.4
87 to 91 RM entry averages:				**120**	**258**	**189**	**189**	**15.7**
92 and later RM entries								
REA Hybrids	4B933	Bt, GLY	93	141	277	189	202	15.8
AgriGold	A625-78VT2RIB	Bt, GLY	95	147	291	203	214	16.2
Enestvedt Seed Co	E612		92	147	280	175	201	16.4
BH Genetics	6218VT2PRIB	Bt, GLY	92	151	286	197	211	16.6
AgriGold	A622-65		92	119	255	227	200	16.7
Anderson Seeds	742R	GLY	92	139	265	199	201	16.8
Dekalb	DKC42-64	Bt, CRW, GLY, LL	92	105	245	212	187	17.1
Dairyland Seed	DS-3550AM	Bt, GLY, LL	95	142	302	173	206	17.3
Dairyland Seed	DS-3366AM	Bt, GLY, LL	93	131	269	177	193	17.3
Hi Fidelity Genetics	HFG0921		92	124	269	204	199	17.5
REA Hybrids	4B958	Bt, GLY	95	134	285	187	202	18.7
DenBesten Brand	DB41-95-OR		95	110	221	186	172	18.9
Hi Fidelity Genetics	HFG0951		95	122	241	188	184	19.1
REA Hybrids	4B944	Bt, GLY	94	115	259	182	185	19.2
Hi Fidelity Genetics	EXP2013		94	122	258	203	194	20.9
Dekalb	DKC44-97	Bt, CRW, GLY, LL	94	133	259	222	205	21.5
Anderson Seeds	7865		95	107	320	189	205	21.6
92 and Later RM entry averages:				**129**	**270**	**195**	**198**	**18.1**
Northern locations averages:				**122**	**261**	**191**	**191**	**16.7**
LSD (0.20)				**16**	**24**	**20**	**11**	**1.4**

2021 Corn Silage field crop trial results

The Minnesota Hybrid Corn Silage Evaluation Program evaluates the silage potential of corn hybrids in Minnesota. The goal of the program is to provide unbiased forage yield and forage quality information for educational and marketing programs.

The program is financed in part by entry fees from private seed companies that choose to enter hybrids for testing, which are listed below. Results are presented from the two corn silage performance trials, Southeast (SE) located in Rochester; and Central (CE) located in Hutchinson. Entries from the southeast and central sites are also evaluated at Waseca in trials designated as Waseca SE and Waseca CE. Trials at each location were split into early and late corn hybrid maturities, to facilitate harvesting the corn silage at about 65 percent whole plant moisture.

Companies Participating in 2021 Hybrid Corn Silage Performance Trials.

AgriGold Hybrids	www.agrigold.com
Bayer Crop Science	www.dekalbasgrowdeltapine.com
Dairyland Seed	www.dairylandseed.com
Golden Harvest	www.goldenharvestseeds.com
Legacy Seeds	www.legacyseeds.com
Peterson Farms Seed	www.petersonfarmsseed.com
Thunder Seed	thunderseed.com
Viking Seed	www.alseed.com

Test Procedures

Plots were established at each test site in a randomized complete block design with four replications.

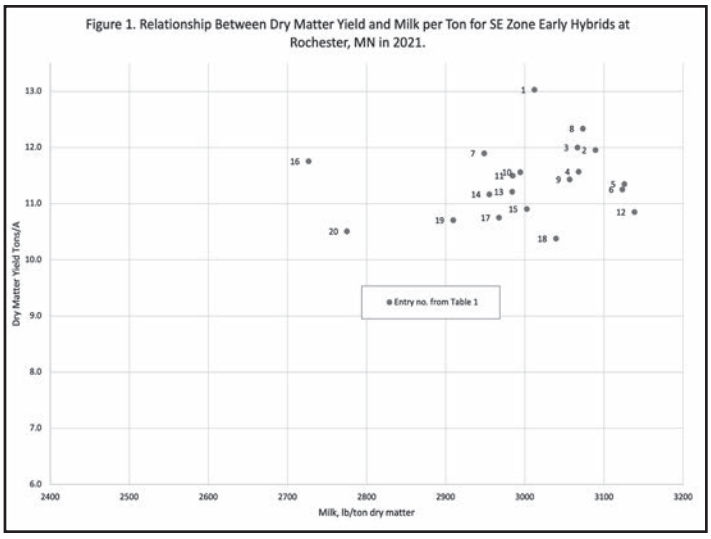
Planting and harvesting dates were (location, planting

CORN SILAGE: Continued on page 38

Table 1. Relative maturity (RM), whole plant moisture, dry matter (DM), silage yield and quality traits for SE zone early RM corn hybrids planted at Rochester, MN in 2021.

						Yield, Tons/Acre[2]		Forage Quality (concentration), %						Milk Yield[9]	
No.	Source	Brand	Traits[1]	RM	Moisture %	Silage	DM	CP[3]	NDF[4]	uNDF[5]	TTNDFD[6]	Starch[7]	StarchD[8]	lb/Ton	lb/Acre
1	Peterson Farms Seed	2LF95	GLY	95	60.4	33.0	13.0	7.4	39.3	12.6	36.5	36.6	55.3	3012	39220
2	Viking	51-04	-	104	61.5	31.0	12.0	6.7	37.0	11.5	38.4	40.3	55.5	3089	36916
3	AgriGold	A636-11STXRIB	Bt, CRW, GLY, LL	106	62.8	32.3	12.0	7.1	36.3	10.8	39.3	40.8	56.6	3067	36758
4	Dairyland Seed	DS-4878AM	Bt,GLY,LL	106	67.6	35.7	11.6	7.5	38.4	11.6	39.9	38.3	58.3	3068	35561
5	Dairyland Seed	HiDF-4545Q	Bt, CRW, GLY, LL	105	64.6	32.1	11.4	7.4	35.5	10.0	42.1	40.6	57.2	3126	35450
6	Dairyland Seed	DS-4840AM	Bt,GLY,LL	108	64.3	31.4	11.3	7.1	37.6	11.0	41.3	39.5	60.3	3123	35293
7	AgriGold	A633-14STX	Bt, CRW, GLY, LL	103	64.8	33.8	11.9	7.3	40.0	12.3	39.0	34.7	56.2	2949	35072
8	Dekalb	DKC50-87	Bt, CRW, GLY, LL	100	57.6	31.5	12.3	7.0	34.0	11.2	36.8	43.5	54.1	3073	35053
9	Dairyland Seed	HiDF-3802Q	Bt, CRW, GLY, LL	102	65.5	33.2	11.4	7.7	37.6	10.7	42.0	38.1	56.9	3057	34934
10	Dairyland Seed	HiDF-4073Q	Bt, CRW, GLY, LL	100	61.5	30.1	11.6	6.8	39.0	11.7	40.7	37.7	58.1	2994	34593
11	AgriGold	A636-16	-	106	64.0	32.0	11.5	7.2	38.2	11.6	39.6	38.2	60.2	2985	34348
12	Dekalb	DKC56-65	Bt, CRW, GLY, LL	106	64.4	30.5	10.9	7.5	35.7	9.7	41.9	41.1	58.0	3139	34123
13	Peterson Farms Seed	73P01	Bt, GLY	101	62.2	29.6	11.2	6.5	39.5	11.8	39.4	37.9	58.6	2984	33488
14	Legacy Seeds	LC555-21	Bt, CRW, GLY, LL	105	65.3	32.1	11.2	7.4	41.0	12.3	40.9	35.0	58.9	2955	33092
15	Legacy Seeds	LC533-20	Bt, CRW, GLY, LL	103	60.6	27.6	10.9	7.5	39.2	12.6	37.0	37.3	53.5	3002	32788
16	Peterson Farms Seed	2LF01	GLY	101	66.7	35.3	11.8	7.1	47.3	15.7	37.2	26.9	57.3	2727	32098
17	Dekalb	DKC52-18	Bt, CRW, GLY, LL	102	64.3	30.1	10.8	7.2	38.3	11.9	37.8	38.3	56.3	2967	31938
18	Peterson Farms Seed	78G95	Bt, GLY	95	53.6	22.6	10.4	6.7	35.4	11.5	37.4	43.2	54.8	3039	31558
19	AgriGold	A632-35-5222EZ	Bt, CRW, GLY, LL	102	61.0	27.5	10.7	6.8	42.0	13.5	37.6	34.6	55.9	2909	31357
20	Dekalb	DKC48-68	Bt, CRW, GLY, LL	98	58.0	27.0	10.5	7.1	41.8	14.3	35.2	35.5	54.7	2775	27131
			Mean		**62.5**	**30.9**	**11.4**	**7.1**	**38.7**	**11.9**	**39.0**	**37.9**	**56.8**	**3002**	**34039**
			LSD (0.20)		**2.7**	**2.3**	**1.0**	**0.4**	**3.6**	**1.4**	**1.4**	**4.2**	**2.4**	**130**	**3757**

[1]Bt,BL,CRW,GLY,LL,WBC traits contain genes for resistance to European corn borer, broad spectrum lepidopteran, Corn rootworm, glyphosate herbicide, Liberty herbicide and Western bean cutworm, respectively.
[2]Silage yield is whole-plant corn yield at harvest moisture, DM is whole plant corn yield at 100% dry matter.
[3]Crude protein as a % of DM.
[4]Neutral detergent fiber as a % of DM.
[5]Undigestible NDF at 240 hour as a % of NDF.
[6]Total tract NDF digestibility as a % of NDF.
[7]Starch as a % of DM.
[8]In situ rumen degradable starch at 7 hours as a % of starch.
[9]Milk production was estimated using the MILK2006 model developed at the University of Wisconsin. Refer to the results provided text for additional information.



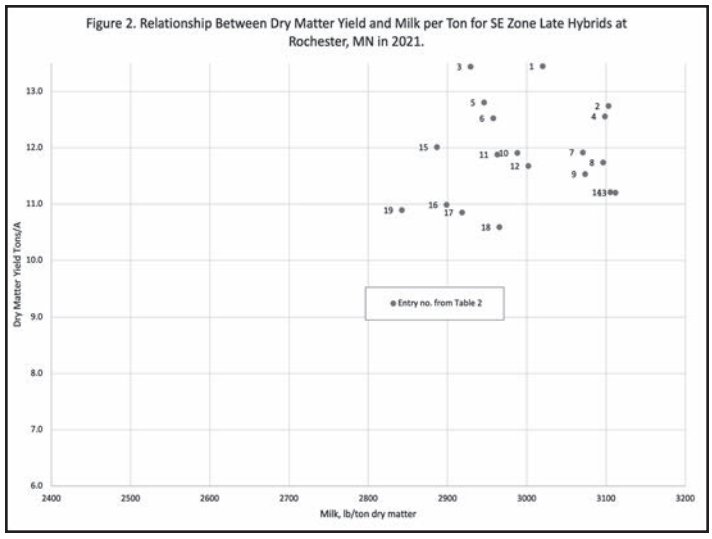


Table 2. Relative maturity (RM), whole plant moisture, dry matter (DM), silage yield, and quality traits for SE zone late RM corn hybrids planted at Rochester, MN in 2021.

						Yield, Tons/Acre[2]		Forage Quality (concentration), %						Milk Yield[9]	
No.	Source	Brand	Traits[1]	RM	Moisture %	Silage	DM	CP[3]	NDF[4]	uNDF[5]	TTNDFD[6]	Starch[7]	StarchD[8]	lb/Ton	lb/Acre
1	Golden Harvest	G12S75-5122	Bt, CRW, GLY, LL	112	63.1	36.4	13.5	6.9	39.0	11.4	40.4	37.9	58.9	3020	40722
2	Dekalb	DKC58-64	Bt, CRW, GLY, LL	108	62.5	34.2	12.7	6.6	36.3	10.5	41.3	40.7	60.5	3103	39537
3	Legacy Seeds	LC623-21	Bt, CRW, GLY, LL	112	64.2	37.5	13.4	7.2	41.6	11.9	41.1	34.5	59.6	2929	39456
4	Viking	58-11	-	111	62.2	33.2	12.6	7.1	34.4	9.7	40.5	43.6	58.5	3099	38911
5	Viking	O.82-14	-	114	66.4	38.1	12.8	7.0	38.7	10.9	42.3	38.6	61.9	2946	37749
6	Golden Harvest	G07G73-5122	Bt, CRW, GLY, LL	107	64.4	35.2	12.5	7.1	39.1	11.3	40.6	37.5	61.0	2958	37094
7	Dairyland Seed	HiDF-4999Q	Bt, CRW, GLY, LL	109	67.0	36.2	11.9	7.4	37.4	9.9	43.2	38.4	60.8	3071	36720
8	Viking	48-08	-	108	63.2	31.9	11.7	6.6	35.7	10.0	42.0	42.1	60.9	3096	36273
9	Dekalb	DKC59-81	Bt, CRW, GLY, LL	109	64.3	32.2	11.5	7.5	36.6	10.3	40.0	40.3	58.8	3074	35697
10	Golden Harvest	G13P84-3120	Bt, GLY, LL	113	62.8	32.0	11.9	7.3	39.3	10.6	42.6	37.1	60.2	2988	35613
11	AgriGold	A638-74VT2RIB	Bt, GLY	108	62.3	31.6	11.9	7.3	38.7	11.3	40.4	38.4	57.6	2963	35182
12	AgriGold	A638-58STX	Bt, CRW, GLY, LL	108	64.7	33.4	11.7	7.4	36.6	10.3	40.7	40.9	59.3	3002	34963
13	AgriGold	A642-47STXRIB	Bt, CRW, GLY, LL	112	63.8	31.0	11.2	7.2	36.5	10.9	41.7	40.9	58.7	3112	34907
14	AgriGold	A639-70STXRIB	Bt, CRW, GLY, LL	109	64.9	32.1	11.2	7.4	36.7	10.4	40.1	40.6	57.2	3105	34805
15	Dairyland Seed	DS-5144Q	Bt, CRW, GLY, LL	109	65.3	34.6	12.0	7.1	42.8	12.9	43.6	33.3	61.9	2887	34709
16	Legacy Seeds	LC592-21	Bt, GLY, LL	109	64.0	30.6	11.0	7.4	40.7	12.0	40.8	35.7	59.9	2899	31826
17	Golden Harvest	G10D21-5332	Bt, CRW, GLY, LL	110	65.4	31.4	10.9	7.7	39.3	12.1	40.1	37.0	57.6	2918	31771
18	Dairyland Seed	HiDF-5202Q	Bt, CRW, GLY, LL	112	68.6	33.7	10.6	6.9	40.0	10.8	41.9	37.4	62.1	2966	31411
19	Golden Harvest	G13D55-5222	Bt, CRW, GLY, LL	113	66.2	32.2	10.9	7.0	42.2	12.6	40.4	34.1	60.9	2842	30970
			Mean		**64.5**	**33.5**	**11.9**	**7.2**	**38.5**	**11.0**	**41.2**	**38.4**	**59.8**	**2999**	**35701**
			LSD (0.20)		**1.7**	**3.0**	**1.1**	**ns**	**3.2**	**1.3**	**1.6**	**3.3**	**2.3**	**121**	**4043**

[1]Bt,BL,CRW,GLY,LL,WBC traits contain genes for resistance to European corn borer, broad spectrum lepidopteran, Corn rootworm, glyphosate herbicide, Liberty herbicide and Western bean cutworm, respectively.

[2]Silage yield is whole-plant corn yield at harvest moisture, DM is whole plant corn yield at 100% dry matter.

[3]Crude protein as a % of DM.

[4]Neutral detergent fiber as a % of DM.

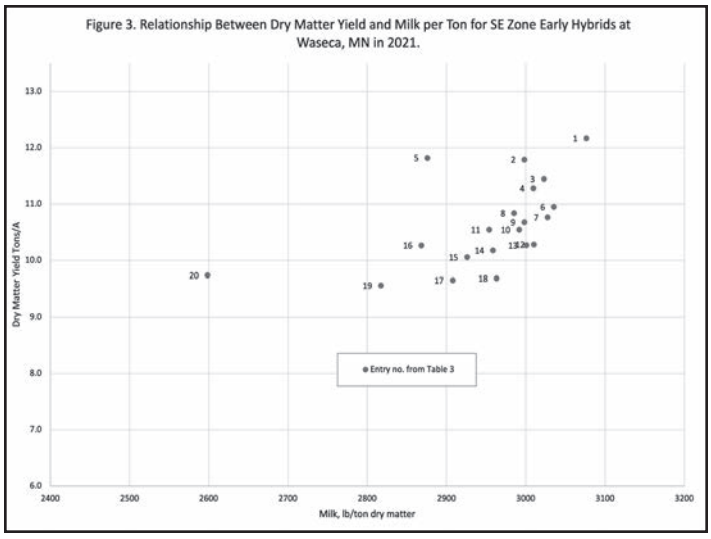
[5]Undigestible NDF at 240 hour as a % of NDF.

[6]Total tract NDF digestibility as a % of NDF.

[7]Starch as a % of DM.

[8]In situ rumen degradable starch at 7 hours as a % of starch.

[9]Milk production was estimated using the MILK2006 model developed at the University of Wisconsin. Refer to the results provided text for additional information.



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date, early harvest, and late harvest):

- Waseca CE, Apr. 26, Aug. 25, Aug. 30
- Waseca SE, Apr. 26, Aug. 30, Aug. 30
- Rochester SE, May 6, Sept. 10, Sept. 14

Location	Planting Date	Early Harvest	Late Harvest
Waseca CE	Apr. 26	Aug. 25	Aug. 30
Waseca SE	Apr. 26	Aug. 30	Aug. 30
Rochester SE	May 6	Sept. 10	Sept. 14
Hutchinson CE	May 7	Aug. 31	Aug. 31

- Hutchinson CE, May 7, Aug. 31, Aug. 31

Hybrid entries were planted at 35,000 seeds per acre with a 30-inch row spacing. Plant nutrients and herbicides were applied according to University of Minnesota recommendations.

Plots were harvested and whole-plant herbage sampled for determination of dry mat-

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Table 3. Relative maturity (RM), whole plant moisture, dry matter (DM), silage yield, and quality traits for SE zone early RM corn hybrids planted at Waseca, MN in 2021.

					Moisture	Yield, Tons/Acre[2]		Forage Quality (concentration), %						Milk Yield[9]	
No.	Source	Brand	Traits[1]	RM	%	Silage	DM	CP[3]	NDF[4]	uNDF[5]	TTNDFD[6]	Starch[7]	StarchD[8]	lb/Ton	lb/Acre
1	Dairyland Seed	HiDF-4545Q	Bt, CRW, GLY, LL	105	63.9	33.8	12.2	7.0	37.1	9.3	46.0	40.0	63.3	3076	37404
2	Dairyland Seed	DS-4840AM	Bt,GLY,LL	108	64.6	33.4	11.8	7.1	39.5	10.5	43.3	37.3	63.8	2998	35393
3	Viking	51-04	-	104	59.8	28.5	11.4	6.6	39.0	10.2	40.8	38.6	59.2	3023	34575
4	Dairyland Seed	DS-4878AM	Bt,GLY,LL	106	66.9	34.1	11.3	7.3	40.8	10.8	45.4	35.9	65.9	3010	34024
5	Peterson Farms Seed	2LF95	GLY	95	58.4	28.4	11.8	6.8	41.0	12.0	38.4	35.7	56.4	2876	33925
6	Dairyland Seed	HiDF-3802Q	Bt, CRW, GLY, LL	102	63.0	29.5	10.9	7.3	38.6	9.6	44.2	38.4	61.3	3035	33359
7	Peterson Farms Seed	78G95	Bt, GLY	95	57.3	24.2	10.8	6.7	38.3	10.2	41.8	40.0	59.5	3027	32579
8	Dairyland Seed	HiDF-4073Q	Bt, CRW, GLY, LL	100	59.9	27.0	10.8	6.5	38.9	10.2	42.5	39.2	61.5	2985	32393
9	Legacy Seeds	LC533-20	Bt, CRW, GLY, LL	103	60.4	27.0	10.7	7.2	39.6	10.7	41.2	37.5	59.5	2998	32103
10	AgriGold	A633-14STX	Bt, CRW, GLY, LL	103	64.8	29.9	10.5	7.0	37.4	9.9	41.6	38.9	61.0	2992	31614
11	AgriGold	A636-16	-	106	64.3	29.6	10.5	6.9	39.6	10.8	42.5	36.7	65.5	2954	31105
12	Dekalb	DKC56-65	Bt, CRW, GLY, LL	106	63.9	28.4	10.3	7.3	37.2	10.0	43.0	39.7	61.1	3010	31065
13	Peterson Farms Seed	73P01	Bt, GLY	101	59.6	25.5	10.3	6.5	37.3	10.0	39.7	41.1	59.1	3001	30789
14	AgriGold	A632-35-5222EZ	Bt, CRW, GLY, LL	102	61.2	26.3	10.2	7.0	38.9	11.2	40.0	38.1	58.7	2959	30074
15	AgriGold	A636-11STXRIB	Bt, CRW, GLY, LL	106	64.8	28.5	10.1	7.0	40.6	11.0	42.2	36.0	62.2	2926	29447
16	Dekalb	DKC52-18	Bt, CRW, GLY, LL	102	62.2	27.2	10.3	7.1	39.4	11.1	40.7	37.1	58.1	2868	29355
17	Dekalb	DKC50-87	Bt, CRW, GLY, LL	100	62.0	25.3	9.7	6.6	38.8	10.9	40.0	39.5	60.2	2908	28735
18	Legacy Seeds	LC555-21	Bt, CRW, GLY, LL	105	61.5	25.1	9.7	7.5	39.2	10.6	40.9	37.8	58.5	2963	28698
19	Dekalb	DKC48-68	Bt, CRW, GLY, LL	98	60.6	24.3	9.6	6.7	39.3	11.3	38.5	39.1	59.9	2817	27018
20	Peterson Farms Seed	2LF01	GLY	101	67.8	30.2	9.7	6.8	51.4	15.0	40.9	22.8	66.5	2598	25349
			Mean		**62.3**	**28.3**	**10.6**	**6.9**	**39.6**	**10.8**	**41.7**	**37.5**	**61.1**	**2951**	**31450**
			LSD (0.20)		**1.5**	**2.2**	**0.9**	**0.3**	**3.6**	**1.4**	**1.5**	**4.0**	**2.0**	**124**	**3113**

[1]Bt,BL,CRW,GLY,LL,WBC traits contain genes for resistance to European corn borer, broad spectrum lepidopteran, Corn rootworm, glyphosate herbicide, Liberty herbicide and Western bean cutworm, respectively.

[2]Silage yield is whole-plant corn yield at harvest moisture, DM is whole plant corn yield at 100% dry matter.

[3]Crude protein as a % of DM.

[4]Neutral detergent fiber as a % of DM.

[5]Undigestible NDF at 240 hour as a % of NDF.

[6]Total tract NDF digestibility as a % of NDF.

[7]Starch as a % of DM.

[8]In situ rumen degradable starch at 7 hours as a % of starch.

[9]Milk production was estimated using the MILK2006 model developed at the University of Wisconsin. Refer to the results provided text for additional information.

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ter content and forage quality. Test sites were harvested when the average whole-plant moisture across entries was estimated to be 65 percent.

Results Provided

Tables 1-8 summarize hybrid yield and forage quality results from Hutchinson, Rochester, and Waseca. Moisture content, whole-plant dry matter (DM) yield, and silage yield at harvest moisture are listed. Hybrids are ranked in descending order of milk yield per acre (Milk Yield, pound/acre). Genetic trait information is supplied by companies entered in the hybrid corn silage performance trials.

Whole-plant forage quality characteristics tested include moisture (percent), crude protein (CP, percent DM), neutral detergent fiber (NDF, percent DM),

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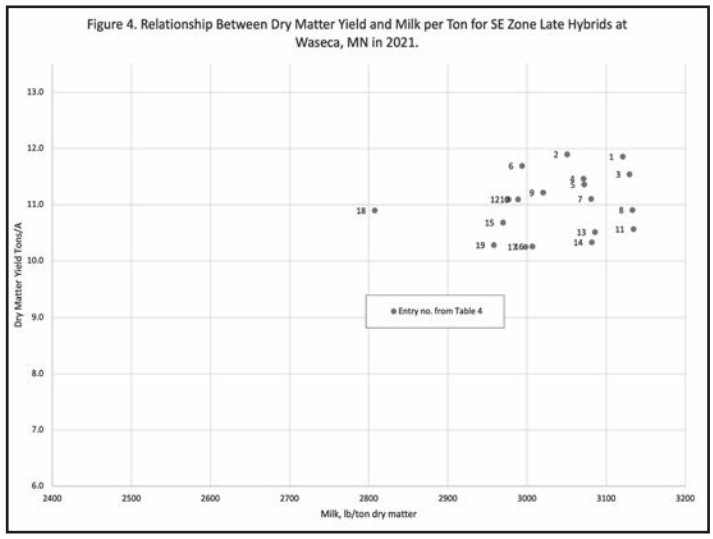


Table 4. Relative maturity (RM), whole plant moisture, dry matter (DM), silage yield, and quality traits for SE zone late RM corn hybrids planted at Waseca, MN in 2021.

						Yield, Tons/Acre[2]		Forage Quality (concentration), %						Milk Yield[9]	
No.	Source	Brand	Traits[1]	RM	Moisture %	Silage	DM	CP[3]	NDF[4]	uNDF[5]	TTNDFD[6]	Starch[7]	StarchD[8]	lb/Ton	lb/Acre
1	Dairyland Seed	HiDF-5202Q	Bt, CRW, GLY, LL	112	66.2	35.1	11.9	7.2	35.9	8.8	44.5	40.5	59.8	3121	37077
2	Dairyland Seed	HiDF-4999Q	Bt, CRW, GLY, LL	109	64.0	33.0	11.9	7.0	37.6	9.5	44.0	39.0	61.7	3051	36288
3	AgriGold	A638-74VT2RIB	Bt, GLY	108	59.3	28.3	11.5	6.9	33.8	8.9	40.4	44.3	56.4	3129	36111
4	Golden Harvest	G12S75-5122	Bt, CRW, GLY, LL	112	63.6	31.5	11.5	7.2	36.2	10.1	41.9	41.3	59.5	3071	35220
5	Dairyland Seed	DS-5144Q	Bt, CRW, GLY, LL	109	63.3	30.9	11.4	6.8	37.9	10.1	43.5	39.5	61.8	3072	35079
6	Legacy Seeds	LC623-21	Bt, CRW, GLY, LL	112	62.7	31.3	11.7	6.7	38.8	10.6	41.9	38.9	61.0	2994	34988
7	Viking	58-11	-	111	60.7	28.3	11.1	6.6	36.6	9.9	40.7	41.0	57.8	3081	34355
8	Dekalb	DKC58-64	Bt, CRW, GLY, LL	108	64.0	30.3	10.9	7.1	36.1	9.9	42.2	41.2	60.5	3133	34103
9	Golden Harvest	G13D55-5222	Bt, CRW, GLY, LL	113	64.3	31.4	11.2	6.9	37.3	10.4	41.6	39.6	58.3	3020	33861
10	Golden Harvest	G07G73-5122	Bt, CRW, GLY, LL	107	64.2	31.0	11.1	6.9	39.0	11.6	41.3	38.4	60.5	2989	33180
11	AgriGold	A639-70STXRIB	Bt, CRW, GLY, LL	109	62.4	28.0	10.6	7.3	36.8	10.3	41.3	40.4	57.5	3134	33170
12	Legacy Seeds	LC592-21	Bt, GLY, LL	109	63.4	30.3	11.1	7.1	38.5	10.6	42.2	38.4	60.0	2977	33160
13	Dekalb	DKC59-81	Bt, CRW, GLY, LL	109	62.7	28.2	10.5	6.8	36.7	10.0	42.1	40.7	61.5	3086	32484
14	Viking	48-08	-	108	60.4	26.1	10.3	6.7	33.7	9.4	41.2	44.4	58.2	3082	31858
15	Golden Harvest	G13P84-3120	Bt, GLY, LL	113	63.5	29.2	10.7	7.3	39.0	10.7	41.7	37.6	58.0	2970	31750
16	Golden Harvest	G10D21-5332	Bt, CRW, GLY, LL	110	63.9	28.4	10.3	7.2	37.2	10.2	41.8	39.8	57.8	3007	31079
17	AgriGold	A638-58STX	Bt, CRW, GLY, LL	108	62.0	27.0	10.2	7.1	36.8	10.4	40.4	40.6	56.2	2998	30785
18	Viking	O.82-14	-	114	68.1	34.1	10.9	6.6	44.0	12.7	43.6	32.1	63.7	2807	30644
19	AgriGold	A642-47STXRIB	Bt, CRW, GLY, LL	112	64.1	28.6	10.3	7.2	39.2	11.0	41.3	37.6	59.8	2958	30373
			Mean		**63.3**	**30.1**	**11.0**	**7.0**	**37.4**	**10.3**	**42.0**	**39.8**	**59.5**	**3036**	**33451**
			LSD (0.20)		**1.6**	**2.3**	**1.0**	**0.3**	**3.7**	**1.5**	**1.5**	**3.9**	**2.4**	**134**	**3962**

[1]Bt,BL,CRW,GLY,LL,WBC traits contain genes for resistance to European corn borer, broad spectrum lepidopteran, Corn rootworm, glyphosate herbicide, Liberty herbicide and Western bean cutworm, respectively.

[2]Silage yield is whole-plant corn yield at harvest moisture, DM is whole plant corn yield at 100% dry matter.

[3]Crude protein as a % of DM.

[4]Neutral detergent fiber as a % of DM.

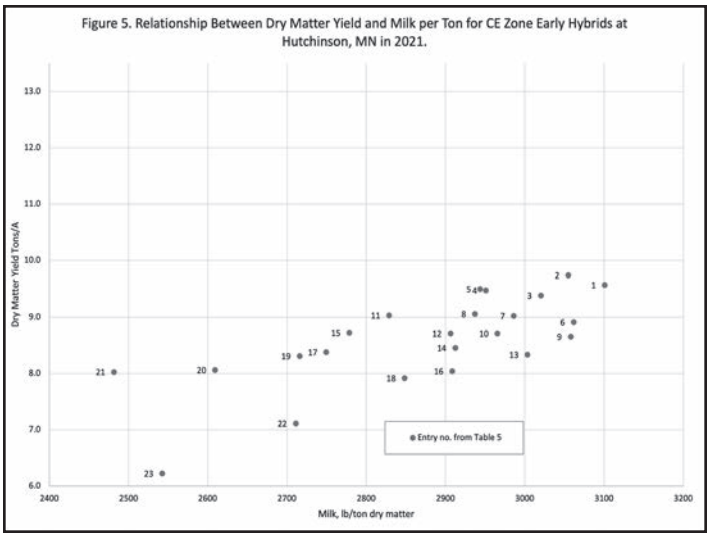
[5]Undigestible NDF at 240 hour as a % of NDF.

[6]Total tract NDF digestibility as a % of NDF.

[7]Starch as a % of DM.

[8]In situ rumen degradable starch at 7 hours as a % of starch.

[9]Milk production was estimated using the MILK2006 model developed at the University of Wisconsin. Refer to the results provided text for additional information.



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undigestible NDF at 240 hour (uNDF, percent NDF), total tract NDF digestibility (TTNDFD, percent of NDF), starch concentration (percent DM), and in situ rumen degradable starch at 7 hours (StarchD, percent of starch). All forage quality variables were predicted using Near-Infrared Reflectance Spectroscopy calibrated using laboratory procedures (Rock River Laboratory; https://www.rockriverlab. com).

Milk production potential per ton (pounds of milk/ ton forage) and per acre (pounds of milk/ acre) of forage was calculated using the MILK2006 model developed by the University of Wisconsin. MILK2006 approximates animal performance based on a standard cow weight and milk produc-

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Table 5. Relative maturity (RM), whole plant moisture, dry matter (DM), silage yield, and quality traits for Central zone early RM corn hybrids planted at Hutchinson, MN in 2021.

						Yield, Tons/Acre[2]		Forage Quality (concentration), %						Milk Yield[9]	
No.	Source	Brand	Traits[1]	RM	Moisture %	Silage	DM	CP[3]	NDF[4]	uNDF[5]	TTNDFD[6]	Starch[7]	StarchD[8]	lb/Ton	lb/Acre
1	AgriGold	A631-90	-	101	57.2	22.6	9.6	7.2	33.7	9.8	39.0	44.1	54.6	3101	29808
2	Dairyland Seed	HiDF-4073Q	Bt, CRW, GLY, LL	100	59.1	23.5	9.7	7.1	36.8	10.6	40.9	40.2	57.0	3055	29794
3	AgriGold	A630-04	-	100	60.5	23.8	9.4	7.5	35.3	10.3	41.2	41.8	57.7	3020	28359
4	Dekalb	DKC50-87	Bt, CRW, GLY, LL	100	59.6	23.5	9.5	7.1	36.5	11.0	39.1	40.9	56.4	2951	28023
5	AgriGold	A630-10STXRIB	Bt, CRW, GLY, LL	100	59.6	23.7	9.5	6.9	37.9	11.5	38.5	39.5	53.6	2943	27913
6	Legacy Seeds	LC-4248	Bt, GLY	100	58.3	21.6	8.9	6.9	34.1	10.4	37.2	43.9	50.0	3062	27317
7	Peterson Farms Seed	78G95	Bt, GLY	95	56.4	20.9	9.0	6.9	37.4	11.4	38.2	40.3	53.3	2986	26859
8	AgriGold	A630-95-5222EZ	Bt, CRW, GLY, LL	100	59.1	22.2	9.1	7.1	39.1	11.6	39.8	38.2	54.7	2937	26669
9	Legacy Seeds	LC484-20	Bt, GLY	98	57.6	20.5	8.7	7.2	35.9	10.1	39.5	41.4	53.7	3058	26561
10	Golden Harvest	G99E68-5122	Bt, CRW, GLY, LL	99	61.2	22.5	8.7	7.7	36.1	10.2	39.7	39.9	52.9	2965	25858
11	Dairyland Seed	DS-4018AM	Bt,GLY,LL	101	63.1	24.5	9.0	7.2	42.6	12.5	41.9	34.1	56.9	2829	25527
12	Viking	42-92	-	100	54.0	19.0	8.7	6.5	39.9	12.8	37.5	38.4	52.8	2906	25464
13	Dairyland Seed	HiDF-3522Q	Bt, CRW, GLY, LL	100	60.6	21.1	8.3	7.3	37.1	11.7	39.8	39.8	55.2	3003	25031
14	Dekalb	DKC48-68	Bt, CRW, GLY, LL	98	57.2	19.8	8.5	7.0	39.1	11.8	39.0	39.1	54.9	2912	24837
15	Legacy Seeds	LC503-21	Bt, CRW, GLY, LL	100	59.9	21.9	8.7	6.7	44.2	13.7	39.2	33.5	57.6	2779	24400
16	Golden Harvest	G96R61-5122	Bt, CRW, GLY, LL	96	61.1	20.7	8.0	7.3	39.0	11.3	39.3	37.8	55.1	2908	23452
17	Thunder Seed	EXS21-100	-	100	66.0	24.7	8.4	6.7	47.6	14.0	42.0	27.0	62.4	2750	23042
18	Peterson Farms Seed	73P01	Bt, GLY	101	58.5	19.1	7.9	6.1	41.8	12.7	37.1	36.6	54.7	2848	22573
19	Thunder Seed	T4001 HDRR	GLY	100	66.4	24.7	8.3	6.7	48.7	14.6	41.7	25.8	62.2	2716	22551
20	Peterson Farms Seed	2LF95	GLY	95	62.4	21.0	8.1	7.0	48.0	15.4	36.6	26.5	54.1	2609	21634
21	Peterson Farms Seed	2LF01	GLY	101	68.4	25.0	8.0	6.1	54.2	17.6	38.7	19.6	60.6	2482	21214
22	Thunder Seed	EXS21-98	-	98	59.6	17.7	7.1	6.5	46.4	14.0	39.6	30.6	58.3	2711	19459
23	Thunder Seed	T4995 HDRR	GLY	95	62.3	16.6	6.2	6.4	48.7	15.6	36.3	27.1	53.0	2543	15717
			Mean		**60.4**	**21.8**	**8.6**	**6.9**	**40.9**	**12.4**	**39.2**	**35.9**	**55.7**	**2873**	**24872**
			LSD (0.20)		**2.6**	**2.6**	**1.1**	**0.6**	**5.1**	**2.2**	**2.4**	**5.5**	**3.6**	**178**	**3765**

[1]Bt,BL,CRW,GLY,LL,WBC traits contain genes for resistance to European corn borer, broad spectrum lepidopteran, Corn rootworm, glyphosate herbicide, Liberty herbicide and Western bean cutworm, respectively.

[2]Silage yield is whole-plant corn yield at harvest moisture, DM is whole plant corn yield at 100% dry matter.

[3]Crude protein as a % of DM.

[4]Neutral detergent fiber as a % of DM.

[5]Undigestible NDF at 240 hour as a % of NDF.

[6]Total tract NDF digestibility as a % of NDF.

[7]Starch as a % of DM.

[8]In situ rumen degradable starch at 7 hours as a % of starch.

[9]Milk production was estimated using the MILK2006 model developed at the University of Wisconsin. Refer to the results provided text for additional information.

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tion level (1,350-pound body weight and 90-pound/day at 3.8 percent fat).

For MILK2006 predictions, we assumed that kernel processing occurred. Milk production (pounds of milk/ton and pound of milk/acre) values can be used as a quick reference for comparison of hybrids within test locations.

How to Use Results

NDF is a negative indicator of forage intake potential; higher NDF concentration generally implies lower intake potential. NDFD estimates digestibility of the NDF fiber fraction. Starch content, a grain component, is positively associated with overall forage digestibility because of its high digestibility. Relatively higher starch concentrations generally predict greater animal performance potential. TTNDFD (total tract NDF

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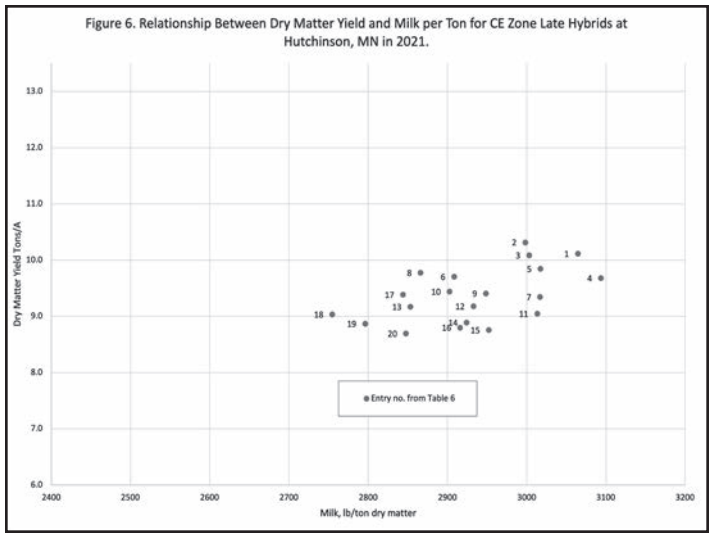


Table 6. Relative maturity (RM), whole plant moisture, dry matter (DM), silage yield, and quality traits for Central zone late RM corn hybrids planted at Hutchinson, MN in 2021.

						Yield, Tons/Acre[2]		Forage Quality (concentration), %						Milk Yield[9]	
					Moisture										
No.	Source	Brand	Traits[1]	RM	%	Silage	DM	CP[3]	NDF[4]	uNDF[5]	TTNDFD[6]	Starch[7]	StarchD[8]	lb/Ton	lb/Acre
1	Dairyland Seed	DS-4329AM	Bt,GLY,LL	105	59.2	25.1	10.1	7.0	38.2	10.8	42.1	39.0	57.3	3065	31097
2	Dairyland Seed	DS-4840AM	Bt,GLY,LL	108	59.5	25.7	10.3	6.5	40.4	12.4	41.7	38.0	61.2	2998	31018
3	Viking	51-04		104	55.9	22.8	10.1	6.3	38.2	11.9	38.5	39.9	54.3	3003	30450
4	Golden Harvest	G02K39-5122	Bt, CRW, GLY, LL	102	57.6	23.3	9.7	7.2	35.0	10.3	39.1	42.6	53.3	3094	29975
5	Dairyland Seed	DS-4878AM	Bt,GLY,LL	108	58.0	25.5	9.8	6.8	38.0	11.3	41.3	39.3	59.1	3017	28825
6	Dekalb	DKC58-64	Bt, CRW, GLY, LL	108	60.6	25.1	9.7	6.6	40.5	12.7	38.9	36.6	57.0	2909	28346
7	Dairyland Seed	HiDF-4545Q	Bt, CRW, GLY, LL	105	60.8	24.4	9.3	7.0	38.9	11.1	42.9	38.0	59.9	3017	28237
8	Dekalb	DKC56-65	Bt, CRW, GLY, LL	106	58.0	23.4	9.8	6.8	40.9	12.3	39.7	36.1	57.7	2866	28015
9	Golden Harvest	G07G73-5122	Bt, CRW, GLY, LL	107	59.3	23.5	9.4	6.6	39.7	11.9	40.8	38.1	59.6	2949	27967
10	AgriGold	A633-14STX	Bt, CRW, GLY, LL	103	59.7	23.6	9.4	6.7	40.3	12.2	39.9	35.2	58.5	2903	27414
11	AgriGold	A635-54VT2RIB	Bt, GLY	105	59.7	22.6	9.0	6.9	37.7	11.1	40.0	39.4	56.4	3013	27310
12	AgriGold	A636-11STXRIB	Bt, CRW, GLY, LL	106	61.6	24.0	9.2	6.5	41.4	12.5	38.8	36.2	55.8	2933	27065
13	Dekalb	DKC52-18	Bt, CRW, GLY, LL	102	59.8	23.0	9.2	6.5	40.7	12.3	38.8	36.7	55.7	2853	26227
14	Golden Harvest	G10D21-5332	Bt, CRW, GLY, LL	110	59.3	21.9	8.9	6.5	39.6	11.4	41.2	38.1	59.7	2924	26142
15	Legacy Seeds	LC533-20	Bt, CRW, GLY, LL	103	59.4	21.4	8.8	7.1	37.4	12.0	35.4	40.7	53.1	2952	25828
16	Dairyland Seed	HiDF-4999Q	Bt, CRW, GLY, LL	109	57.3	21.0	8.8	7.0	40.0	12.0	39.8	36.4	57.4	2916	25675
17	Legacy Seeds	LC555-21	Bt, CRW, GLY, LL	105	58.8	23.8	9.4	6.2	41.9	13.3	38.0	36.4	56.1	2844	25027
18	Legacy Seeds	LC592-21	Bt, GLY, LL	109	57.2	21.3	9.0	6.3	43.5	13.6	39.6	33.9	58.5	2755	24969
19	Legacy Seeds	LC623-21	Bt, CRW, GLY, LL	112	60.0	22.3	8.9	6.1	43.3	13.6	38.9	35.1	59.0	2796	24875
20	Dairyland Seed	DS-5144Q	Bt, CRW, GLY, LL	109	60.6	22.3	8.7	6.4	45.5	13.6	41.4	30.8	60.7	2848	24786
			Mean		**59.1**	**23.3**	**9.4**	**6.6**	**40.1**	**12.1**	**39.8**	**37.3**	**57.5**	**2933**	**27462**
			LSD (0.20)		**ns**	**2.0**	**0.6**	**0.5**	**3.4**	**1.4**	**1.8**	**3.5**	**2.3**	**110**	**2115**

[1]Bt,BL,CRW,GLY,LL,WBC traits contain genes for resistance to European corn borer, broad spectrum lepidopteran, Corn rootworm, glyphosate herbicide, Liberty herbicide and Western bean cutworm, respectively.

[2]Silage yield is whole-plant corn yield at harvest moisture, DM is whole plant corn yield at 100% dry matter.

[3]Crude protein as a % of DM.

[4]Neutral detergent fiber as a % of DM.

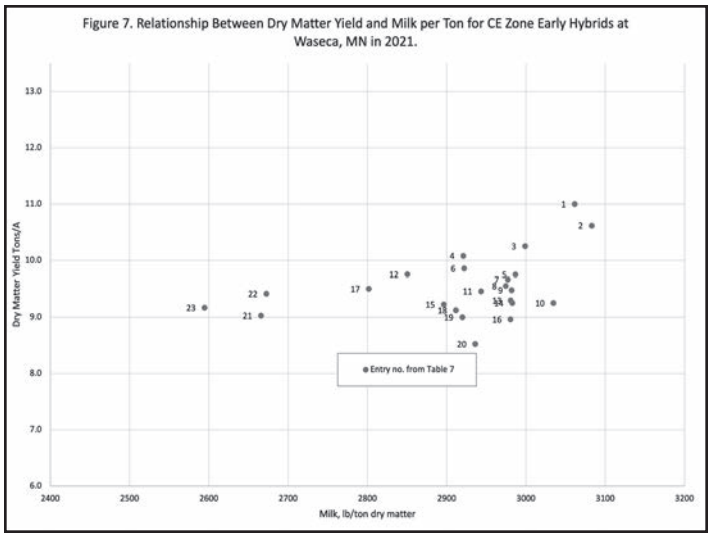
[5]Undigestible NDF at 240 hour as a % of NDF.

[6]Total tract NDF digestibility as a % of NDF.

[7]Starch as a % of DM.

[8]In situ rumen degradable starch at 7 hours as a % of starch.

[9]Milk production was estimated using the MILK2006 model developed at the University of Wisconsin. Refer to the results provided text for additional information.



CORN SILAGE: Continued from page 41

digestibility) is an advanced research validated model to predict forage digestibility in dairy cattle rations. It combines both rate of digestion and indigestibility of NDF. Milk yield per acre represents the combined effects of silage yield and quality.

Corn hybrids differed in yield, forage quality parameters and milk production potential at all sites. Means and least significant difference (LSD) values at the 20 percent probability level are shown for each parameter. Where the difference between the two hybrids for a particular yield or quality trait is greater than the LSD value, there is an 80 percent probability that there is a significant difference between the two hybrids for that parameter (i.e., moisture, yield, quality concentration or milk production). A

CORN SILAGE: Continued on page 43

Table 7. Relative maturity (RM), whole plant moisture, dry matter (DM), silage yield, and quality traits for Central zone early RM corn hybrids planted at Waseca, MN in 2021.

						Yield, Tons/Acre[2]		Forage Quality (concentration), %						Milk Yield[9]	
No.	Source	Brand	Traits[1]	RM	Moisture %	Silage	DM	CP[3]	NDF[4]	uNDF[5]	TTNDFD[6]	Starch[7]	StarchD[8]	lb/Ton	lb/Acre
1	AgriGold	A631-90		101	64.6	30.7	11.0	7.1	37.1	10.2	42.7	39.8	61.3	3061	34095
2	Peterson Farms Seed	2LF95	GLY	95	64.6	30.0	10.6	7.6	39.3	10.6	43.4	36.5	61.0	3083	32765
3	Legacy Seeds	LC503-21	Bt, CRW, GLY, LL	100	62.1	27.1	10.3	7.3	39.7	11.6	42.1	37.6	60.1	2999	30777
4	Thunder Seed	T4995 HDRR	GLY	95	64.1	28.1	10.1	7.3	42.0	12.2	42.6	34.1	60.3	2921	29510
5	Dairyland Seed	DS-4018AM	Bt,GLY,LL	101	64.4	27.4	9.8	6.8	39.8	10.3	44.6	37.3	61.4	2987	29145
6	Dairyland Seed	HiDF-4073Q	Bt, CRW, GLY, LL	100	66.2	29.2	9.9	7.1	40.8	11.4	45.0	35.7	61.6	2922	28955
7	Dairyland Seed	HiDF-3522Q	Bt, CRW, GLY, LL	100	63.5	26.5	9.7	6.9	40.4	11.5	44.5	37.0	62.9	2977	28731
8	Legacy Seeds	LC484-20	BT, GLY	98	62.9	25.7	9.6	7.2	40.6	11.2	43.5	35.7	60.6	2974	28421
9	AgriGold	A630-04		100	65.9	27.9	9.5	7.0	39.0	11.1	42.6	38.0	61.6	2982	28182
10	Peterson Farms Seed	73P01	Bt, GLY	101	63.8	25.5	9.3	6.5	39.3	11.1	43.8	38.4	62.1	3035	28116
11	Legacy Seeds	LC-4248	BT, GLY	100	63.2	25.7	9.5	6.5	41.3	11.7	42.3	36.1	60.8	2943	27867
12	Golden Harvest	G99E68-5122	Bt, CRW, GLY, LL	99	65.6	28.4	9.8	7.2	42.3	12.3	42.4	33.1	61.7	2850	27811
13	AgriGold	A630-10STXRIB	Bt, CRW, GLY, LL	100	65.6	26.9	9.3	6.9	39.7	10.6	43.2	37.3	60.7	2981	27768
14	Dekalb	DKC50-87	Bt, CRW, GLY, LL	100	64.1	25.8	9.3	7.1	38.1	11.3	41.5	39.1	59.3	2983	27611
15	Thunder Seed	EXS21-98		98	64.4	26.0	9.2	7.4	42.2	12.2	42.0	33.7	60.6	2896	26749
16	AgriGold	A630-95-5222EZ	Bt, CRW, GLY, LL	100	64.9	25.5	9.0	7.4	42.2	11.6	43.0	34.1	59.3	2980	26715
17	Peterson Farms Seed	78G95	Bt, GLY	95	61.6	25.0	9.5	6.5	44.3	12.9	43.1	32.4	61.6	2802	26647
18	Golden Harvest	G96R61-5122	Bt, CRW, GLY, LL	96	65.5	26.4	9.1	7.3	41.6	11.4	42.6	34.0	61.1	2912	26556
19	Dekalb	DKC48-68	Bt, CRW, GLY, LL	98	63.9	25.1	9.0	7.0	41.0	12.1	41.2	36.3	61.4	2920	26270
20	Viking	42-92		100	62.5	22.6	8.5	6.9	42.1	11.6	44.3	35.0	61.6	2936	24951
21	Thunder Seed	EXS21-100		100	70.6	30.2	9.0	7.4	48.6	13.8	44.2	23.5	64.6	2666	24540
22	Thunder Seed	T4001 HDRR	GLY	100	69.2	31.0	9.4	6.9	48.6	14.3	42.7	24.6	65.9	2673	24395
23	Peterson Farms Seed	2LF01	GLY	101	69.5	30.0	9.2	7.1	50.0	14.9	41.8	22.8	66.4	2595	23817
			Mean		**64.9**	**27.2**	**9.5**	**7.1**	**41.7**	**11.8**	**43.0**	**34.4**	**61.6**	**2916**	**27843**
			LSD (0.20)		**1.4**	**2.0**	**0.7**	**0.3**	**3.5**	**1.4**	**1.4**	**4.0**	**1.6**	**134**	**2772**

[1]Bt,BL,CRW,GLY,LL,WBC traits contain genes for resistance to European corn borer, broad spectrum lepidopteran, Corn rootworm, glyphosate herbicide, Liberty herbicide and Western bean cutworm, respectively.
[2]Silage yield is whole-plant corn yield at harvest moisture, DM is whole plant corn yield at 100% dry matter.
[3]Crude protein as a % of DM.
[4]Neutral detergent fiber as a % of DM.
[5]Undigestible NDF at 240 hour as a % of NDF.
[6]Total tract NDF digestibility as a % of NDF.
[7]Starch as a % of DM.
[8]In situ rumen degradable starch at 7 hours as a % of starch.
[9]Milk production was estimated using the MILK2006 model developed at the University of Wisconsin. Refer to the results provided text for additional information.

CORN SILAGE: Continued from page 42

difference less than the LSD value probably is due to environmental factors.

Figures 1-8 summarize the relationship between silage dry matter yield and milk per ton for test sites at Hutchinson, Rochester, and Waseca. The figures also highlight those entries at each site that have a combination of high silage dry matter yields and milk production per ton.

Authors and Researchers

Thomas Hoverstad, Wade Ihlenfeld and Craig Sheaffer. ✻

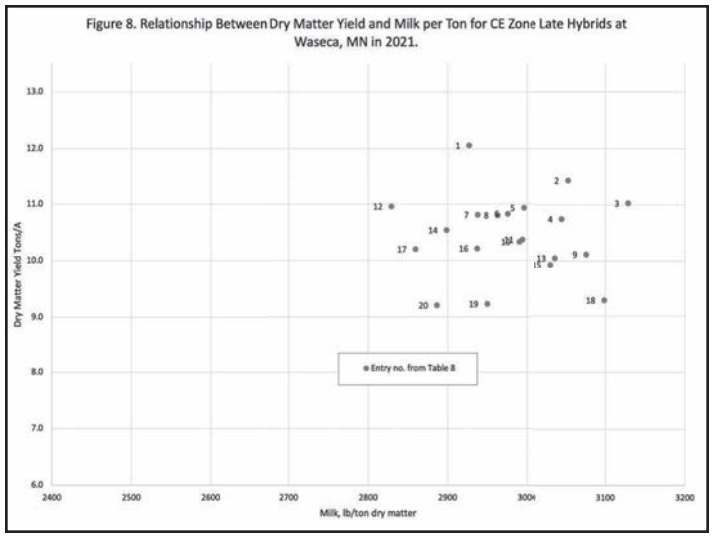


Table 8. Relative maturity (RM), whole plant moisture, dry matter (DM), silage yield, and quality traits for Central zone late RM corn hybrids planted at Waseca, MN in 2020.

						Yield, Tons/Acre[2]		Forage Quality (concentration), %						Milk Yield[9]	
No.	Source	Brand	Traits[1]	RM	Moisture %	Silage	DM	CP[3]	NDF[4]	uNDF[5]	TTNDFD[6]	Starch[7]	StarchD[8]	lb/Ton	lb/Acre
1	Golden Harvest	G07G73-5122	Bt, CRW, GLY, LL	107	65.3	34.3	12.1	7.1	41.6	11.7	42.6	35.2	62.3	2927	36397
2	Dekalb	DKC58-64	Bt, CRW, GLY, LL	108	65.0	32.6	11.4	7.1	38.9	10.8	42.5	37.8	61.2	3053	34898
3	AgriGold	A636-11STXRIB	Bt, CRW, GLY, LL	106	62.9	29.7	11.0	7.1	36.4	10.1	43.0	41.5	62.0	3129	34483
4	Golden Harvest	G10D21-5332	Bt, CRW, GLY, LL	110	63.1	29.2	10.7	7.5	38.6	10.3	43.6	38.3	59.3	3045	32814
5	Dairyland Seed	HiDF-4545Q	Bt, CRW, GLY, LL	105	64.7	30.9	10.9	7.2	40.4	11.1	45.4	36.4	64.7	2996	32761
6	Dairyland Seed	DS-4878AM	Bt,GLY,LL	108	66.1	32.0	10.8	7.4	39.9	11.2	44.0	37.0	64.0	2976	32217
7	Dairyland Seed	HiDF-4999Q	Bt, CRW, GLY, LL	109	66.9	32.6	10.8	7.2	40.8	10.7	43.5	34.9	63.1	2938	32008
8	Dairyland Seed	DS-4329AM	Bt,GLY,LL	105	65.5	31.3	10.8	7.1	40.4	10.8	44.6	36.4	61.8	2963	31997
9	Viking	51-04		104	61.1	26.0	10.1	6.8	37.1	10.2	41.1	40.8	58.0	3076	31173
10	Dairyland Seed	DS-5144Q	Bt, CRW, GLY, LL	109	64.5	29.0	10.3	7.0	38.8	10.5	43.5	38.1	63.0	2990	31121
11	Legacy Seeds	LC592-21	BT, GLY, LL	109	62.9	28.1	10.4	7.1	38.7	11.2	42.2	38.5	60.2	2994	31022
12	Legacy Seeds	LC623-21	Bt, CRW, GLY, LL	112	64.0	30.4	11.0	6.7	44.0	12.5	41.8	33.1	62.8	2829	30981
13	AgriGold	A635-54VT2RIB	Bt, GLY	105	63.4	27.4	10.0	6.7	38.6	10.6	41.9	39.2	61.5	3037	30585
14	Dairyland Seed	DS-4840AM	Bt,GLY,LL	106	65.6	30.5	10.5	7.1	41.6	11.8	42.8	34.9	62.0	2899	30541
15	Dekalb	DKC52-18	Bt, CRW, GLY, LL	102	61.0	25.5	9.9	7.1	37.5	10.1	42.4	40.4	59.0	3031	30075
16	AgriGold	A633-14STX	Bt, CRW, GLY, LL	103	66.1	30.1	10.2	7.1	39.8	10.7	43.3	36.3	62.4	2937	30048
17	Legacy Seeds	LC533-20	Bt, CRW, GLY, LL	103	61.2	26.2	10.2	6.9	43.4	12.8	40.8	33.8	60.5	2860	29257
18	Golden Harvest	G02K39-5122	Bt, CRW, GLY, LL	102	62.4	24.6	9.3	7.4	36.3	9.1	43.2	40.5	58.6	3099	28696
19	Legacy Seeds	LC555-21	Bt, CRW, GLY, LL	105	61.2	23.8	9.2	7.1	39.9	11.2	41.4	37.3	58.7	2950	27215
20	Dekalb	DKC56-65	Bt, CRW, GLY, LL	106	65.9	27.0	9.2	7.4	43.0	11.2	44.3	32.8	62.6	2886	26668
			Mean		**62.3**	**32.6**	**12.2**	**6.6**	**36.5**	**28.2**	**33.8**	**38.5**	**71.0**	**3,134**	**38,163**
			LSD (0.20)		**1.9**	**2.3**	**0.9**	**NS**	**3.4**	**3.0**	**2.1**	**3.5**	**2.5**	**165**	**3343**

[1]Bt,BL,CRW,GLY,LL,WBC traits contain genes for resistance to European corn borer, broad spectrum lepidopteran, Corn rootworm, glyphosate herbicide, Liberty herbicide and Western bean cutworm, respectively.

[2]Silage yield is whole-plant corn yield at harvest moisture, DM is whole plant corn yield at 100% dry matter.

[3]Crude protein as a % of DM.

[4]Neutral detergent fiber as a % of DM.

[5]Undigestible NDF at 240 hour as a % of NDF.

[6]Total tract NDF digestibility as a % of NDF.

[7]Starch as a % of DM.

[8]In situ rumen degradable starch at 7 hours as a % of starch.

[9]Milk production was estimated using the MILK2006 model developed at the University of Wisconsin. Refer to the results provided text for additional information.

2021 Oat field crop trial results

Oat varieties were sown in trials plots at Lamberton, Le Center, Rochester, Morris and Waseca in southern Minnesota (south of I-94). In northern Minnesota (north of I-94), trials were conducted in Crookston, Fergus Falls, Roseau and Stephen. Yield performance from single years should be viewed cautiously as environmental variability may significantly affect the yields in single locations or years. Maturity, height, and test weight data are presented as statewide averages from 2019-21 except where noted. Straw strength data is also a statewide average from the same period, but only from locations where lodging was present. Grain protein, oil and beta-glucan content are presented based on data from three locations from 2019 and 2020. In addition, entries were evaluated for disease resistance to crown rust, barley yellow dwarf virus (BYDV), and loose smut in specific inoculated nurseries. The severe drought in 2021 prevented crown rust development in our screening nursery, so ratings are based on data from 2019 and 2020.

Variety Selection

While yield is an impor-

OAT:
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Table 2. Disease characteristics of oat varieties.

Entry	Crown Rust[2] (1-9)	Loose Smut[3] (1-9)	BYDV[4] (1-9)
Antigo	4	3	4
CS Camden[1]	5	1	4
Deon	3	1	4
Esker 2020	4	1	3
Hayden	5	1	3
MN Pearl	4	1	4
ND Heart[1]	5	7	4
Reins	6	1	4
Rushmore	4	2	4
Saddle	3	1	4
Shelby 427	5	1	4
Streaker	5	1	4
Sumo	4	2	4
Warrior	3	2	4

[1]Line tested in 2020 and 2021.
[2]Tested in 2019, 2020, and 2021 with a mixed race population of crown rust; 1 = most resistant, 9 = most susceptible.
[3]Tested in 2019 and 2020; 1 = most resistant, 9 = most susceptible.
[4]Tested in 2021; 1 = most resistant, 9 = most susceptible.

Table 1. Origin and agronomic characteristics of oat varieties in Minnesota in multiple-year comparisons (2019-2021).

Entry	Origin	Year of Release	Legal Status	Seed Color	Days to Heading (days)	Plant Height (inches)	Straw Strength[4] (1-9)	Test Weight (lbs/bu)	Grain Protein[5,6] (%)	Grain Oil[5,6] (%)	Grain Beta-glucan[5,6] (%)
Antigo	WI	2017	PVP(94)	Yellow	55.8	30.4	3	36.9	17.3	7.1	5.2
CS Camden[1]	Meridian Seeds	2013	PVP(94)	White	61.2	31.0	2	31.5	14.2	6.5	5.1
Deon	MN	2014	PVP(94)	Yellow	59.5	31.4	3	35.4	14.3	6.8	4.8
Esker 2020	WI	2020	PVP(94)	Yellow	57.2	30.6	3	33.6	14.9	5.8	5.3
Hayden	SD	2015	PVP(94)	White	59.3	32.7	3	34.0	13.4	7.4	5.1
MN Pearl	MN	2018	PVP(94)	White	58.9	33.9	3	35.8	12.8	7.4	4.6
ND Heart[2]	ND	2020	PVP(94)	White	59.2	32.6	3	34.5	15.7	6.6	5.6
Reins	IL	2016	PVP(94)	White	56.0	29.3	2	35.7	14.9	6.2	4.8
Rushmore	SD	2020	Pending	White	57.4	30.8	3	36.6	15.0	6.0	4.9
Saddle	SD	2018	PVP(94)	White	55.4	30.3	1	35.2	14.9	6.1	4.5
Shelby 427	SD	2011	PVP(94)	White	56.7	32.0	3	36.1	14.1	7.0	4.6
Streaker[3]	SD	2016	PVP(94)	Hulless	57.4	30.0	4	42.5	14.9	7.1	5.1
Sumo	SD	2017	PVP(94)	White	54.1	30.7	3	34.9	16.4	5.8	4.5
Warrior	SD	2019	PVP(94)	White	57.8	28.8	2	35.4	14.7	6.4	4.5

[1]Line tested in 2020 and 2021; developed by Lantmannen Seed in Sweden.
[2]Line tested in 2020 and 2021.
[3]Hulless oat.
[4]1-9 scale where 1=most resistant, 9=most susceptible
[5]12% grain moisture.
[6]Trait measured for 3 locations in 2019 and 3 locations in 2020.

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tant selection criterion, grain quality and disease resistance should also be considered. Millers have grain quality and variety preferences which can be considered if that is the intended target. Crown rust continues to be a major limiting factor to oat production in Minnesota that must be managed to achieve optimal yield. 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 without disease infection. All disease scores are on a "1-9" scale where "1" is very resistant and "9" is very susceptible. Crown rust resistance was evaluated in the Buckthorn Nursery in St. Paul by the USDA-ARS using an exceptionally aggressive crown rust population in 2019 and 2020. 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.

Other important diseases include BYDV and smut, which were evaluated in inoculated nurseries at the University of Illinois and the University of

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Table 3. Relative grain yield of oat varieties in Minnesota in single-year (2021) and multiple-year comparisons (2019-2021).

	Northern Minnesota			Southern Minnesota			Statewide		
Entry	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr
	% of mean								
Antigo	85	86	89	97	96	98	91	91	94
CS Camden[1]	111	111	-	104	101	-	107	106	-
Deon	116	110	110	109	109	109	112	109	110
Esker 2020	101	100	102	104	102	103	102	101	102
Hayden	112	113	112	114	111	106	113	112	109
MN Pearl	116	115	116	108	112	113	112	114	114
ND Heart[2]	103	102	-	92	94	-	97	98	-
Reins	85	94	95	96	98	98	91	96	97
Rushmore	106	112	112	105	109	111	105	111	112
Saddle	93	95	98	91	94	99	92	94	98
Shelby 427	98	97	97	106	101	98	102	99	98
Streaker[3]	76	78	81	79	77	72	78	78	76
Sumo	88	80	81	94	94	93	91	88	87
Warrior	110	108	106	103	102	100	106	105	103
Mean (Bu/Acre)	**108**	**125**	**119**	**94**	**110**	**114**	**100**	**117**	**116**
LSD (0.05)	**16.4**	**12.5**	**11.1**	**13.5**	**10.1**	**9.4**	**10.5**	**8.1**	**7.2**
# of Environments	**4**	**8**	**11**	**5**	**10**	**15**	**9**	**18**	**26**

[1]Data presented from 2020 and 2021, see previous years' reports for additional data.
[2]Line was tested in 2020 and 2021 only.
[3]Hulless oat.

Table 4. Relative grain yield of oat varieties in Northern Minnesota locations in single-year (2021) and multiple-year comparisons (2019-2021).

	Crookston		Fergus Falls[4]		Roseau		Stephen	
Entry	2021	3 Yr	2021	2 Yr	2021	3 Yr	2021	3 Yr
	% of mean							
Antigo	100	102	89	96	65	88	85	85
CS Camden[1]	116	-	110	-	99	-	113	-
Deon	105	100	90	100	116	114	113	115
Esker 2020	107	-	83	-	105	-	101	-
Hayden	119	121	111	115	123	109	106	108
MN Pearl	111	110	120	126	112	120	116	118
ND Heart[2]	96	-	102	-	98	-	107	-
Reins	98	96	101	92	106	104	101	108
Rushmore	113	-	115	-	117	-	125	-
Saddle	89	99	93	91	100	106	105	105
Shelby 427	98	102	95	95	99	98	94	95
Streaker[3]	75	84	101	101	72	75	68	75
Sumo	75	69	61	76	84	92	81	90
Warrior	97	-	116	-	121	-	99	-
Mean (Bu/Acre)	**165**	**132**	**146**	**143**	**101**	**118**	**155**	**138**
LSD (0.05)[5]	**26.9**	**18.6**	**37.8**	**33.0**	**34.8**	**24.6**	**25.9**	**20.2**

[1]Data presented from 2020 and 2021, see previous years' reports for additional data.
[2]Line was tested in 2020 and 2021 only.
[3]Hulless oat.
[4]Location was tested in 2020 and 2021.
[5]A large LSD suggests large variability from year to year for the specific location.

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Minnesota, respectively. Varieties susceptible to BYDV (rating > 3) should be selected with caution particularly in the southern Minnesota, where aphid disease transmitters are more common early in the season. A seed treatment and certified seed should be used to manage smut. Disease resistance may be a driving factor if pesticides are not economical or if the intended production system is organic.

Oat
Planting Rate and Date

Bushel Weight, Pounds	32
Seeds/Pound	16,200
Planting Rate, Pounds/Acre	80
Planting Rate, Seeds/Sq. Ft	28
Planting Date	Early Spring

PVP Status

The U.S. Plant Variety Protection Act (PVP) status is listed for all varieties tested. PVP(94) notation indicates that seed of that variety may not be sold by a grower without the permission of the variety's owner. If the PVP is pending, consider the variety as having PVP(94) protection.

Authors and Researchers

This reports is authored by: Kevin Smith, Ruth Dill-Macky, Karen Beaubien and Jochum Wiersma.

Test plot establishment and management are supervised by: Dimitri von Ruckert, Curtis Reese, Mike Leiseth, Steve Quiring and Donn Vellekson. ✻

Table 5. Relative grain yield of oat varieties in Southern Minnesota locations in single-year (2021) and multiple-year comparisons (2019-2021).

	Becker[4]	Kimball[5]	Lamberton		Le Center		Rochester		St. Paul[6]	Waseca	
Entry	2021	2019	2021	3 Yr	2021	3 Yr	2021	2 Yr	2020	2021	3 Yr
					% of mean						
Antigo	84	104	81	94	102	101	109	107	84	101	95
CS Camden[1]	113	-	107	-	106	-	78	-	99	147	-
Deon	96	99	114	120	105	103	110	109	109	126	117
Esker 2020	114	98	117	106	87	101	98	101	100	116	107
Hayden	119	102	110	93	110	109	116	109	118	115	102
MN Pearl	104	104	119	120	106	110	94	104	128	140	123
ND Heart[2]	97	-	93	-	95	-	100	-	91	56	-
Reins	93	98	92	89	103	98	96	103	102	87	101
Rushmore	101	108	98	114	104	112	115	113	98	102	114
Saddle	93	112	80	88	100	107	103	102	97	53	89
Shelby 427	111	99	99	84	103	105	115	103	104	89	88
Streaker[3]	72	78	85	71	77	71	79	70	77	87	74
Sumo	97	90	104	106	98	91	82	90	79	94	92
Warrior	106	107	102	115	103	94	106	90	113	89	98
Mean (Bu/Acre)	**81**	**154**	**95**	**101**	**123**	**139**	**126**	**127**	**127**	**46**	**82**
LSD (0.05)[7]	**17.6**	**37.6**	**21**	**22**	**21.6**	**24**	**18.8**	**21.7**	**12.7**	**12.6**	**19.2**

[1]Data presented from 2020 and 2021, see previous years' reports for additional data.
[2]Line was tested in 2020 and 2021 only.
[3]Hulless oat.
[4]Line was tested in 2021 only.
[5]Location was tested in 2019 only.
[6]Location was tested in 2020 only.
[7]A large LSD suggests large variability from year to year for the specific location.

2021 Soybean field crop trial results

Each year, Minnesota Agricultural Experiment Station scientists conduct performance tests of appropriately adapted public and private soybean entries. Companies are charged a fee for each entry they enter to partially cover the costs of conducting these tests. One of the stipulations of the testing program is that the company is marketing or intends to begin marketing the entry in the next growing season. This information is also available electronically at www.soybeans.umn.edu and varietytrials.umn.edu/soybean.

The 2021 season was abnormally dry across much of the state, especially in the northwestern part of the state. There were scattered and timely precipitation events that greatly helped the crop. Overall, yields in the trials were higher than expected based on localized timely rainfall and strong performance from today's elite varieties. The locations that experienced the worst yield reductions included Crookston and Rosemount. Another casualty of the dry year was lack of iron deficiency chlorosis in our dedicated nurseries. We observed very little pressure and therefore have few results to report.

The 2021 Variety Trials were generally planted and harvested on time. Data was collected from all locations except from Thief River Falls where the ground was too wet for harvest in the fall.

Tables 1-4 provide results from tests of available conventional, special-purpose, and transgenic entries adapted to the far northern, northern, central, and southern production zones. The map shows test locations and zone boundaries. All of these tests were planted between May 5 and May 29 at planting rates of 174,000 seeds/acre.

Location	*2021 Planting Date*
Becker	May 5
Crookston	May 18
Danvers	May 12
Fairfax	May 16
Glyndon	May 18
Lamberton	May 15
Moorhead	May 21
Roseau	May 29
Rosemount	May 19
Rosemount SCN	May 26
Shelly	May 22
Waseca	May 10
Waseca SCN	May 11
Westbrook	May 16

Locations of 2020 soybean trials.

Herbicides were used as necessary for good weed control. Row spacings were 24 inches at Crookston and 30 inches at all other locations. Plots were machine harvested using a small plot combine.

Tables 5-10 provide characteristics and performance data from special-purpose soybean entry tests. These tests were conducted to provide reliable data for growers who are interested in producing special-purpose soybeans, which are typically grown under contract.

Table 11 provides important characteristics of publicly developed entries in the 2021 tests as well as those for which seed is available.

Tables 12-14 provide results from the performance tests of soybean cyst nematode (SCN) resistant entries in infested field sites near Danvers, Fairfax, Lamberton, Rosemount, and Waseca. SCN pressure should be gauged by comparing a susceptible check to resistant varieties within that same range of maturity (+/- 5 days). This year not enough varieties were entered into the Northern SCN Tests to justify a separate test. The few varieties entered into this test were merged into the general test displayed in Table 2.

Tables 15 displays results from greenhouse tests conducted by the Nematology Laboratory at the University of Minnesota Southern Research and Outreach Center in Waseca, MN. Plants were grown in soil inoculated with an HG type 7 (race 6) population of soybean cyst nematode in 2021.

To better understand and use the data provided in these tables, please carefully read the following additional information.

Seed Treatments and Transgenic Traits

Entrants were allowed to enter treated seed in 2021. The type of seed treatment, as provided by the originator, is designated as follows:

AC = Acceleron
AMS = Agrishield Max + Saltro
CM = Cruiser Maxx + Ilevo
CMVC = Cruiser Maxx + Vibrance + Clariva pn
MA = Maximum ArmourGuard
Met/Azo = Metalaxyl/Azoxystrobin
OPVI = Obvious Plus, Poncho/Votivo+ ILeVO
LI = Lumigen+Ilevo
PS = Peterson Select
FVM = Fortenza Vibrance Maxx

Research indicates that under some conditions seed treatments can affect the final yield. The exact situations are not always clear but when comparing entries note if a seed treatment was used on the seed being tested.

In some tables the transgenic trait is indicated in a separate column using the following designations:

CV = conventional variety (non-transgenic)
E3 = Enlist E3 (glyphosate, glufosinate and 2,4-D tolerant)
LL = LibertyLink (glufosinate tolerant)
GT = glyphosate tolerant R2 = Roundup Ready 2 Yield (glyphosate tolerant)
R2-Xt = glyphosate and dicamba tolerant
XF = Xtendflex (dicamba, glyphosate and glufosinate tolerant)
LLGT27 = glyphosate, glufosinate, and HPPD/Group 27 herbicide tolerant
GT27 = glyphosate and HPPD/Group 27 tolerant

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Names and email addresses of seed company representatives that entered varieties into the 2021 trials.

Company	Rep Name	Contact Email
AgriGold	Justin Warren	justin.warren@agrigold.com
Albert Lea Seed/Viking Seed	Jake Hansen	jake@alseed.com
Anderson Seeds	Kelsey Anderson	kelsey.anderson528@gmail.com
Bayer Crop Science	Harmon Wilts	harmon.wilts@bayer.com
Brushvale Seed, Inc.	Travis Meyer	travis@brushvaleseed.com
Credenz Soybean Seed	Nick Weidenbenner	nick.weidenbenner@basf.com
Dairyland Seed	Rodney Moran	rmoran@dairylandseed.com
Federal Hybrids	Dan Swalla	dan.swalla@federalhybrids.com
GDM Seeds	Jonathan Linke	jlinke@gdmseeds.com
Minnesota Ag Experiment Station (Minnesota AES)	Roger Wippler	wippl002@umn.edu
P3 Genetics	Dennis Schultze	dennis@petersonfarmsseed.com
Peterson Farms Seed	Dennis Schultze	dennis@petersonfarmsseed.com
Prograin	Alexandre Payeur	alexandre.payeur@prograin.qc.ca
Proseed, Inc.	Cole Peterson	cole.peterson@proseed.net
Richland IFC, Inc.	Jake Noll	jake@richlandifc.com
Sevita International	John Van Herk	johnv@sevita.com
Xitavo Soybean Seed	Nick Weidenbenner	nick.weidenbenner@basf.com

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Relative Maturity and Calendar Dates of Maturity

Soybeans are photoperiod sensitive; that is, they respond to changing day length. The actual calendar date of maturity achievement is affected by latitude. Each entry has a narrow range (about 100 miles) of north/south adaptation. Soybean yield and quality are best achieved when physiological maturity occurs before a hard frost. Maturity is determined visually by noting the calendar date when 95 percent of the pods show their genetically programmed mature color. The dates for 2021 are provided in the tables under the column heading "Maturity Date." Harvest dates are typically 7-14 days later depending upon drying conditions. Almost all entries were essentially mature before a hard frost.

Relative maturity ratings are also provided for each entry. These ratings consist of a number for the maturity group designations (000, 00, 0, 1, 2) followed by a decimal and another number, ranging from 0-9, which indicates a ranking within each maturity group. For example, the entry MN0101 indicates a 0.1, making it an early group 0, while MN0901, with a 0.9 rating, is the latest group 0. The values for public entries are developed after observing them for several years in many locations. Relative maturity ratings for private entries in these tables were provided by their originators and were developed in a similar manner.

Yield

Because maturity is a very important attribute, entries are ordered in the tables according to their actual 2021 calendar date of maturity.

Later maturing entries usually can be expected to have higher yields than earlier maturing types. If you wish to compare yields, do so only between entries with similar calendar dates of maturity, usually within 3-5 days. More reliable comparisons can be made using yields from several consecutive years. All yield determinations were made from replicated tests harvested with a plot combine.

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Table 1. Performance and characteristics of transgenic, conventional and special purpose soybean entries evaluated in the far northern zone. Trial was conducted in Crookston and Roseau.

Entry	Originator	Maturity Date	Yield % of Mean 2020	Yield % of Mean 2021	% of Mean Protein	% of Mean Oil	Maturity Rating	Phyto. Gene	Chlorosis Score†	Seed Treatment	Trans. Trait
22XF006	Peterson Farms Seed	9/7	—	88	98	107	00.6	Rps1k	NA	PS	R2-Xt
21X007	Peterson Farms Seed	9/9	—	90	96	103	00.7	Rps1c	NA	PS	R2-Xt
XT20-07	Proseed	9/9	103	96	96	104	00.7	Rps1c	NA	CMVC	R2-Xt
Liska	Prograin	9/9	83	90	110	92	00.3	Rps1c	NA	Met/Azo	CV
22XF009	Peterson Farms Seed	9/9	—	100	96	104	00.9	Rps1k	NA	PS	R2-Xt
EL80-093N	Proseed	9/9	—	101	99	100	00.9	Rps1a	NA	CMVC	E3
Maya	Prograin	9/11	—	93	109	90	00.7	Rps1c	NA	Met/Azo	CV
19EN008	Peterson Farms Seed	9/11	—	100	93	102	00.8	S	NA	PS	E3
Hana	Prograin	9/11	99	100	108	95	0.1	S	NA	Met/Azo	CV
P00A75X	Pioneer	9/13	—	106	96	110	0.0	Rps1k	NA	None	R2-Xt
AG11XF2	Bayer Crop Science	9/24	—	122	98	97	1.1	Rps3a	NA	AC	R2-Xt
AG10XF1	Bayer Crop Science	9/25	—	115	102	97	1.0	Rps3a	NA	AC	R2-Xt
Mean		**9/12**	**37 bu/a**	**35 bu/a**	**33%**	**19%**					
LSD 25%		**1d**	**7%**	**8%**	**2%**	**3%**					

LSD numbers beneath yield columns indicate whether the difference between yield is due to genetics or other factors, such as variations in environment. If a yield difference between two entries equals or exceeds the LSD value, the higher yielding entry probably was superior in yield. A difference less than the LSD value is likely due to environmental factors.

— indicates "not specified."

†NA indicates ratings could not be made this year because of lack of IDC pressure in the field.

Table 2. Performance and characteristics of transgenic, conventional and special purpose soybean entries evaluated in the northern zone. Trial was conducted in Crookston, Moorhead and Shelly.

Entry	Originator	Maturity Date	Yield % of Mean 2020	Yield % of Mean 2021	% of Mean Protein	% of Mean Oil	Maturity Rating	Phyto. Gene	Chlorosis Score†	Seed Treatment	Trans. Trait
DSR-0119E	Dairyland Seed	9/04	—	90	96	107	0.1	Rps1c	NA	LI	E3
P07A18X	Pioneer	9/06	—	107	100	103	0.7	Rps1k	NA	None	R2-Xt
22XF03	Peterson Farms Seed	9/06	—	108	100	103	0.3	Rps1c	NA	PS	R2-Xt
2201E	P3 Genetics	9/07	—	94	99	103	0.1	Rps3a	NA	PS	E3
2106E	P3 Genetics	9/07	—	107	99	102	0.6	Rps3a	NA	PS	E3
Hana	Prograin	9/08	—	84	107	96	0.1	S	NA	Met/Azo	CV
P03A17X	Pioneer	9/08	—	102	99	109	0.3	Rps1c	NA	None	R2-Xt
EL90-33N	Proseed	9/08	—	101	99	101	0.3	S	NA	CMVC	E3
22XF06	Peterson Farms Seed	9/08	—	107	100	96	0.6	Rps1c	NA	PS	R2-Xt
DSR-0645E	Dairyland Seed	9/09	110	101	96	105	0.4	Rps3a	NA	LI	E3
XT80-20N	Proseed	9/09	105	99	97	101	0.2	Rps1c	NA	CMVC	R2-Xt
MK0249	Richland IFC, Inc.	9/10	—	91	98	102	0.2	S	NA	None	CV
21XF07	Peterson Farms Seed	9/10	—	98	100	99	0.7	Rps3a	NA	PS	R2-Xt
AG11XF2	Bayer Crop Science	9/11	—	99	99	98	1.1	Rps3a	NA	AC	R2-Xt
MK808CN	Richland IFC, Inc.	9/12	89	105	98	103	0.8	Rps1c	NA	None	CV
MK0508	Richland IFC, Inc.	9/12	86	107	99	95	0.8	S	NA	None	CV
Marula	Prograin	9/13	98	96	108	92	0.6	Rps1c	NA	Met/Azo	CV
MK0603	Richland IFC, Inc.	9/13	87	93	102	90	0.6	S	NA	None	CV
CZ 0661GTLL	Credenz Soybean Seed	9/15	—	93	100	103	0.6	Rps1k	NA	OPVI	LLGT27
DSR-0660E	Dairyland Seed	9/16	—	100	100	98	0.6	S	NA	LI	GT27
AG10XF1	Bayer Crop Science	9/16	—	114	102	98	1.0	Rps3a	NA	AC	R2-Xt
XO 0602E	Xitavo Soybean Seed	9/17	—	104	101	96	0.6	S	NA	OPVI	E3
Mean		**9/10**	**42 bu/a**	**31 bu/a**	**33%**	**19%**					
LSD 25%		**NA††**	**7%**	**7%**	**2%**	**2%**					

LSD numbers beneath yield columns indicate whether the difference between yield is due to genetics or other factors, such as variations in environment. If a yield difference between two entries equals or exceeds the LSD value, the higher yielding entry probably was superior in yield. A difference less than the LSD value is likely due to environmental factors.

— indicates "not specified."

†NA indicates ratings could not be made this year because of lack of IDC pressure in the field.

†† LSD not estimable because of lack of replication. Maturity dates in this trial should be treated with caution because of lack of replication.

Table 3. Performance and characteristics of transgenic, conventional and special purpose soybean entries evaluated in the central zone. Trial was conducted in Becker, Danvers, and Rosemount.

Entry	Originator	Maturity Date	Yield % of Mean 2020	Yield % of Mean 2021	% of Mean Protein	% of Mean Oil	Maturity Rating	Phyto. Gene	Chlorosis Score	Seed Treatment	Trans. Trait
DSR-1820E	Dairyland Seed	9/20	—	106	99	102	1.8	Rps1k	2.3	LI	E3
O.1718N	Albert Lea Seed/Viking Seed	9/21	—	112	99	101	1.7	Rps1k	2.0	None	CV
XO 1212E	Xitavo Soybean Seed	9/21	—	116	101	99	1.2	Rps1c	2.0	OPVI	E3
AG18XF1	Bayer Crop Science	9/21	—	114	97	100	1.8	S	2.0	AC	R2-Xt
XO 1822E	Xitavo Soybean Seed	9/21	—	112	99	99	1.8	Rps3a	2.8	OPVI	E3
V1821	Albert Lea Seed/Viking Seed	9/23	—	117	99	98	1.8	Rps1c	1.0	None	CV
XO 1971E	Xitavo Soybean Seed	9/23	92	113	98	97	1.9	S	3.0	OPVI	E3
P18A33X	Pioneer	9/23	—	112	97	105	1.8	Rps1k	1.8	None	R2-Xt
XO 1761E	Xitavo Soybean Seed	9/23	109	108	98	103	1.7	Rps1k	2.3	OPVI	E3
MK373	Richland IFC, Inc.	9/25	—	74	102	99	2.0	S	2.3	None	CV
DSR-2424E	Dairyland Seed	9/25	—	106	101	99	2.4	Rps1k	1.5	LI	E3
AG21XF0	Bayer Crop Science	9/25	—	110	103	102	2.1	Rps1c	2.5	AC	R2-Xt
Mean		**9/14**	**60 bu/a**	**49 bu/a**	**34%**	**19%**			**2.2**		
LSD 25%		**2d**	**9%**	**8%**	**2%**	**3%**					

LSD numbers beneath yield columns indicate whether the difference between yield is due to genetics or other factors, such as variations in environment. If a yield difference between two entries equals or exceeds the LSD value, the higher yielding entry probably was superior in yield. A difference less than the LSD value is likely due to environmental factors.
— indicates "not specified."

Table 4. Performance and characteristics of transgenic, conventional and special purpose soybean entries evaluated in the southern zone. Trial was conducted in Waseca, Lamberton and Westbrook.

Entry	Originator	Maturity Date	Yield % of Mean 2020	Yield % of Mean 2021	% of Mean Protein	% of Mean Oil	Maturity Rating	Phyto. Gene	Chlorosis Score†	Seed Treatment	Trans. Trait
O.1718N	Albert Lea Seed/Viking Seed	9/24	—	102	99	99	1.7	Rps1k	NA	None	CV
A200E3	Anderson Seeds	9/24	114	114	96	104	2.0	Rps1k	NA	None	E3
217RXT	Anderson Seeds	9/25	108	112	102	99	2.0	Rps1c	NA	None	R2-Xt
XO 1971E	Xitavo Soybean Seed	9/25	106	99	100	99	1.9	S	NA	OPVI	E3
XO 2181E	Xitavo Soybean Seed	9/25	103	100	98	104	2.1	Rps1k	NA	OPVI	E3
AG21XF0	Bayer Crop Science	9/26	—	92	105	101	2.1	Rps1c	NA	AC	R2-Xt
O.2244AT	Albert Lea Seed/Viking Seed	9/26	101	99	102	99	2.2	S	NA	None	CV
2340KN	Albert Lea Seed/Viking Seed	9/27	103	100	98	103	2.3	Rps1k	NA	None	CV
PA23A15X	Pioneer	9/27	—	100	98	100	2.3	Rps1c	NA	None	R2-Xt
DSR-2424E	Dairyland Seed	9/28	102	98	100	99	2.4	Rps1k	NA	LI	E3
A2121XF	Anderson Seeds	9/28	—	107	105	100	2.0	Rps3a	NA	None	XF
2155N	Albert Lea Seed/Viking Seed	9/29	102	107	101	97	2.1	S	NA	None	CV
MK373	Richland IFC, Inc.	9/29	—	69	104	93	2.0	S	NA	None	CV
P24T35E	Pioneer	9/29	—	91	98	100	2.4	Rps1k	NA	None	E3
CZ 2121GTLL	Credenz Soybean Seed	9/29	—	96	98	102	2.1	S	NA	OPVI	LLGT27
Mean		**9/21**	**76 bu/a**	**65 bu/a**	**34%**	**19%**					
LSD 25%		**2d**	**4%**	**3%**	**2%**	**3%**					

LSD numbers beneath yield columns indicate whether the difference between yield is due to genetics or other factors, such as variations in environment. If a yield difference between two entries equals or exceeds the LSD value, the higher yielding entry probably was superior in yield. A difference less than the LSD value is likely due to environmental factors.
— indicates "not specified."
†NA indicates ratings could not be made this year because of lack of IDC pressure in the field.

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Multi-location data are necessary for determining true differences between varieties, and therefore only multi-location averages are reported.

The yield information is presented as a percent of the mean of the test. The actual mean value is given at the bottom of each table.

Values over 100 indicate the entry had a yield greater than the mean while those less than 100 have a yield less than the mean. LSD values associated with data in these tables are measures of variability within the trials. The LSD numbers beneath the yield columns indicate whether the difference between yields is due to genetics or other factors, such as environmental variation and measurement error. If yield differences between two entries equals or exceeds the LSD value, the higher-yielding entry probably was superior in yield. A difference less than the LSD value is probably due to environmental and/or measurement factors. The LSD values are given on the percent of mean data, not the actual yields. A 25 percent level of significance is used in all tables contained in this report. This means that there is a 25 percent probability that yield differences exceeding the stated LSD are not true yield differences.

Numerical Score	Rating
1 to 2	Tolerant (T)
2.1 to 3	Moderately Tolerant (MT)
3.1 to 4	Moderately Susceptible (MS)
4.1 to 5	Susceptible (S)

Chlorosis

Iron deficiency chlorosis (IDC) is a yield-limiting condition of soybeans grown in alkaline soils with high calcium carbonate or calcium sulfate ions present, making iron unavailable and causing soybean plants to turn yellow. This yellowing is visually scored on a 1 to 5 scale, where 1 indicates no yellowing and 5 indicates severe yellowing and necrosis that may even include death of the plant.

Research has shown that for every unit increase in chlorosis, a 20 percent reduction in yield may occur. For example, a plot rated as a

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Table 5. Characteristics of special purpose soybean entries evaluated in the northern zone. Trial was conducted in Crookston, Moorhead, Shelly and Glydon.

Entry	Originator	Maturity Date	Special Characteristics	Hilum Color	Phyto. Gene	Seeds/lb	Trans. Trait
MN0083	Minnesota AES	8/31	General purpose	Yellow	Rps6	4,095	CV
M10-159-1007	Minnesota AES	8/31	Natto	Yellow	Rps1a	6,402	CV
M11-320-1018	Minnesota AES	8/31	Natto	Yellow	Rps1k	5,903	CV
M08-450148	Minnesota AES	9/07	Natto	Yellow	S	5,165	CV
ND Stutsman	No Dakota AES	9/09	General purpose	Yellow	Rps1c	3,247	CV
Panorama	Sevita International	9/10	Tofu	Yellow	S	3,051	CV
MN0303SP	Minnesota AES	9/10	Natto	Yellow	Rps1a	6,887	CV
M10-159-4011	Minnesota AES	9/10	Natto	Yellow	Rps1c	6,887	CV
M13-171089	Minnesota AES	9/13	Natto	Yellow	Rps1c	6,227	CV
Astor	Sevita International	9/14	Tofu	Yellow	S	2,539	CV
MN0205SP	Minnesota AES	9/14	Natto	Yellow	S	5,225	CV
M03-238028	Minnesota AES	9/14	Natto	Yellow	Rps1a	6,684	CV
M06-260048	Minnesota AES	9/14	Natto	Yellow	Rps1a	6,494	CV
M10-159-4007	Minnesota AES	9/14	Natto	Yellow	Rps1a	5,754	CV
M12-395086	Minnesota AES	9/14	Tofu	Yellow	S	2,261	CV
MN1012SP	Minnesota AES	9/15	Natto	Yellow	Rps1a	5,903	CV
M07-257020	Minnesota AES	9/15	Natto, SCN	Yellow	S	4,288	CV
M10-159-2022	Minnesota AES	9/15	Natto	Yellow	Rps1a	6,402	CV

Table 6. Performance and characteristics of special purpose soybean entries evaluated in the northern zone. Trial was conducted in Crookston, Moorhead,Shelly and Glyndon.

Entry	Originator	Maturity Date	% of Mean Yield	% of Mean Protein	% of Mean Oil	Chlorosis Score†
MN0083	Minnesota AES	8/31	97	101	104	NA
M10-159-1007	Minnesota AES	8/31	100	105	102	NA
M11-320-1018	Minnesota AES	8/31	93	99	102	NA
M08-450148	Minnesota AES	9/07	112	98	103	NA
ND Stutsman	No Dakota AES	9/09	136	96	104	NA
Panorama	Sevita International	9/10	98	104	93	NA
MN0303SP	Minnesota AES	9/10	92	99	100	NA
M10-159-4011	Minnesota AES	9/10	108	99	98	NA
M13-171089	Minnesota AES	9/13	96	98	100	NA
Astor	Sevita International	9/14	83	108	98	NA
MN0205SP	Minnesota AES	9/14	82	100	100	NA
M03-238028	Minnesota AES	9/14	102	101	102	NA
M06-260048	Minnesota AES	9/14	91	97	104	NA
M10-159-4007	Minnesota AES	9/14	89	97	104	NA
M12-395086	Minnesota AES	9/14	103	107	96	NA
MN1012SP	Minnesota AES	9/15	98	96	96	NA
M07-257020	Minnesota AES	9/15	103	101	95	NA
M10-159-2022	Minnesota AES	9/15	117	94	101	NA
Mean		**9/10**	**29 bu/a**	**34%**	**19%**	
LSD 25%		**3d**	**6%**	**2%**	**2%**	

LSD numbers beneath yield columns indicate whether the difference between yield is due to genetics or other factors, such as variations in environment.
If a yield difference between two entries equals or exceeds the LSD value, the higher yielding entry probably was superior in yield.
A difference less than the LSD value is likely due to environmental factors.
†NA indicates ratings could not be made this year because of lack of IDC pressure in the field.

Table 7. Characteristics of special purpose soybean entries evaluated in the central zone. Trial was conducted in Danvers and Rosemount.

Entry	Originator	Maturity Date	Special Characteristics	Hilum Color	Phyto. Gene	Seeds/ lb	Trans. Trait
M08-450148	Minnesota AES	8/26	Natto	Yellow	S	4,545	CV
M03-238028	Minnesota AES	8/30	Natto	Yellow	Rps1a	5,981	CV
M13-172108	Minnesota AES	8/30	Natto	Yellow	S	4,785	CV
M10-159-4007	Minnesota AES	8/31	Natto	Yellow	Rps1a	5,612	CV
MN1012SP	Minnesota AES	9/04	Natto	Yellow	Rps1a	5,754	CV
MN0811CN	Minnesota AES	9/05	SCN, General purpose	Black	Rps1k	3,318	CV
MN0810CN	Minnesota AES	9/06	SCN, General purpose	Yellow	S	3,270	CV
M07-257020	Minnesota AES	9/07	SCN, Natto	Yellow	S	4,413	CV
MK1016	Richland IFC, Inc.	9/07	Natto	Yellow	Rps1a	5,612	CV
M10-159-2022	Minnesota AES	9/08	Natto	Yellow	Rps1a	5,981	CV
M10-161065	Minnesota AES	9/08	Natto	Yellow	Rps1c	5,225	CV
M07-303013	Minnesota AES	9/09	Tofu	Yellow	S	1,994	CV
BS1282	Brushvale Seed, Inc.	9/10	Hi Oleic	Yellow	S	3,418	CV
M13-170064	Minnesota AES	9/10	Natto	Yellow	S	5,411	CV
BS1512	Brushvale Seed, Inc.	9/11		Yellow	Rps1k	2,914	CV
Skyline	Sevita International	9/11	Tofu	Yellow	S	2,568	CV
M11-314101	Minnesota AES	9/11	High Protein	Yellow	Rps1k	2,284	CV
M11-297035	Minnesota AES	9/12	Tofu	Yellow	Rps1c	1,762	CV
M08-332003	Minnesota AES	9/14	High Protein	Buff	S	2,877	CV
BS1146	Brushvale Seed, Inc.	9/16	High protein/tofu	Yellow	S	2,859	CV
MN1807CN	Minnesota AES	9/19	SCN, General purpose	Buff	Rps1c	2,877	CV

Table 8. Performance and characteristics of special purpose soybean entries evaluated in the central zone. Trial was conducted in Danvers and Rosemount.

Entry	Originator	Maturity Date	% of Mean			Chlorosis Score†
			Yield	Protein	Oil	
M08-450148	Minnesota AES	8/26	90	96	107	NA
M03-238028	Minnesota AES	8/30	89	98	103	NA
M13-172108	Minnesota AES	8/30	97	98	103	NA
M10-159-4007	Minnesota AES	8/31	78	98	103	NA
MN1012SP	Minnesota AES	9/04	54	97	98	NA
MN0811CN	Minnesota AES	9/05	111	96	102	NA
MN0810CN	Minnesota AES	9/06	105	102	98	NA
M07-257020	Minnesota AES	9/07	103	98	99	NA
MK1016	Richland IFC, Inc.	9/07	85	101	100	NA
M10-159-2022	Minnesota AES	9/08	91	98	102	NA
M10-161065	Minnesota AES	9/08	74	100	100	NA
M07-303013	Minnesota AES	9/09	106	104	97	NA
BS1282	Brushvale Seed, Inc.	9/10	110	101	99	NA
M13-170064	Minnesota AES	9/10	107	98	98	NA
BS1512	Brushvale Seed, Inc.	9/11	112	101	101	NA
Skyline	Sevita International	9/11	118	101	100	NA
M11-314101	Minnesota AES	9/11	116	102	100	NA
M11-297035	Minnesota AES	9/12	127	101	98	NA
M08-332003	Minnesota AES	9/14	102	111	89	NA
BS1146	Brushvale Seed, Inc.	9/16	114	101	100	NA
MN1807CN	Minnesota AES	9/19	111	98	101	NA
Mean		**9/8**	**38 Bu/A**	**35%**	**20%**	
LSD 25%		**1d**	**8%**	**2%**	**3%**	

LSD numbers beneath yield columns indicate whether the difference between yield is due to genetics or other factors, such as variations in environment. If a yield difference between two entries equals or exceeds the LSD value, the higher yielding entry probably was superior in yield. A difference less than the LSD value is likely due to environmental factors.

†NA indicates ratings could not be made this year because of lack of IDC pressure in the field.

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3 may yield 20 percent less than a plot given a rating of 2. All IDC ratings in tables are from tests conducted on high lime (high pH) soils near Danvers and Graceville, Minn., in 2021. Limited IDC pressure in 2021 prevented us from obtaining reliable scores and therefore results are not available for most trials.

$$\frac{100\text{-desired moisture}}{87} \times \text{protein or oil value given in the table}$$

The value of a bushel of soybeans (APV) based on its oil and protein content can be calculated by:

$$APV = \frac{60\,[Po\,(X) + Pm\,(Y)]}{.44}$$

Where:

APV = Approximate value of a bushel of soybeans

Po = soybean oil price (in $ per pound)

Pm = price of 44% meal (in $ per pound)*

X = oil content at 13% moisture (in decimals)

Y = protein content at 13% moisture (in decimals)

And:

$$\frac{\text{*price of meal \$ / ton}}{2{,}000} = \text{\$ / pound}$$

The value of an acre of soybeans can be calculated by multiplying the APV by the yield in bushels per acre.

Comparing chlorosis scores of entries allows you to estimate how well they perform relative to each other. Actual chlorosis ratings can vary depending on the specific site, year of test, and location in the field. Because of this high level of variability, it is usually very difficult to identify the best performing entries. Varieties should be compared for IDC ratings relative to one another within a single trial only and not across trials. Producers with a known history of IDC problems should at least avoid entries with the most severe (4 or 5) IDC ratings. Different organizations may use different scales or descriptions. The below table provides some general rules for a trial with moderate stress able to produce ratings ranging from 1 to 5.

Protein and Oil

Protein and oil values were determined from mature seed using near infrared reflectance spectroscopy. The tabled values are for the 2021 season only. Protein and oil

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results are presented on a percent of the mean for each test.

The actual mean values, expressed on a 13 percent moisture basis, are given at the bottom of each table. Values over 100 indicate the protein and/or oil contents of the entry are greater than the mean value while those less than 100 have protein and/or oil contents less than the mean. Absolute values of protein and oil can vary from year to year. The following formula is used to adjust the protein and oil values to another moisture basis.

Phytophthora

Phytophthora root rot is a soilborne disease that occurs in heavy wet soils. Infection generally occurs during germination. Phytophthora root rot can cause significant yield reductions if susceptible varieties are planted in poorly drained, infested fields. Variety selection is the best defense against this yield reducing pathogen. There are many known pathotypes (races) of this fungus, and therefore it is important to know which are present in a particular field. Genes can be incorporated into varieties to provide resistance to races present in a field. Soybean varieties that have specific resistance genes (or gene) provide some level of protection, but race-specific resistance genes do not guarantee protection against infection and yield loss because so many different races exist. Research indicates that Rps3a and Rps6 provide the broadest protection to Phytophthora races currently present in soybean fields in the Midwest.

Some published information refers to Phytophthora "tolerance" or "field resistance," which is not race-specific and should not be confused with race-specific resistance. It is possible that a certain level of field tolerance can provide yield protection even when the race-specific genes are not effective. Reliable tests for tolerance have not yet been fully developed.

Tables included in this report indicate which race-specific Phytophthora gene or genes is/are present in each entry. This information was provided by the originator. An "S" indicates a variety is expected to be susceptible to all races. A "--" indicates that a Phy-

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Table 10. Performance and characteristics of special purpose soybean entries evaluated in the southern zone. Trials were conducted in Lamberton, Waseca and Westbrook.

Entry	Originator	Maturity Date	% of Mean Yield	% of Mean Protein	% of Mean Oil	Chlorosis Score†
M10-238-2036	Minnesota AES	9/13	92	100	106	NA
M11-314101	Minnesota AES	9/15	94	103	104	NA
M11-297035	Minnesota AES	9/16	98	102	98	NA
BS1743	Brushvale Seed, Inc.	9/20	111	101	99	NA
M07-2074210	Minnesota AES	9/20	87	96	100	NA
Candor	Sevita International	9/21	106	103	95	NA
MN1807CN	Minnesota AES	9/21	107	94	106	NA
MN1901CN	Minnesota AES	9/21	120	92	108	NA
M12-377028	Minnesota AES	9/22	86	113	87	NA
MN1806CN	Minnesota AES	9/23	95	98	103	NA
M13-172117	Minnesota AES	9/23	96	95	96	NA
M11-297025	Minnesota AES	9/24	109	103	99	NA
Mean		**9/20**	**50 bu/a**	**35%**	**18%**	
LSD 25%		**2d**	**7%**	**2%**	**3%**	

LSD numbers beneath yield columns indicate whether the difference between yield is due to genetics or other factors, such as variations in environment. If a yield difference between two entries equals or exceeds the LSD value, the higher yielding entry probably was superior in yield. A difference less than the LSD value is likely due to environmental factors.

†NA indicates ratings could not be made this year because of lack of IDC pressure in the field.

Table 9. Characteristics of special purpose soybean entries evaluated in the southern zone. Trial was conducted in Lamberton, Waseca and Westbrook.

Entry	Originator	Maturity Date	Special Characteristics	Hilum Color	Phyto. Gene	Seeds/ lb	Trans. Trait
M10-238-2036	Minnesota AES	9/13	High Oleic	Gray	Rps1k	2,971	CV
M11-314101	Minnesota AES	9/15	High Protein	Yellow	Rps1k	2,175	CV
M11-297035	Minnesota AES	9/16	Tofu	Yellow	Rps1c	1,790	CV
BS1743	Brushvale Seed, Inc.	9/20		Yellow	S	2,431	CV
M07-2074210	Minnesota AES	9/20	SCN, Natto	Yellow	Rps1a	4,545	CV
Candor	Sevita International	9/21	Tofu	Yellow	S	1,878	CV
MN1807CN	Minnesota AES	9/21	SCN, General Purpose	Buff	Rps1c	2,772	CV
MN1901CN	Minnesota AES	9/21	SCN, General Purpose	Imperfect Black	S	2,568	CV
M12-377028	Minnesota AES	9/22	High Protein	Black	Rps1k	2,755	CV
MN1806CN	Minnesota AES	9/23	SCN, General Purpose	Yellow	Rps1k	2,658	CV
M13-172117	Minnesota AES	9/23	Natto	Yellow	Rps1c	4,058	CV
M11-297025	Minnesota AES	9/24	Tofu	Yellow	Rps1k	1,863	CV

Table 11. Characteristics of publicly developed general-purpose soybean varieties entered in 2021 tests, and/or seed produced in Minnesota.

Entry	Originator	Maturity Rating	Hilum Color	Phyto. Gene	SCN Rating	Trans. Trait
IA1022	Iowa AES	1.9	Yellow	S	S	CV
IA1029	Iowa AES	1.8	Yellow	—	S	CV
IA2053	Iowa AES	2.0	Black	Rps1a	S	CV
IA2076LF	Iowa AES	2.0	Yellow	—	S	CV
IA2104	Iowa AES	2.2	Yellow	S	S	CV
IA2104RA12	Iowa AES	2.3	Yellow	S	S	CV
IA2113RA12	Iowa AES	2.2	Yellow	S	S	CV
MN0083	Minnesota AES	00.8	Yellow	Rps6	S	CV
MN0702CN	Minnesota AES	0.7	Yellow	Rps1k	R	CV
MN0808CN	Minnesota AES	0.8	Yellow	Rps1c	R	CV
MN0810CN	Minnesota AES	0.8	Yellow	S	R	CV
MN0811CN	Minnesota AES	0.8	Black	Rps1k	R	CV
MN1012SP	Minnesota AES	1.2	Yellow	Rps1a	S	CV
MN1312CN	Minnesota AES	1.3	Yellow	Rps1a	R	CV
MN1806CN	Minnesota AES	1.8	Yellow	Rps1k	R	CV
MN1807CN	Minnesota AES	1.8	Buff	Rps1c	R	CV
MN1901CN	Minnesota AES	1.9	Imperfect black	S	R	CV
ND Benson	No Dakota AES	0.4	Buff	Rps3a	R	CV
ND Dickey	No Dakota AES	0.7	Yellow	Res.*	S	CV
ND Stutsman	No Dakota AES	0.7	Yellow	Res.*	S	CV
ND1406HP	No Dakota AES	0.6	Yellow	S	S	CV
ND17009GT	No Dakota AES	00.9	Brown	Rps4	S	GT
ND21008GT20	No Dakota AES	00.8	Gray	—	S	GT
ND2108GT73	No Dakota AES	0.8	Yellow	—	S	GT
Sheyenne	No Dakota AES	0.7	Yellow	Rps1c	S	CV
Traill	No Dakota AES	0.0	Yellow	S	S	CV
Brookings	So Dakota AES	1.7	Brown	Rps1k	S	CV

*Resistance to certain races of Phytophthora indicated in variety release information but information on gene not provided.
— indicates "not specified."

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tophthora gene was not specified by the originator.

Soybean Cyst Nematode

Soybean cyst nematode (SCN) is a microscopic round worm that infects and reproduces in soybean roots. It was first identified in Minnesota in 1978 and is now known to occur in most Minnesota counties where soybeans are grown. Both the area of infestation and number of nematodes per unit of soil appear to be increasing. Several races of this pest are known to occur in Minnesota. When SCN numbers are high (> than 5,000 eggs/100 cc soil), significant yield losses can occur. Rotations to non-host crops and planting of resistant varieties can assist in reducing nematode populations as well as reducing the SCN's impact on yield.

Yield performance results of susceptible (S), moderately susceptible (MS), moderately resistant (MR) and resistant (R) entries planted in infested fields in northern, central and southern Minnesota are provided in Tables 12-14. The source for SCN resistance for each entry was provided by the originator. In Table 15 the resistance ratings were given based on a greenhouse bioassay with five replicates using an HG Type 7 (Race 6) SCN population. Each container (one plant) was inoculated with 4000

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Table 12. The Northern SCN Test was not conducted in 2021 because only a limited number of varieties were entered. Those entries were placed in the General Purpose Northern Test displayed in Table 2.

Entry	Originator	Maturity Date	Yield % of Mean 2018	Yield % of Mean 2019	% of Mean Protein	% of Mean Oil	Maturity Rating	Phyto. Gene	Chlorosis Score	SCN Rating	Seed Treatment	Trans. Trait
NO TEST 84 THIS YEAR												
Mean			**Bu/A**	**Bu/A**	**%**	**%**						
LSD 20%			**%**	**%**	**%**	**%**						

LSD numbers beneath yield columns indicate whether the difference between yield is due to genetics or other factors, such as variations in environment. If a yield difference between two entries equals or exceeds the LSD value, the higher yielding entry probably was superior in yield. A difference less than the LSD value is likely due to environmental factors.

Table 13. Performance and characteristics of soybean entries evaluated at soybean cyst nematode infested sites in the central zone. Trial was conducted at Becker, Danvers and Rosemount.

Entry	Originator	Maturity Date	Yield % of Mean 2020	Yield % of Mean 2021	% of Mean Protein	% of Mean Oil	Maturity Rating	Phyto. Gene	Chlorosis Score†	SCN Rating	Seed Treatment	Trans. Trait
P07A18X	Pioneer	9/12	—	101	96	106	0.7	Rps1k	NA	MR	None	R2-Xt
Skyline	Sevita International	9/13	78	80	105	100	1.0	S	NA	MR	FVM	CV
AG11XF2	Bayer Crop Science	9/14	—	102	98	103	1.1	Rps3a	NA	MR	AC	R2-Xt
P11T55E	Pioneer	9/15	—	101	99	100	1.1	-	NA	MR	None	E3
P09T24E	Pioneer	9/15	—	96	102	99	0.9	-	NA	R	None	R2-Xt
P13T61E	Pioneer	9/17	—	95	99	98	1.3	Rps1c	NA	MR	None	E3
AG10XF1	Bayer Crop Science	9/17	—	99	100	100	1.0	Rps3a	NA	R	AC	R2-Xt
AG17XF2	Bayer Crop Science	9/21	—	94	99	103	1.7	Rps3a	NA	R	AC	R2-Xt
AG14XF2	Bayer Crop Science	9/22	—	105	97	103	1.4	Rps1c	NA	R	AC	R2-Xt
A151E3	Anderson Seeds	9/22	—	107	103	99	1.5	Rps3a	NA	MR	None	E3
AE1910	Federal Hybrids	9/23	—	99	101	99	1.9	None	NA	R	MA	E3
F2290N R2X	Federal Hybrids	9/25	123	110	99	100	2.2	Rps1c	NA	MR	MA	R2-Xt
AE2110	Federal Hybrids	9/25	—	110	99	95	2.1	Rps1k	NA	MR	MA	E3
P18A33X	Pioneer	9/25	—	110	97	107	1.8	Rps1k	NA	R	None	R2-Xt
F2121 LLGT+	Federal Hybrids	9/25	—	101	105	93	2.1	None	NA	R	MA	LLGT27
A1821XF	Anderson Seeds	9/26	—	94	98	97	1.8	None	NA	MR	None	XF
A2121XF	Anderson Seeds	9/28	—	97	103	98	2.0	Rps3a	NA	MR	None	XF
Mean		**9/20**	**50 bu/a**	**48 bu/a**	**35%**	**19%**						
LSD 25%		**1d**	**10%**	**7%**	**3%**	**3%**						

LSD numbers beneath yield columns indicate whether the difference between yield is due to genetics or other factors, such as variations in environment. If a yield difference between two entries equals or exceeds the LSD value, the higher yielding entry probably was superior in yield. A difference less than the LSD value is likely due to environmental factors.

— indicates "not specified."

†NA indicates ratings could not be made this year because of lack of IDC pressure in the field.

Table 14. Performance and characteristics of soybean entries evaluated at soybean cyst nematode infested sites in the southern zone. Trial was conducted at Fairfax, Lamberton and Waseca.

Entry	Originator	Maturity Date	Yield % of Mean 2020	Yield % of Mean 2021	% of Mean Protein	% of Mean Oil	Maturity Rating	Phyto. Gene	Chlorosis Score†	SCN Rating	Seed Treatment	Trans. Trait
AE1910	Federal Hybrids	9/17	—	95	99	99	1.9	None	NA	R	MA	E3
F1909N LLGT+	Federal Hybrids	9/19	111	99	100	100	1.9	Rps1c	NA	MR	MA	LLGT27
AG21XF0	Bayer Crop Science	9/20	—	99	105	98	2.1	Rps1c	NA	R	AC	R2-Xt
AG22XF2	Bayer Crop Science	9/20	—	103	104	99	2.2	Rps1c	NA	R	AC	R2-Xt
F2121 LLGT+	Federal Hybrids	9/20	—	99	99	99	2.1	None	NA	R	MA	LLGT27
P18A33X	Pioneer	9/20	—	106	99	104	1.8	Rps1k	NA	R	None	R2-Xt
AE2110	Federal Hybrids	9/21	—	96	101	99	2.1	Rps1k	NA	MR	MA	E3
AG18XF1	Bayer Crop Science	9/21	—	109	97	103	1.8	S	NA	R	AC	R2-Xt
P24T35E	Pioneer	9/26	—	93	98	102	2.4	Rps1k	NA	MS	None	E3
PA23A15X	Pioneer	9/27	—	102	100	97	2.3	Rps1c	NA	MR	None	R2-Xt
Mean		**9/21**	**59 bu/a**	**52 bu/a**	**34%**	**20%**						
LSD 25%		**3d**	**5%**	**5%**	**2%**	**2%**						

LSD numbers beneath yield columns indicate whether the difference between yield is due to genetics or other factors, such as variations in environment. If a yield difference between two entries equals or exceeds the LSD value, the higher yielding entry probably was superior in yield. A difference less than the LSD value is likely due to environmental factors.

— indicates "not specified."

†NA indicates ratings could not be made this year because of lack of IDC pressure in the field.

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SCN eggs. After 30 days a female index (FI) was calculated for each entry using Lee 74 as the susceptible check. FI = (# of cysts on entry/# of cysts on Lee 74) x100. If the FI was < 10 percent, an entry was considered R. If the FI was 10-30 percent, it was considered MR. If the FI was 10-60 percent, it was considered MS, and greater than 60 percent S. These are fairly arbitrary cutoffs, and thus it is important to look at the actual FI values to judge the level of resistance. Comparison to varieties known to have a good level of resistance is also advisable.

For proper management of fields with SCN, it is recommended that entries with an R rating be planted. If the SCN population numbers are relatively low (<1500 eggs/100 cm3) an entry with an MR rating might be considered. Entries with S and MS ratings should not be considered for planting in fields where SCN is present at levels greater than 200 eggs/100 cm3. Some entries are rated as tolerant, however no data from the northern United States has verified the usefulness of tolerant entries in maintaining yield and reducing SCN numbers.

Management information is available from the website www.soybeans.umn.edu or from the Minnesota Soybean Research and Promotion Council, 151 St. Andrews Court, Suite 710, Mankato, Minn., 56001, 1-888-8969678, www.mnsoybean.org.

White Mold

White mold, also known as Sclerotinia stem rot, develops in infested fields when high relative humidity and moderate temperatures occur during soybean flowering. Planting less susceptible entries in wider row spacings or at lower populations is the most effective method of reducing the severity of white mold. Accurate ratings for resistance to white mold are difficult to obtain because both infection and disease development are dependent on weather conditions. Because of this variability, performance can change significantly among locations and years depending on the interaction of plant development, precipitation, relative humidity, and temperature. White mold severity also tends to be greater if lodging occurs. Growers concerned about performance in the presence of white mold should select varieties that show consistently less white mold during several years of testing.

Brown Stem Rot

Brown stem rot (BSR) is a fungal disease that can cause yield losses in certain situations. The disease occurs most frequently when soybeans follow soybeans but can occur where soybeans are planted every other year. Resistant entries, or longer rotations, assist in the management of this disease. MN0304, MN0902CN, MN1302, Freeborn, and IA2008R are available public varieties with resistance to BSR. Some information refers to "tolerance" or "field resistance." Reliable tests for tolerance or field resistance have not yet been developed.

Special-Purpose Entries

There continues to be interest in producing soybeans with special characteristics important to specialty food product manufacturers, such as tofu, natto, miso, and soy milk. Soybean scientists previously developed some of these special-purpose entries, which were general releases, but more recently entries have been released under exclusive or nonexclusive licenses to specific companies who then contract with growers for production. For further information, contact Minnesota Crop Improvement Association at website www.mncia@tc.umn.edu or telephone number 612-625-7766

Authors and Researchers

Authors of this soybean report are: A. Lorenz, S. Naeve, S. Bhusal, and A. Killam.

Test plot establishment and management are supervised by Michael Leiseth, Gerald Holz, Tom Hoverstad, Steve Quiring, Curtis Reese, and Donn Vellekson.

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Table 15. Results of soybean cyst nematode greenhouse bioassay performed on soybean entries grown in 2021 SCN trials, all zones. Entries are sorted by originator and entry name.

Entry	Originator	SCN Resist Source[1]	Greenhouse Test HG Type 7 (Race 6) FI	SCN Rating[2]
A151E3	Anderson Seeds	PI 88788	13	MR
A1821XF	Anderson Seeds	PI 88788	12	MR
A2121XF	Anderson Seeds	PI 88788	18	MR
AG10XF1	Bayer Crop Science	PI 88788	1	R
AG11XF2	Bayer Crop Science	PI 88788	13	MR
AG14XF2	Bayer Crop Science	PI 88788	0	R
AG17XF2	Bayer Crop Science	PI 88788	0	R
AG18XF1	Bayer Crop Science	PI 88788	0	R
AG21XF0	Bayer Crop Science	PI 88788	0	R
AG22XF2	Bayer Crop Science	PI 88788	0	R
AE1910	Federal Hybrids	PI 88788	7	R
AE2110	Federal Hybrids	PI 88788	11	MR
F1909N LLGT+	Federal Hybrids	PI 88788	12	MR
F2121 LLGT+	Federal Hybrids	PI 88788	9	R
F2290N R2X	Federal Hybrids	Peking	12	MR
P07A18X	Pioneer	PI 88788	13	MR
P09T24E	Pioneer	PI 88788	9	R
P11T55E	Pioneer	PI 88788	22	MR
P13T61E	Pioneer	PI 88788	17	MR
P18A33X	Pioneer	Peking	3	R
P24T35E	Pioneer	Peking	60	MS
PA23A15X	Pioneer	PI 88788	28	MR
Skyline	Sevita International	PI 88788	24	MR

[1]Resistance source provided by originator.

[2]SCN resistance rating: R = resistant (FI less than or equal to 10%); MR = moderately resistant (FI 11-30%); MS = moderately susceptible (FI 31-60%); S = susceptible (FI greater than 60%).

Female index (FI) was calculated using Williams 82 as the susceptible check.

2021 Hard Red Spring Wheat field crop trial results

Spring wheat varieties were sown in trial plots at Becker, Crookston, Lamberton, Morris, Roseau, St. Paul and Waseca, and on-farm sites near Benson, Fergus Falls, Hallock, Le Center, Oklee, Perley, Stephen and Strathcona.

These plots are handled so that the factors affecting yield and other characteristics are as nearly the same for all varieties at each location as possible, but seed providers are allowed to

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Table 1. Origin and agronomic characteristics of hard red spring wheat varieties in Minnesota in single-year (2021) and multiple-year comparisons.

Entry	Origin[1]	Legal Status	Desired Stand (Plants/Acre)[2]	Days to Heading[3]	Height Inches[3]	Straw Strength[4]
AP Gunsmoke CL2[5]	2021 AgriPro/Syngenta	PVP (94) (pending)	1.3	55.6	26.2	4–5
AP Murdock	2020 AgriPro/Syngenta	PVP (94) (pending)	1.3	55.3	25.2	5
AP Smith	2021 AgriPro/Syngenta	PVP (94) (pending)	1.3	58.1	24.7	2–3
Bolles	2015 MN	PVP (94)	1.3	58.4	28.3	4
CAG Justify	2021 Champions Alliance Group	PVP (94) (pending)	1.3	57.5	26.8	–
CAG Reckless	2021 Champions Alliance Group	PVP (94) (pending)	1.3	56.3	27.3	–
CP3099A	2020 CROPLAN by WinField United	PVP (94) (pending)	1.3	60.9	27.0	–
CP3119A	2021 CROPLAN by WinField United	PVP (94) (pending)	1.3	61.0	26.3	–
CP3188	2020 CROPLAN by WinField United	PVP (94) (pending)	1.3	56.1	27.7	–
CP3530	2015 CROPLAN by WinField United	Patented	1.3	58.1	28.3	5
CP3915	2019 CROPLAN by WinField United	PVP (94) (pending)	1.3	57.2	26.3	4
Driver	2020 SDSU	PVP (94) (pending)	1.3	57.7	28.2	4
Dyna-Gro Ambush	2016 Dyna-Gro	PVP (94)	1.4	54.5	26.9	4
Dyna-Gro Ballistic	2018 Dyna-Gro	PVP (94)	1.1	57.0	26.3	5
Dyna-Gro Commander	2019 Dyna-Gro	PVP (94)	1.4	54.9	25.9	4
Lang-MN	2017 MN	PVP (94)	0.9	56.9	26.6	4
LCS Buster	2020 Limagrain Cereal Seeds	PVP (94) (pending)	1.3	60.0	27.7	5
LCS Cannon	2018 Limagrain Cereal Seeds	PVP (94)	1.3	53.5	25.5	4
LCS Rebel	2017 Limagrain Cereal Seeds	PVP (94)	1.3	55.0	27.8	6
LCS Trigger	2016 Limagrain Cereal Seeds	PVP (94)	1.3	60.2	26.4	5
Linkert	2013 MN	PVP (94)	1.3	55.2	25.8	2
MN-Torgy	2020 MN	PVP (94) (pending)	1.3	55.7	25.6	4
MN-Washburn	2019 MN	PVP (94)	1.3	57.3	25.3	3
MS Barracuda	2018 Meridian Seeds	PVP (94)	1.3	53.3	26.0	3
MS Cobra	2022 Meridian Seeds	PVP (94) (pending)	1.3	55.3	26.9	–
MS Ranchero	2020 Meridian Seeds	PVP (94) (pending)	1.3	54.8	26.1	4–5
ND Frohberg	2020 NDSU	PVP (94) (pending)	1.3	56.8	28.2	4–5
PFS-Buns	2021 Peterson Farms Seed	PVP (94) (pending)	1.3	62.0	24.7	–
Prosper	2011 NDSU	PVP (94)	1.3	57.8	28.5	6
Shelly	2016 MN	PVP (94)	1.3	57.9	26.3	5
SY 611 CL2[5]	2019 AgriPro/Syngenta	PVP (94)	1.3	56.1	24.9	4
SY Longmire[6]	2019 AgriPro/Syngenta	PVP (94)	1.3	56.9	26.1	4
SY McCloud	2019 AgriPro/Syngenta	PVP (94)	1.3	55.4	26.1	4
SY Valda	2015 AgriPro/Syngenta	PVP (94)	1.3	56.9	25.4	5
TCG-Heartland	2019 21st Century Genetics	PVP (94), Patent pending	1.6	54.3	24.9	3
TCG-Spitfire	2016 21st Century Genetics	PVP (94)	1.5	59.2	26.4	3
TCG-Wildcat	2020 21st Century Genetics	PVP (94) (pending), Patent pending	1.5	57.7	26.9	3
WB9479	2017 WestBred	Patented, PVP (94)	1.3	54.3	24.3	3
WB9590	2017 WestBred	Patented, PVP (94)	1.3	54.7	23.6	3
Mean				**57.0**	**26.2**	

[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 10% stand loss and adjusting for the germination percentage and seed weight of each variety.

[3]2021 data.

[4]1-9 scale in which 1 is the strongest straw and 9 is the weakest. Based on 2014-2021 data. The rating of newer entries may change by as much as one rating point as more data are collected.

[5]AP Gunsmoke CL2 and SY 611 CL2 have 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 (2021) and multiple-year comparisons.

Entry	Test Weight (lb/Bu)		Protein (%)[1]		Baking Quality[2]	Pre-Harvest Sprouting[3]
	2021	2 Yr	2021	2 Yr		
AP Gunsmoke CL2	60.8	–	15.0	–	–	3
AP Murdock	60.9	60.3	14.8	14.8	5	1
AP Smith	61.5	–	15.0	–	–	4
Bolles	61.2	60.1	16.5	16.6	1	1
CAG Justify	59.3	–	14.0	–	–	3
CAG Reckless	62.3	–	14.9	–	–	4
CP3099A	59.2	–	12.8	–	–	1
CP3119A	57.1	–	13.3	–	–	3
CP3188	59.6	–	13.3	–	–	3
CP3530	60.8	60.1	15.0	15.1	3	1
CP3915	62.2	61.4	15.0	15.0	4	1
Driver	63.1	–	14.0	–	–	3
Dyna-Gro Ambush	62.4	61.9	14.9	15.0	2	3*
Dyna-Gro Ballistic	61.1	60.2	14.0	14.1	5	3*
Dyna-Gro Commander	62.1	61.0	14.7	14.9	6	1
Lang-MN	61.8	61.1	15.0	15.2	3	1
LCS Buster	59.1	–	12.8	–	–	4
LCS Cannon	63.4	62.1	14.6	14.6	4	3*
LCS Rebel	63.0	62.1	15.0	15.1	3	5
LCS Trigger	61.0	60.5	13.4	13.1	7	1
Linkert	62.6	61.4	15.9	15.8	1	1
MN-Torgy	62.4	61.2	15.3	15.2	4	1
MN-Washburn	61.6	60.7	14.4	14.6	3	1
MS Barracuda	62.1	61.0	14.9	15.1	4	3
MS Cobra	62.3	–	14.8	–	–	4
MS Ranchero	61.1	–	14.0	–	–	4
ND Frohberg	62.1	–	14.8	–	–	4
PFS-Buns	58.8	–	14.4	–	–	4
Prosper	61.1	60.3	14.2	14.3	5	1
Shelly	62.2	60.9	14.1	14.2	5	1
SY 611 CL2	62.3	61.3	14.7	15.0	6	2*
SY Longmire	62.0	60.8	14.9	15.1	3	2*
SY McCloud	63.0	62.0	15.6	15.6	3	2*
SY Valda	62.0	61.1	14.2	14.5	6	2
TCG-Heartland	62.6	61.8	15.3	15.5	2	2
TCG-Spitfire	60.8	60.3	14.2	14.2	3	3*
TCG-Wildcat	62.2	–	14.7	–	–	1
WB9479	62.0	–	15.7	–	2	1
WB9590	61.9	–	15.4	–	4	1
Mean	**61.5**	**61.0**	**14.6**	**14.9**		
No. of Environments	**11**	**21**	**11**	**21**		

[1]12% moisture basis.

[2]2014-2020 crop years, where applicable.

[3]1-9 scale in which 1 = best and 9 = 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.

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choose a preferred seeding rate for each variety. The standard seeding rate is designed to achieve a desired stand of 1.3 million plants/acre, assuming a 10 percent stand loss and adjusting for the germination percentage and seed weight of each variety.

These hard red spring wheat trials are not designed for crop (species) comparisons, because the various crops are grown on different fields or with different management. The data should only be used to compare varieties within a table. All locations are set up as randomized complete blocks with 3 replications. Spatial analysis is used to adjust plot yields for each location. Tested hard red spring wheat varieties are listed in alphabetical order in the tables.

Variety Selection Criteria

While grain yield is an important economic trait, return per acre is also affected by grain quality. Because Fusarium head blight (FHB), or scab, can reduce

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grain quality and yield dramatically, it is an important consideration. Disease ratings are on a 1-9 scale where 1 = most resistant and 9 = most susceptible. Rating differences of 2 or more should be considered significant.

Leaf and stripe rust pressure throughout Minnesota has been low the past four seasons. The majority of varieties are resistant or moderately resistant, but a few are moderately susceptible. Stripe rust can be very damaging when temperatures remain unseasonably cool into early July. Carefully consider a variety's rating for leaf and stripe rust and plan to use a fungicide if a variety is rated 5 or higher and disease levels warrant treatment. Varieties with ratings of 4 or better should not experience economic levels of damage in most years. Stem rust ratings are included in the disease tables because there are differences in variety reaction. However, the levels of this disease have been very low in production fields in recent years, even on susceptible varieties.

Due to dry conditions in 2021, no bacterial leaf streak was observed, so ratings are based on past years. This disease cannot be controlled with fungicides. Selection of more resistant varieties is the only recommended practice at this time to reduce losses caused by this disease. The

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Table 3. Disease reactions[1] 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
AP Gunsmoke CL2	3	–	1	7	6	4
AP Murdock	3	–	1	4	6	7
AP Smith	6	–	1	4	4	6
Bolles	2	1	2	4	3	5
CAG Justify	–	–	2	–	–	–
CAG Reckless	–	–	1	–	–	–
CP3099A	–	–	8	–	–	–
CP3119A	–	–	2	–	–	–
CP3188	–	–	6	–	–	–
CP3530	3	3	1	4	4	4
CP3915	1	–	1	2	5	4
Driver	3	–	1	3–4	5	4
Dyna-Gro Ambush	2	–	2	5	4	4
Dyna-Gro Ballistic	3	–	3	3	5	5
Dyna-Gro Commander	2	–	1	4	6	5
Lang-MN	1	–	2	3	4	3
LCS Buster	2	–	1	4	3	3
LCS Cannon	3	–	2	5	7	4
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 Cobra	–	–	1	–	–	–
MS Ranchero	1	–	1	6–7	3	4
ND Frohberg	3	–	1	3	4	5
PFS-Buns	–	–	1	–	–	–
Prosper	6	5	2	4	4	5
Shelly	3	1	2	6	4	4
SY 611 CL2	3	–	5	4	4	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	6
TCG-Spitfire	4	–	2	3	4	5
TCG-Wildcat	3	–	3	6–7	7	6
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.

Hard red spring wheat seeding rate calculator.

Calculating and seeding the appropriate amount of seed is an important first step towards maximizing yield. The seeding rate is a function of the number of kernels per pound of seed, the percent germination of the lot, the expected stand loss as a function of the quality of the seedbed and the desired stand. In Minnesota, an average optimum stand for hard red spring wheat when planted early is between 28 to 30 plants per square foot or approximately 1.3 million plants per acre. This number should increase by 1 to 2 plants per square foot for every week planting is delayed past the early, optimum, seeding date. Expected stand loss even under good seedbed conditions is between 10% to 20% and will increase with a poor seedbed or improper seed placement due to poor depth control.

The general formula for calculating a seeding rate is:

$$\text{Seeding Rate (Pounds/Acre)} = \frac{\text{Desired Stand (Plants/Acre)} \div (1 - \text{Expected Stand Loss})}{\text{(Seeds/Pound)} \times \text{Percentage Germination}}$$

Calculate the seeding rate for every single seed lot and calibrate the drill accordingly.

Example: Early variety.

Desired Stand, (Plants/Acre)	Expected Stand Loss	Seeds Per Pound	Percentage Germination	Seeding Rate, (lb/Acre)
1.3 million	0.10	14,000	0.95	109

Table 4. Relative grain yield of hard red spring wheat varieties in northern Minnesota locations in single-year (2021) and multiple-year comparisons (2019-2021).

	Crookston			Fergus Falls			Hallock			Oklee			Perley			Roseau			Stephen			Strathcona		
Entry	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr
AP Murdock	107	108	—	96	99	—	99	106	—	111	110	—	110	112	—	107	108	—	120	111	—	123	118	—
Bolles	94	98	97	90	91	91	94	96	93	90	91	91	100	95	93	94	91	93	94	95	92	87	90	91
CP3055	95	—	—	112	—	—	110	—	—	115	—	—	78	—	—	107	—	—	83	—	—	115	—	—
CP3530	92	96	96	95	99	100	112	106	103	100	98	98	104	106	106	94	98	98	97	98	98	112	105	102
CP3903	93	—	—	97	—	—	108	—	—	90	—	—	108	—	—	92	—	—	90	—	—	84	—	—
CP3910	98	103	—	97	99	—	103	106	—	92	101	—	106	104	—	83	98	—	92	97	—	95	98	—
CP3915	103	104	—	99	103	—	90	95	—	87	95	—	95	95	—	117	114	—	101	106	—	85	93	—
Driver	99	—	—	104	—	—	115	—	—	106	—	—	111	—	—	98	—	—	108	—	—	94	—	—
Dyna-Gro Ambush	105	104	100	98	100	99	104	101	101	103	104	106	107	96	96	92	90	94	108	100	102	108	105	104
Dyna-Gro Ballistic	107	108	105	105	109	111	102	106	106	104	109	107	107	104	106	118	114	113	110	108	108	95	100	100
Dyna-Gro Commander	94	97	—	100	101	—	102	104	—	99	100	—	91	104	—	98	104	—	108	104	—	104	102	—
Dyna-Gro Velocity	93	92	—	96	95	—	95	96	—	89	88	—	90	88	—	99	100	—	90	92	—	79	84	—
Lang-MN	99	98	99	99	98	99	102	98	98	95	98	96	96	98	97	102	100	103	89	94	95	118	112	104
LCS Buster	103	—	—	114	—	—	111	—	—	126	—	—	120	—	—	122	—	—	117	—	—	113	—	—
LCS Cannon	98	100	100	96	100	101	89	98	101	102	104	104	113	115	111	92	99	100	93	101	104	104	103	106
LCS Rebel	97	101	101	101	97	97	106	102	101	91	96	98	109	108	109	110	108	105	97	99	101	107	105	101
LCS Trigger	114	116	114	118	115	113	127	118	111	116	119	115	125	119	119	118	118	117	113	111	112	116	117	110
Linkert	92	92	92	93	92	92	95	97	97	92	93	92	90	88	90	90	89	91	83	88	90	83	87	92
MN-Torgy	106	101	104	105	105	104	93	100	101	106	105	102	94	97	103	102	105	102	115	107	104	106	106	105
MN-Washburn	98	99	99	98	101	102	97	99	98	97	101	98	97	100	104	73	85	92	99	99	100	73	87	91
MS Barracuda	94	97	98	95	94	96	94	95	97	100	103	103	82	93	92	87	93	97	93	96	99	111	108	109
MS Chevelle	95	101	102	97	100	100	115	109	110	97	98	101	98	94	98	114	110	108	84	94	101	85	90	96
MS Ranchero	101	—	—	93	—	—	108	—	—	102	—	—	100	—	—	110	—	—	117	—	—	129	—	—
ND Frohberg	93	—	—	103	—	—	87	—	—	98	—	—	93	—	—	92	—	—	86	—	—	100	—	—
Prosper	109	109	106	108	109	108	105	103	105	109	108	109	101	96	102	107	104	107	112	107	109	99	105	103
Rollag	77	87	85	89	91	89	91	97	96	94	93	92	92	95	93	84	82	84	111	101	99	100	93	93
Shelly	107	106	106	107	111	110	109	110	107	104	105	105	94	96	96	90	102	103	95	101	104	115	111	107
SY 611 CL2	102	102	—	102	103	—	90	99	—	109	106	—	99	95	—	105	102	—	104	107	—	94	101	—
SY Ingmar	95	95	97	106	100	100	89	92	96	102	100	100	96	102	99	104	102	99	94	96	97	96	96	98
SY Longmire	97	100	—	95	101	—	92	97	—	91	98	—	95	85	—	90	92	—	101	104	—	71	86	—
SY McCloud	91	92	95	99	97	99	103	98	98	101	98	98	97	96	93	97	97	97	78	91	94	105	102	102
SY Valda	103	104	107	103	99	101	107	109	111	100	103	107	108	102	104	96	109	107	120	118	117	110	110	106
TCG-Heartland	102	99	—	100	97	—	87	89	—	92	93	—	114	110	—	95	92	—	108	102	—	89	91	—
TCG-Spitfire	108	106	108	105	104	104	90	94	96	103	104	104	106	109	107	100	107	105	97	99	102	100	100	99
TCG-Wildcat	102	—	—	100	—	—	95	—	—	96	—	—	100	—	—	109	—	—	115	—	—	105	—	—
WB-Mayville	85	88	89	89	90	93	89	89	92	89	91	94	107	109	105	80	90	91	89	87	92	93	91	95
WB9479	110	—	—	96	—	—	103	—	—	104	—	—	83	—	—	91	—	—	103	—	—	104	—	—
WB9590	113	—	—	99	—	—	120	—	—	104	—	—	109	—	—	105	—	—	93	—	—	113	—	—
Mean (Bu/Acre)	**70.1**	**74.7**	**71.4**	**83.7**	**83.4**	**88.8**	**66.8**	**76.3**	**83.5**	**81.0**	**72.5**	**80.6**	**67.4**	**67.7**	**70.1**	**88.3**	**86.9**	**87.4**	**72.4**	**77.4**	**83.8**	**68.9**	**70.5**	**78.6**
LSD (0.10)	**7.6**	**6.5**	**6.1**	**6.5**	**6.6**	**4.6**	**17.7**	**8.0**	**6.6**	**12.0**	**9.7**	**6.1**	**18.6**	**12.3**	**9.0**	**18.7**	**14.0**	**9.9**	**18.8**	**11.4**	**7.9**	**18.4**	**12.2**	**8.8**

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rating of newer varieties may change by as much as one rating point once more data is collected.

The "Other Leaf Diseases" rating represents a combined reaction to two different Septoria leaf blotches and tan spot. Although varieties may differ for their response to each of those diseases, the rating does not differentiate among them. Consequently, the rating should be used as a general indication and only for varietal selection in areas where these diseases have been a problem or if the previous crop was wheat or barley. Control of fungal leaf diseases with fungicides may be warranted, even for varieties with an above-average rating.

After 5 years as the no. 1 variety in Minnesota, Linkert was supplanted by WB9590 in 2021, sown on 18.0 percent of the state's

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Table 5. Relative grain yield of hard red spring wheat varieties in southern Minnesota locations in single-year (2021) and multiple-year comparisons (2019-2021).

	Becker[1]		Benson			Le Center			Lamberton			Morris			St Paul			Waseca[2]
Entry	2021	2 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021
AP Gunsmoke CL2	104	–	96	100	–	110	106	–	106	91	–	105	103	–	89	94	–	–
AP Murdock	104	112	89	93	99	93	101	106	99	100	104	91	98	99	110	109	112	123
AP Smith	92	–	103	104	–	102	98	–	103	101	–	104	108	–	105	99	–	–
Bolles	79	83	102	100	100	89	87	87	90	96	91	101	100	99	101	99	100	99
CAG Justify	87	–	112	–	–	88	–	–	99	–	–	128	–	–	106	–	–	–
CAG Reckless	125	–	99	–	–	96	–	–	99	–	–	103	–	–	109	–	–	–
CP3099A	103	–	113	–	–	90	–	–	119	–	–	135	–	–	92	–	–	–
CP3119A	123	–	108	–	–	105	–	–	110	–	–	125	–	–	91	–	–	–
CP3188	108	–	110	–	–	109	–	–	121	–	–	125	–	–	107	–	–	–
CP3530	95	103	101	107	111	109	106	110	100	99	102	95	95	102	103	103	106	103
CP3915	109	102	99	94	99	95	96	95	100	103	104	97	100	104	77	82	86	84
Driver	104	–	109	103	–	100	98	–	118	113	–	106	106	–	103	102	–	–
Dyna-Gro Ambush	91	103	104	104	99	110	107	109	95	94	99	65	87	91	118	112	113	114
Dyna-Gro Ballistic	112	109	94	105	105	104	104	103	97	103	106	107	107	111	84	97	98	108
Dyna-Gro Commander	112	109	111	112	105	106	104	102	96	99	98	101	109	111	119	111	110	114
Lang-MN	98	98	90	95	95	99	97	99	96	94	99	98	101	98	115	106	105	106
LCS Buster	125	–	103	105	–	99	103	–	102	109	–	95	106	–	111	105	–	–
LCS Cannon	101	111	111	101	96	111	111	110	101	102	100	68	91	94	115	118	115	113
LCS Rebel	96	101	103	101	100	97	99	98	104	106	105	113	105	103	107	106	100	109
LCS Trigger	116	111	106	118	118	116	112	114	117	119	121	124	129	123	122	111	109	116
Linkert	98	100	92	97	93	100	94	91	94	92	91	91	91	91	101	101	99	91
MN-Torgy	105	102	102	102	104	105	106	106	95	104	103	104	107	108	112	105	104	106
MN-Washburn	94	92	96	93	93	100	102	100	96	100	97	111	102	100	102	95	101	101
MS Barracuda	93	106	95	95	94	109	108	107	99	100	91	71	81	84	116	114	113	101
MS Cobra	96	–	94	–	–	105	–	–	100	–	–	101	–	–	114	–	–	–
MS Ranchero	92	–	111	102	–	102	96	–	97	95	–	90	96	–	103	109	–	–
ND Frohberg	101	–	109	104	–	102	99	–	97	98	–	103	106	–	102	103	–	–
PFS-Buns	100	–	106	–	–	102	–	–	99	–	–	112	–	–	85	–	–	–
Prosper	111	104	105	105	104	104	106	104	97	107	109	120	112	115	88	99	98	95
Shelly	97	100	103	107	103	105	106	103	102	101	95	109	112	109	117	106	107	102
SY 611 CL2	104	105	106	98	102	96	91	93	102	97	95	92	93	98	89	96	92	96
SY Longmire	107	90	99	94	97	96	94	92	107	109	106	114	105	96	63	78	81	71
SY McCloud	83	92	96	93	91	103	100	96	98	90	94	81	86	91	92	100	99	94
SY Valda	95	102	97	102	106	105	105	110	104	100	102	99	100	101	101	99	100	110
TCG-Heartland	92	100	88	95	97	97	96	93	97	96	91	88	87	90	91	97	101	101
TCG-Spitfire	107	103	111	109	114	106	103	105	118	122	124	104	117	116	95	96	100	94
TCG-Wildcat	108	–	96	96	–	103	103	–	114	110	–	106	103	–	110	104	–	–
WB9479	89	–	96	92	–	103	99	–	86	88	–	86	89	–	92	95	–	–
WB9590	86	–	97	98	–	101	105	–	104	103	–	86	91	–	96	103	–	–
Mean (Bu/Acre)	**42.4**	**60.1**	**60.8**	**72.7**	**81.2**	**70.9**	**74.8**	**69.8**	**60.1**	**61.6**	**49.1**	**54.7**	**50.7**	**55.8**	**48.1**	**61.3**	**64.8**	**44.3**
LSD (0.10)	**19.2**	**16.0**	**11.0**	**10.8**	**10.4**	**8.0**	**8.4**	**8.0**	**17.5**	**14.3**	**13.6**	**18.7**	**18.3**	**14.5**	**8.9**	**10.6**	**8.8**	**15.6**

[1]2020 Becker was discarded due to drought. 2 yr data is the mean of 2021 Becker and 2019 Kimball.
[2]2021 Waseca was discarded due to excessive within trial variation. 2 year is the mean of 2019 and 2020.

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wheat acres. SY Valda was the second-most popular variety at 12.8 percent, followed by Linkert (11.9 percent), WB9479 (10.3 percent), and MN-Torgy (9.7 percent).

Varieties tested for the first time in 2021 were AP Gunsmoke CL2, AP Smith (both also tested in 2020 under their experimental designations), CAG Justify, CAG Reckless, CP3099A, CP3119A, CP3188, MS Cobra, and PFS-Buns. As in 2019 & 2020, WestBred opted to not submit any HRSW varieties for testing, but WB9479 and WB9590 were both tested in 2021 because each occupied more than 5 percent of the state's acreage in 2020. Testing of CP3055, CP3903, CP3910, Dyna-Gro Velocity, MS Chevelle, Rollag, SY Ingmar, and WB-Mayville was discontinued.

Since 2004 we have been conducting an "intensive" management trial in which fungicides are applied at the time of herbicide application (Feekes 5), flag leaf emergence (Feekes 9), and at the onset of flowering (Feekes 10.51).

The practice of three fungicide applications during the growing season is not recommended. This fungicide regime was implemented to measure the varieties' performance when fungal diseases were controlled to the maximum extent possible. Decisions regarding fungicide applications should be based on the available decision support systems and used only if and when disease levels are forecasted to reach economically damaging levels. The additional performance evaluations were carried out adjacent to the conventional (no fungicides applied) trials, so results can be compared directly.

Data from trials conducted in Crookston, Lamberton, Morris and Roseau are included in the 2021 and multi-year summaries. In the two northern locations, the fungicide regime as applied in these trials increased grain yield on average by 5.8 bushels per acre

Table 6. Relative grain yield of hard red spring wheat varieties in Minnesota in single-year (2021) and multiple-year comparisons (2019-2021).

	State			North			South		
Entry	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr	2021	2 Yr	3 Yr
AP Gunsmoke CL2	103	101	–	104	102	–	102	100	–
AP Murdock	94	101	104	92	101	103	97	101	106
AP Smith	101	99	–	101	98	–	102	101	–
Bolles	94	94	94	94	93	94	94	95	95
CAG Justify	104	–	–	104	–	–	103	–	–
CAG Reckless	105	–	–	106	–	–	104	–	–
CP3099A	111	–	–	112	–	–	109	–	–
CP3119A	110	–	–	110	–	–	110	–	–
CP3188	109	–	–	107	–	–	114	–	–
CP3530	98	100	102	96	98	99	101	101	106
CP3915	96	96	98	96	97	99	96	95	97
Driver	106	105	–	106	105	–	107	104	–
Dyna-Gro Ambush	100	102	102	101	102	100	97	102	104
Dyna-Gro Ballistic	102	104	106	103	105	106	100	104	105
Dyna-Gro Commander	103	103	103	101	100	102	107	108	106
Lang-MN	96	98	99	95	98	98	99	99	99
LCS Buster	105	109	–	104	110	–	105	108	–
LCS Cannon	102	102	103	103	100	102	102	106	105
LCS Rebel	101	102	101	100	101	101	103	103	102
LCS Trigger	106	113	113	100	109	111	116	118	116
Linkert	95	93	92	94	92	92	96	95	94
MN-Torgy	101	102	103	99	101	102	104	104	105
MN-Washburn	97	95	97	96	93	96	100	99	98
MS Barracuda	99	98	99	100	97	98	98	100	99
MS Cobra	101	–	–	101	–	–	102	–	–
MS Ranchero	101	103	–	102	105	–	100	99	–
ND Frohberg	101	99	–	100	97	–	102	102	–
PFS-Buns	103	–	–	104	–	–	101	–	–
Prosper	104	105	105	104	105	105	104	105	105
Shelly	103	103	104	101	102	104	105	105	103
SY 611 CL2	100	99	100	101	101	102	98	95	97
SY Longmire	98	95	95	98	95	96	98	95	92
SY McCloud	98	96	96	100	98	97	93	93	94
SY Valda	102	103	105	103	104	105	100	101	104
TCG-Heartland	93	95	95	93	96	95	93	95	96
TCG-Spitfire	106	105	106	105	103	103	107	108	109
TCG-Wildcat	103	102	–	101	102	–	106	103	–
WB9479	94	95	–	94	97	–	93	93	–
WB9590	96	101	–	96	102	–	96	100	–
Mean (Bu/Acre)	**65.4**	**68.1**	**69.0**	**72.4**	**73.6**	**74.9**	**56.2**	**60.9**	**61.6**
LSD (0.10)	**5.1**	**3.5**	**2.8**	**6.2**	**4.5**	**3.3**	**8.9**	**5.4**	**4.7**
No. of Environments	**14**	**28**	**43**	**8**	**16**	**24**	**6**	**12**	**19**

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in 2021 and by 4.0 bushels per acre over the past three years. The two southern locations, Lamberton and Morris, averaged 10.2 bushels per acre higher grain yield when fungicide protected in 2021 and 5.4 bushels per acre higher from 2019-21. Rather than the average increases in grain yield, the responses of individual varieties provide the most useful information; varieties rated susceptible to leaf rust, stripe rust, and other fungal leaf diseases usually benefited most from fungicide applications.

Authors and researchers

This report is authored by James Anderson, Jochum Wiersma, Ruth Dill-Macky, James Kolmer, Matt Rouse, Yue Jin and Linda Dykes.

Test plot establishment and management were supervised by Matt Bickell, Robert Bouvette, Dave Grafstrom, Mark Hanson, Tom Hoverstad, Mike Leiseth, Houston Lindell, Steve Quiring, Curtis Reese, Susan Reynolds, Nathan Stuart, Donn Vellekson and Joe Wodarek. ✻

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

	North						South						State					
	2021		2 Yr		3 Yr		2021		2 Yr		3 Yr		2021		2 Yr		3 Yr	
Entry	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int	Conv	Int
AP Gunsmoke CL2	76.6	83.5	78.8	83.9	–	–	60.4	70.6	54.1	61.3	–	–	68.5	77.1	66.5	72.6	–	–
AP Murdock	69.7	71.2	77.2	81.3	81.3	84.2	54.6	61.6	55.7	58.3	55.2	60.2	62.2	66.4	66.4	69.8	68.2	72.2
AP Smith	71.6	73.7	75.7	75.4	–	–	59.6	68.0	58.5	59.7	–	–	65.6	70.9	67.1	67.6	–	–
Bolles	70.9	74.9	72.6	73.9	74.1	74.9	54.4	61.3	54.7	58.7	52.1	56.9	62.6	68.1	63.7	66.3	63.1	65.9
CAG Justify	71.7	88.8	–	–	–	–	64.7	70.2	–	–	–	–	68.2	79.5	–	–	–	–
CAG Reckless	80.5	81.9	–	–	–	–	57.9	61.1	–	–	–	–	69.2	71.5	–	–	–	–
CP3099A	75.0	88.2	–	–	–	–	72.6	87.6	–	–	–	–	73.8	87.9	–	–	–	–
CP3119A	87.3	101.0	–	–	–	–	67.3	77.7	–	–	–	–	77.3	89.3	–	–	–	–
CP3188	80.4	89.2	–	–	–	–	70.7	73.7	–	–	–	–	75.6	81.5	–	–	–	–
CP3530	69.3	75.9	71.6	80.9	75.5	84.1	56.0	64.5	54.6	60.6	54.6	60.7	62.6	70.2	63.1	70.7	65.1	72.4
CP3915	66.9	81.4	77.3	83.9	81.2	85.3	56.6	67.7	57.2	61.8	53.8	59.9	61.7	74.6	67.2	72.9	67.5	72.6
Driver	74.4	88.1	76.1	80.6	–	–	64.5	65.7	61.7	60.2	–	–	69.4	76.9	68.9	70.4	–	–
Dyna-Gro Ambush	81.0	78.4	79.3	77.5	78.9	76.6	46.1	64.4	51.5	59.5	51.1	60.1	63.5	71.4	65.4	68.5	65.0	68.3
Dyna-Gro Ballistic	73.7	87.3	81.5	84.3	84.5	88.9	58.3	66.8	58.9	65.2	57.9	65.0	66.0	77.0	70.2	74.7	71.2	76.9
Dyna-Gro Commander	77.3	83.0	76.8	80.2	80.0	83.1	56.6	64.8	58.1	61.1	56.3	59.3	66.9	73.9	67.4	70.6	68.2	71.2
Lang-MN	69.8	73.3	74.8	76.6	76.7	80.0	55.5	65.0	54.6	60.6	53.3	60.2	62.6	69.2	64.7	68.6	65.0	70.1
LCS Buster	72.4	87.8	81.2	87.2	–	–	56.9	78.6	60.8	70.7	–	–	64.6	83.2	71.0	79.0	–	–
LCS Cannon	75.1	82.3	74.9	80.4	78.4	82.9	49.0	71.6	54.6	64.4	52.6	60.9	62.1	77.0	64.8	72.4	65.5	71.9
LCS Rebel	73.9	82.2	78.4	79.7	80.9	80.1	62.1	61.8	59.2	59.2	55.8	59.0	68.0	72.0	68.8	69.4	68.4	69.6
LCS Trigger	71.3	82.8	81.7	83.8	87.0	90.2	68.9	77.2	69.1	74.4	64.3	71.6	70.1	80.0	75.4	79.1	75.7	80.9
Linkert	71.9	69.6	71.9	74.6	72.6	76.7	53.0	66.3	51.5	58.7	48.7	54.8	62.4	67.9	61.7	66.7	60.7	65.7
MN-Torgy	72.0	73.7	77.3	77.3	79.6	82.3	56.9	66.6	59.3	59.8	57.4	59.0	64.4	70.1	68.3	68.6	68.5	70.6
MN-Washburn	72.4	74.6	69.5	82.5	73.5	83.8	59.4	66.0	56.9	59.3	55.0	59.2	65.9	70.3	63.2	70.9	64.2	71.5
MS Barracuda	70.8	80.0	71.1	75.5	74.8	78.2	49.2	61.4	51.6	56.0	47.7	53.5	60.0	70.7	61.3	65.8	61.3	65.9
MS Cobra	75.9	80.5	–	–	–	–	57.6	66.6	–	–	–	–	66.7	73.6	–	–	–	–
MS Ranchero	84.5	81.6	84.3	79.7	–	–	53.7	63.8	53.8	54.9	–	–	69.1	72.7	69.1	67.3	–	–
ND Frohberg	79.8	80.9	76.7	77.2	–	–	57.2	62.0	57.5	58.7	–	–	68.5	71.4	67.1	68.0	–	–
PFS-Buns	78.9	91.0	–	–	–	–	60.4	72.1	–	–	–	–	69.7	81.5	–	–	–	–
Prosper	75.1	83.6	80.3	84.8	82.4	88.8	62.0	71.7	61.4	66.7	60.0	66.3	68.5	77.7	70.8	75.7	71.2	77.5
Shelly	73.5	82.7	75.2	85.5	80.4	87.6	60.4	73.4	59.4	62.2	55.6	61.2	67.0	78.1	67.3	73.9	68.0	74.4
SY 611 CL2	72.5	79.6	77.3	81.4	79.1	86.2	56.0	65.7	53.5	58.9	51.9	56.8	64.2	72.7	65.4	70.2	65.5	71.5
SY Longmire	69.6	76.7	71.5	78.3	74.7	81.2	63.5	69.2	60.0	62.3	54.9	58.9	66.5	73.0	65.7	70.3	64.8	70.0
SY McCloud	79.6	73.0	77.3	75.5	77.7	78.4	51.6	63.7	49.6	55.3	48.9	53.9	65.6	68.3	63.4	65.4	63.3	66.2
SY Valda	75.8	84.0	77.2	84.3	82.7	88.3	58.1	71.8	56.3	62.8	54.6	60.9	67.0	77.9	66.7	73.6	68.7	74.6
TCG-Heartland	75.2	75.4	76.5	79.0	76.4	80.5	53.2	69.0	51.6	57.7	49.3	56.0	64.2	72.2	64.0	68.3	62.8	68.3
TCG-Spitfire	72.0	85.9	77.0	87.7	81.2	89.7	63.9	74.9	67.7	71.1	63.6	67.5	67.9	80.4	72.3	79.4	72.4	78.6
TCG-Wildcat	71.0	81.7	77.4	83.5	–	–	63.2	63.0	60.2	60.2	–	–	67.1	72.4	68.8	71.8	–	–
WB9479	70.1	73.3	74.3	75.3	–	–	49.4	62.7	49.5	55.5	–	–	59.7	68.0	61.9	65.4	–	–
WB9590	74.4	83.0	80.2	85.2	–	–	54.7	60.3	55.1	58.0	–	–	64.5	71.7	67.7	71.6	–	–
Mean (Bu/Acre)	**74.3**	**80.1**	**76.8**	**79.8**	**78.5**	**82.6**	**57.4**	**67.6**	**56.3**	**60.6**	**53.9**	**59.4**	**65.8**	**73.8**	**66.5**	**70.2**	**66.2**	**71.0**
LSD (0.10)	**11.7**	**9.9**	**7.8**	**7.7**	**5.9**	**6.0**	**8.7**	**9.1**	**5.8**	**6.0**	**4.8**	**4.8**	**7.6**	**6.5**	**5.0**	**4.8**	**3.8**	**3.8**
No. of Environments	**2**	**2**	**4**	**4**	**6**	**6**	**2**	**2**	**4**	**4**	**6**	**6**	**4**	**4**	**8**	**8**	**12**	**12**

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2021 Winter Wheat field crop trial results

Fall establishment and winter survival are key for winter wheat to reach its potential in Minnesota. Yield potential of winter wheat is higher than spring wheat, especially in the southern half of the state. Ideally, the winter wheat crop will have started to tiller in the fall, prior to freezing temperatures that force dormancy. Secondly, winter survival greatly improves if the crop does not break dormancy during a mid-winter thaw. No-till production practices help maintain snow cover, thereby improving winter survival. A stubble height of 4-6 inches is ideal but even shorter soybean stubble provides some protection.

The results of the variety performance evaluations are summarized in Tables 1-3. The winter wheat performance trials were conducted near Lamberton, Le Center, St. Paul, Becker, Crookston, and Roseau in 2021. The very dry fall and open winter resulted in a very variable stand in the trial near Crookston and the trial was abandoned. The

moderate drought that had cut a swath from Lake Traverse to Duluth in 2020 expanded to the whole state in 2021. By the end of July, a quarter of the state was classified as in an extreme drought and another half of the state in a severe drought. The earlier spring allowed for very good grain yields despite the lack of precipitation later in the growing season; the average grain yield of the winter wheat trials across the southern locations was nearly a third higher compared to the spring wheat trials in the same locations. Testing of Freeman, Northern, Oahe, WB4595, and Whitetail was discontinued. LCS Helix AX, Ray, SD Andes, and WB4309 were tested for the first time.

Winter hardiness, days to heading, plant height, and resistance to lodging have been converted to a 1-9 scale to allow for easier interpretation of the data (Table 1). Differences for all four characteristics are generally much less in the southern half of the state, while in the northern half of the state, the gap in these characteristics widens. Presenting averages of the actual data therefore can be misleading. Likewise, differences in test weight and grain protein are converted to a 1-9 scale. Varieties with lodging scores greater than 4 should be chosen with caution as lodging can reduce harvestability, yield, and quality. This is especially important if your soils are highly fertile.

While all winter wheat varieties should be considered susceptible to very susceptible to Fusarium head blight (scab), they head earlier than spring wheat varieties and thus have a chance of escaping losses in grain yield and test weight and presence of deoxynivalenol or vomitoxin, a major food safety concern that can result in steep discounts. AC Emerson, LCS Helix AX, ND Noreen, Redfield, Thompson, and Winner provide some of the best genetic resistance among winter wheat varieties (Table 3).

However, still consider these varieties to be more susceptible to Fusarium head blight than most spring wheat varieties. Most winter wheat varieties are also susceptible to very susceptible to the leaf diseases – including powdery mildew. Disease ratings for leaf diseases, stripe, leaf, and stem rust, and scab are provided by South Dakota State University and USDAARS. Re-

WINTER WHEAT: Continued on page 66

Table 1. Agronomic characteristics of winter wheat varieties.

Entry	Agent or Breeder[1]	Year of Release	Class[2]	Legal Status	Winter Hardiness[3]	Days to Heading[4]	Plant Height[5]	Straw Strength[6]	Test Weight[3]	Grain Protein[3]
					(1-9)					
AAC Goldrush	FP Genetics	2016	CWRW	PVP(94)	3	8	6	5	4	3
AC Emerson	Meridian Seeds	2010	CWRW	PVP(94)	4	7	6	4	4	1
Bobcat	MT	2019	HRWW	PVP(94)	3	7	1	4	6	3
Flathead	MT	2019	HRWW	PVP(94)	3	1	4	4	4	4
FourOSix	MT	2018	HRWW	PVP(94)	3	6	4	3	5	5
Ideal	SDSU	2011	HRWW	PVP(94)	4	6	4	5	5	4
Jupiter	MSU	2012	SWWW	PVP(94)	3	5	1	3	7	9
Keldin	WestBred	2011	HRWW	PVP(94)	5	7	6	4	5	6
LCS Helix AX	Limagrain Cereal Seeds	2020	HRWW	PVP(94)	-	1	2	-	3	9
ND Noreen	NDSU	2019	HRWW	PVP Pending	3	7	8	6	1	3
Ray	MT	2019	HRWW	PVP(94)	-	9	6	-	7	4
Redfield	SDSU	2013	HRWW	PVP(94)	5	5	3	4	3	5
Ruth	NE	2015	HRWW	PVP(94)	5	3	3	5	4	5
SD Andes	SDSU	2020	HRWW	PVP Pending	-	6	3	-	1	6
SY Wolf	AgriPro/Syngenta	2010	HRWW	PVP(94)	6	3	2	3	3	3
SY Wolverine	AgriPro/Syngenta	2019	HRWW	PVP(94)	4	1	1	4	4	5
Thompson	SDSU	2017	HRWW	PVP(94)	5	5	7	3	4	4
WB4309	WestBred	2020	HRWW	PVP(94)	-	1	3	-	5	2
WB4462	WestBred	2016	HRWW	PVP(94)	4	1	4	4	5	6
Winner	SDSU	2020	HRWW	PVP(94)	5	3	4	3	4	5
LSD (0.1)					**2**	**1**	**1**	**2**	**2**	**1**

[1]MSU = Michigan State University, MT = Montana State University, NE = University of Nebraska/Husker Genetics, NDSU = North Dakota State University, SDSU = South Dakota State University.
[2]CWRW = Canadian Western Red Winter Wheat, HRWW = Hard Red Winter Wheat, and SWWW = Soft White Winter Wheat.
[3]1 = highest and 9 = lowest.
[4]1 = earliest and 9 = latest.
[5]1 = shortest and 9 = tallest.
[6]1 = least prone and 9 = most prone to lodging.

Table 3. Disease reactions to economically important diseases of winter wheat.

Entry	Leaf Spotting Diseases[1,2]	Stripe Rust[2]	Leaf Rust[2]	Stem Rust[2]	Bacterial Leaf Streak[2]	FHB[2]
	(1-9)[3]					
AAC Goldrush	-	5	7	4	-	-
AC Emerson	6	3	7	5	-	4
Bobcat	-	2	7	6	7	-
Flathead	6	2	7	6	7	6
FourOSix	6	3	6	5	-	-
Ideal	7	8	5	4	5	5
Jupiter	-	8	8	8	-	6
Keldin	5	4	-	5	6	6
LCS Helix AX	7	2	8	1	-	4
ND Noreen	7	4	7	4	2	4
Ray	-	1	8	-	-	-
Redfield	7	5	7	4	6	4
Ruth	-	4	8	3	4	-
SD Andes	6	2	6	8	6	5
SY Wolf	4	7	3	5	5	6
SY Wolverine	6	6	5	2	3	6
Thompson	7	5	5	5	7	4
WB4309	7	5	6	5	6	7
WB4462	8	8	5	-	-	6
Winner	7	6	6	4	7	4

[1]Includes tan spot and Septoria complex.
[2]Data provided by SDSU and USDA-ARS.
[3]1 = most resistant and 9 = least resistant.

WINTER WHEAT:
Continued from page 65

search results in the region indicate that fungicides to control leaf diseases early in the season and suppress scab at anthesis are nearly always warranted and should be considered an integral part of your production practices.

Authors and Researchers

Authors of this winter wheat report are: Jochum Wiersma and Jim Anderson.

Test plot establishment and management are supervised by Dave Grafstrom, Houston Lindell, Susan Reynolds, Steve Quiring, Nate Stuart and Donn Vellekson. ✻

Winter Wheat
Planting Rate and Date

Bushel Weight, Pounds.....60
Seeds/Pound.....14,500
Planting Rate, Pounds Acre.....75+
Planting Rate, Seeds/Sq. Ft.....25
Planting Date.....Sept. 1 - Oct. 1

Table 2. Relative grain yield of winter wheat cultivars in Minnesota in single-year (2020) and mutiple-year comparisons (2018-2020).

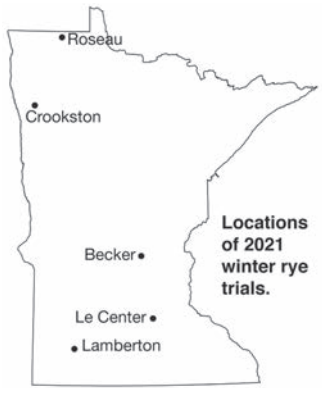
	Lamberton		Le Center		St. Paul		Becker[1] (irrigated)	Roseau		State	
Entry	2021	3 Yr	2021	3 Yr	2021	2 Yr[2]	2021	2021	2 Yr[3]	1 Yr	3 Yr
AAC Goldrush	100	100	101	95	89	89	91	87	91	95	96
AC Emerson	87	91	82	81	86	85	86	101	111	86	90
Bobcat[4]	84	86	90	84	85	72	88	107	104	89	84
Flathead[4]	93	91	107	104	111	109	93	94	93	97	99
FourOSix	101	102	95	101	109	107	103	117	103	104	102
Ideal	111	112	96	104	92	102	106	86	101	103	104
Jupiter	117	103	112	116	123	129	107	119	110	114	109
Keldin	113	109	110	113	115	112	117	97	102	113	109
LCS Helix AX	95	-	104	-	99	-	88	100	-	92	-
ND Noreen	92	104	97	98	88	88	93	119	115	94	101
Ray	98	-	97	-	91	-	103	64	-	97	-
Redfield	100	100	96	104	102	106	89	120	107	98	102
Ruth	104	96	100	102	102	104	98	96	102	100	98
SD Andes	101	-	103	-	111	-	102	109	-	106	-
SY Wolf	93	105	103	111	102	103	101	83	99	100	106
SY Wolverine	98	97	102	110	101	107	107	102	103	99	103
Thompson	111	106	104	104	94	103	106	82	94	104	105
WB4309	107	-	106	-	115	-	107	91	-	105	-
WB4462	96	100	95	104	93	104	114	103	106	99	103
Winner[4]	107	110	109	114	114	110	111	117	116	111	113
Mean (Bu/Acre)	**75.9**	**76.5**	**89.0**	**90.4**	**109.0**	**113.8**	**72.5**	**63.6**	**69.4**	**76.8**	**80.0**
LSD (0.1)	**14**	**9**	**10**	**9**	**9**	**8**	**15**	**16**	**18**	**7**	**5**

[1]Irrigated trial.
[2]2020 and 2021 data.
[3]2019 and 2021 data.
[4]Not testing in 2019, the 3-year data is a statitical prediction.

2021 Winter Rye field crop trial results

Winter rye (*Secale cereale* L.), also known as cereal rye, is the most winter hardy and drought tolerant of all small grains. Winter rye performs best in sandy loam, well-drained soils compared to fine textured soils with poor internal drainage. Soil pH for optimum growth ranges from 5.6 to 7.0, but rye can tolerate pH as low as 4.5 and as high as 8. Expect winter rye to be more productive than other small grains on infertile, sandy soils. Winter rye will continue to grow until late fall, overwinter, and resume growth quickly in the early spring. The aforementioned attributes explain the popularity of winter rye as a cover crop/green manure in both organic and conventional production systems. Other primary uses of winter rye are pasture/forage and grain crop.

Results of the University of Minnesota's variety performance evaluations are summarized in Tables 1 and 2. The rye performance trials were grown near Lamberton, LeCenter, Becker, Crookston and Roseau in 2021. The moderate drought that had cut a swath from Lake Traverse to Duluth in 2020 expanded to the whole state in 2021. By the end of July, a quarter of the state was classified as in an extreme drought and another half of the state in a severe drought. This year's trial results are a testament to winter rye's drought tolerance. The earlier spring allowed for very good grain yields despite the lack of precipitation during the growing season.



The dry conditions allowed for some temperature records to be broken in the last days of May and the first days of June with frost and record lows being reported on May 29 followed by triple digit heat and record highs on June 5. The widespread frost was of little consequence to the spring cereals but caused some sterility in winter rye that had just started to head. The drought and the accompanying low dew points made that no ergot or Fusarium head blight was observed in the trials.

The primary use, agronomic characteristics, and grain quality are summarized in Table 1. Winter hardiness, days to heading, plant height, straw strength, test weight, and grain protein have been converted to a 1-9 scale to allow for more straightforward interpretation of the data. Differences in days to heading, plant height, and straw strength are generally much less in the northern half of the state. In the southern half of

WINTER RYE: Continued on page 69

Table 1. Origin and agronomic characteristics of winter rye varieties in Minnesota in single-year (2021) and mutiple-year comparisons (2019-2021).

Entry	Agent or Breeder[1]	Year of Release	Type[2]	Legal Status[3]	Primary Use	Seed Color	Winter Hardiness	Days to Heading	Plant Height	Straw Strength	Ergot	Test Weight	Grain Protein
							(1-9)[4]						
Danko	Danko Hodowla Roślin	1976	OPV	None	Grain	Blue/Grey	1	5	4	2	3	1	7
Elbon	OK	1956	OPV	None	Forage	Green	5	1	9	9	9	9	1
Hazlet	SeCan	2006	OPV	None	Grain	Blue/Grey	2	7	7	6	1	2	6
KWS Bono[5]	KWS	2013	Hybrid	N/A	Grain	Green	2	7	1	1	1	1	9
KWS Brasetto	KWS	2007	Hybrid	N/A	Grain	Blue/Grey	3	6	1	1	1	9	9
KWS Receptor	KWS	2019	Hybrid	N/A	Grain	Green	2	9	1	2	-	2	9
KWS Serafino	KWS	2017	Hybrid	N/A	Grain	Green	2	6	2	1	1	2	9
KWS Tayo	KWS	2018	Hybrid	N/A	Grain	Green	2	6	1	1	1	4	9
Musketeer	SeCan	1981	OPV	None	Grain	Green	3	5	7	9	4	1	5
ND Dylan	NDSU	2016	OPV	PVP (Pending)	Dual Purpose	Green	2	7	9	7	2	3	5
ND Gardner	NDSU	2019	OPV	PVP (Pending)	Dual Purpose	Green/Yellow	3	1	9	5	3	9	2
Remington	SeCan	2000	OPV	None	Grain	Blue/Grey	2	5	7	7	2	9	3
Rymin	MN	1973	OPV	None	Grain	Blue/Grey	1	6	6	6	4	9	4
Spooner	WI	1992	OPV	None	Grain	Yellow	5	4	9	6	4	9	4
LSD (0.1)							**1**	**1**	**1**	**1**	**1**	**3**	**1**

[1]OK = Oklohoma State University; NDSU = North Dakota State University; UM = University of Minnesota; WI = University of Wisconsin.
[2]OPV= Open Pollinated Variety.
[3]Status under the Plant Variety Protection Act.
[4]1 = best and 9 = worst.
[5]Not tested in 2020, the 3-year data is a statistical prediction.

WINTER RYE: Continued from page 68

Minnesota, the differences between varieties for these characteristics are greater as the period of vegetative growth is generally longer in the south, especially with early and mild springs. Therefore, the averages of the actual data can be misleading. Varieties with lodging scores greater than 6 should be chosen with caution as lodging can reduce harvestability, yield, and quality. This is especially important if soils are highly fertile.

For comparison, the three-year average of relative grain yield of tested varieties is presented in Table 2. The average yield across the two testing locations included in the average was 85.8 bushels per acre in 2021. This compares to a three-year average of 85.2 bushels per acre. Danko, Hazlet, and Rymin are the most productive and best adapted of the open pollinated varieties. Hybrid winter rye that are commercially available yield 30-40 percent more compared to the best performing open pollinated varieties.

Varieties differ in their susceptibility to several economically important fungal pathogens, including powdery mildew, leaf rust, leaf spotting diseases, Fusarium head blight and ergot. Not enough observations have been made to-date to reliably differentiate winter rye varieties based on their susceptibility to these diseases. A preliminary rating to susceptibility to ergot is included due to the economic importance of this disease. Note that no variety tested is immune to ergot and that fungicides do not provide control of ergot. Application of a fungicide should be considered if powdery mildew is present before jointing. Likewise, control of leaf rust may be warranted if the disease is found near the top of the canopy just as the flag leaf is emerging.

Authors and researchers

This report is authored by Jochum Wiersma.

Test plot establishment and management were supervised by Dave Grafstrom, Houston Lindell, Steve Quiring and Donn Vellekson. ✻

Thank you for reading the 2022 Minnesota Certified Seed Guide!

Table 2. Relative grain yield of winter rye varieties in five Minnesota locations in single-year (2021) and multiple-year comparisons (2019-2021).

	Lamberton		Le Center		Becker		Crookston	Roseau		State	
Entry	2021	3 Yr	2021	3 Yr	2021	2 Yr[1]	2021	2021	2 Yr[1]	2021	3 Yr
Danko	120	116	124	124	117	111	94	101	102	115	110
Elbon	72	82	81	80	62	71	61	62	59	70	72
Hazlet	113	106	112	110	111	115	104	103	106	108	107
KWS Bono[2]	144	149	141	157	152	162	155	140	142	144	145
KWS Brasetto	148	130	144	157	144	136	136	147	142	143	136
KWS Receptor	155	165	139	149	148	146	173	157	157	148	151
KWS Serafino	137	157	145	176	158	154	142	157	161	145	151
KWS Tayo	147	149	149	175	146	138	150	163	164	146	147
Musketeer	104	112	105	99	107	107	107	102	94	103	105
ND Dylan	107	107	105	104	105	105	126	110	103	107	107
ND Gardner	91	104	96	101	81	92	90	75	81	90	93
Remington	94	92	108	102	99	100	107	97	100	101	100
Rymin	100	100	100	100	100	102	100	100	94	100	100
Spooner	89	97	97	98	91	96	73	73	73	89	90
Mean (bu/acre)	**82.4**	**71.7**	**96.2**	**95.2**	**74.4**	**78.4**	**63.1**	**100.1**	**99.7**	**83.1**	**84.0**
LSD (0.1)	**12**	**13**	**7**	**13**	**10**	**10**	**11**	**8**	**11**	**5**	**5**

[1]2019 and 2021 data.
[2]Not tested in 2020, the 3-year data is a statistical prediction.

Certified Seed Directory of Growers

The crops and varieties listed in this portion of the *Seed Guide* were grown by members of the Minnesota Crop Improvement Association. Varieties listed are those applied for by Oct. 1, 2021. Certification of field crops is not complete until the fields have passed inspection, a representative cleaned seed sample has met standards based on complete laboratory analysis, and the seed is properly labeled. The certification tag on the bag or a bulk sale certificate is the buyer's assurance that seed so represented has met all certified seed standards. Seed sold without proper certification markings is not certified seed.

Under the columns for acreage, Registered and Certified classes are designated as follows:

R = Registered

C = Certified

Not all certifiable crops and varieties are included. Varieties intended for export and some private varieties are not included, by choice of the owner.

Protected crop varieties

Most varieties listed in the directory portion of the *Seed Guide* are protected by the U.S. Plant Variety Protection Act or by license agreements with the owner of the variety. Crop varieties for which applications have been filed or certificates issued for protection under the Plant Variety Protection Act (PVPA) have been noted elsewhere in this publication. PVPA Title V specifies the seed of the variety may be sold only as a class of certified seed. In addition, for varieties noted as PVP(94), you may save seed only for your own planting. You may not provide/sell/barter/exchange it to a neighbor or another party without specific permission of the variety owner. Some protected crop varieties need not be sold as a class of certified seed; owners of those varieties are responsible for informing growers of restrictions regarding seed production.

The information in the *Seed Guide* is not an all-inclusive PVP list! Call MCIA if you are unsure of a variety's PVP status or you can check PVP status on the Internet at https://www.ams.usda.gov/services/plant-variety-protection/application-status.

Notice to buyers

The Minnesota Crop Improvement Association can assume no financial responsibility for seed or other products listed in this directory or for disagreements over sales which may arise from this list. However, complaints about certified seed addressed to the association will be investigated. Should there be a claim over seed performance involving the Minnesota Crop Improvement Association, it must be addressed as provided in the Minnesota Department of Agriculture Rules for Arbitration of Seed Performance Disputes.

Inquiries for seed should be directed to applicants and conditioners listed. It is the applicant's (seller's) responsibility to supply seed representative of the samples submitted and approved for certification by the Minnesota Crop Improvement Association. Buyers should insist on certification being complete (including attachment of certified seed tags to bags or obtaining a bulk sale certificate when purchasing seed). ✻

Barley

County	Producer	City	Phone	R	C
LACEY					
Carlton	Northland Farm Supply Inc.	Cromwell	218-821-1627		30
Grant	Adams Seed	Wendell	218-458-2151		74
Mahnomen	Sweep, Nathan A	Fosston	218-435-1360		50
Norman	Chisholm, Keith, Bill & Nick	Gary	218-356-8300	55	
Polk	Fosston Tri-Coop	Fosston	218-435-6222	40	98
Todd	Faust, Kevin	Long Prairie	320-732-3361	34	
Wilkin	Gowin, Kyle	Breckenridge	701-640-1450		133
ND GENESIS					
Marshall	Kowalski, John & Darrin	Stephen	218-478-4119		50
QUEST					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		225
RASMUSSON					
Polk	Capistran, Kevin	Crookston	218-891-7840	20	65
ROBUST					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161	25	
Meeker	Peterson, Russell M	Grove City	320-877-7793		
ROYAL					
Wabasha	Zabel Seeds	Plainview	507-534-2498		94
TRADITION					
Kittson	Kirkeby, Aaron	Kennedy	701-899-3215	150	
Norman	Spring Creek Seed & Consulting	Ulen	218-261-1647	52	

Beans

County	Producer	City	Phone	R	C
ECLIPSE BLACK					
Grant	Kapphahn, John M	Elbow Lake	218-685-4604	80	
ND TWILIGHT BLACK					
Grant	Kapphahn, John M	Elbow Lake	218-685-4604	110	
Norman	Star of the North	Gary	218-356-8300	30	
ND WHITETAIL WHITE KIDNEY					
Norman	Star of the North	Gary	218-356-8300	50	
RED CEDAR DARK RED KIDNEY					
Norman	Star of the North	Gary	218-356-8300		35
ROSIE LIGHT RED KIDNEY					
Norman	Star of the North	Gary	218-356-8300	5	50
TALON DARK RED KIDNEY					
Norman	Star of the North	Gary	218-356-8300	35	35

Kentucky Bluegrass

County	Producer	City	Phone	R	C
PARK					
Roseau	C&S Habstritt Inc	Roseau	218-463-1193	20	290
Roseau	Elton, Marlin	Roseau	218-689-7528		200
Roseau	Erickson, Douglas	Roseau	218-469-2660	10	291
Roseau	Haugen Family Farms	Roseau	218-242-0497		360
Roseau	Magnusson, Erik	Roseau	218-684-5442		77
Roseau	Olafson, Mark	Roseau	218-242-2216		489
Roseau	Slater, Bridget	Roseau	218-469-2533		80
Roseau	Slater, Gary	Roseau	218-463-1064		857
Roseau	Wensloff, Tony	Roseau	218-463-2668		381

Oats

County	Producer	City	Phone	R	C
ANTIGO					
Rice	Werner Seed Company	Dundas	507-645-7995		23
Wabasha	Zabel Seeds	Plainview	507-534-2498		46
DEON					
Carlton	Northland Farm Supply Inc.	Cromwell	218-821-1627		49
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		92
Polk	Fosston Tri-Coop	Fosston	218-435-6222	30	440
Polk	Gully Ag Inc	Gully	218-268-3050		100
Redwood	Sawvell's Seed, Inc	Clements	507-692-2240		10
Rice	Werner Seed Company	Dundas	507-645-7995		20
Stearns	Nietfeld Farm, Inc	Melrose	320-987-3442		112
Swift	Falk's Seed Farm	Murdock	320-875-4341	33	
Todd	Faust, Kevin	Long Prairie	320-732-3361		156
Wabasha	Gerken's Feed & Grain LLC	Wabasha	651-565-2611	19	
ESKER2020					
Mower	Grass & Sons Seed, Inc	LeRoy	507-324-5820		20
Wabasha	Zabel Seeds	Plainview	507-534-2498		60
HAYDEN					
Polk	Fosston Tri-Coop	Fosston	218-435-6222		35
MN-PEARL					
Brown	Cunningham Seed Farms	Sleepy Eye	507-794-7323	20	
Clay	Tobolt Seed	Moorhead	218-287-2904	29	
Kandiyohi	Loge, Alan	Willmar	320-212-5578		22
Lake of the Woods	Northern Excellence Seed LLC	Williams	218-783-2228		
Le Sueur	Haas Seed Farm	Le Sueur	612-327-5385	20	43
Le Sueur	Stangler Seed Co LLC	Kilkenny	507-595-2883		50
Meeker	Anderson Seeds	Dassel	320-286-2700		100
Pipestone	Spronk & Sons Seed Farm, Art	Edgerton	507-442-5334		60
Polk	Fosston Tri-Coop	Fosston	218-435-6222	30	608
Rice	Werner Seed Company	Dundas	507-645-7995		28
Roseau	Kukowski, Jim	Strathcona	218-781-2478	80	
Swift	Falk's Seed Farm	Murdock	320-875-4341		50
Todd	Faust, Kevin	Long Prairie	320-732-3361	78	
Traverse	Triple J Seed	Wheaton	320-563-4509		226
Wadena	Petersen, Mike	Sebeka	218-639-5448	22	
Wilkin	Wolverton Farm Supply (Ross E Aigner)	Wolverton	701-367-4133		35
REINS					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		508
Todd	Faust, Kevin	Long Prairie	320-732-3361		50
Wabasha	Zabel Seeds	Plainview	507-534-2498		42
RUSHMORE					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		310
Lincoln	Deutz, Daniel	Lake Benton	507-368-9234		15
SADDLE					
Brown	Cunningham Seed Farms	Sleepy Eye	507-794-7323		16
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		304
Le Sueur	Stangler Seed Co LLC	Kilkenny	507-595-2883		50
Mower	Grass & Sons Seed, Inc	LeRoy	507-324-5820		42
Rice	Werner Seed Company	Dundas	507-645-7995		30
Stearns	Spring Water Acres LLC	Melrose	320-249-2254		255
Swift	Falk's Seed Farm	Murdock	320-875-4341		94
Wabasha	Zabel Seeds	Plainview	507-534-2498		47
SHELBY 427					
Wabasha	Gerken's Feed & Grain LLC	Wabasha	651-565-2611		22

County	Producer	City	Phone	R	C
STREAKER					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161	102	
Swift	Falk's Seed Farm	Murdock	320-875-4341	42	
SUMO					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		139
WARRIOR					
Clay	Tobolt Seed	Moorhead	218-287-2904		13
Rice	Werner Seed Co.	Dundas	507-645-7995		30
Stearns	Nietfeld Farm, Inc	Melrose	320-987-3442		60

Rye

AROOSTOOK					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161	13	59
KWS BONO					
IL-Champaign	KWS Cereals USA, LLC	Champaign	815-200-2666		
KWS SERAFINO					
IL-Champaign	KWS Cereals USA, LLC	Champaign	815-200-2666		
KWS TAYO					
IL-Champaign	KWS Cereals USA, LLC	Champaign	815-200-2666		
ND DYLAN					
Wilkin	Nichol, Stuart	Wolverton	701-238-2681		77
Wilkin	Scheffler, Richard	Barnesville	218-493-4456		60
ND GARDNER					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		150
SPOONER					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		44

Soybeans

201602142					
Pennington	Funk, Terry	Thief River Falls	218-289-3797		
IA1010					
Houston	Sno Pac Farms LLC	Caledonia	507-725-5281		
IA1022					
Faribault	Prescher-Willette Seeds	Delavan	507-854-3595		
IA1029					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		
IA2076LF					
Houston	Sno Pac Farms LLC	Caledonia	507-725-5281		
MN0702CN					
Wilkin	Brushvale Seed, Inc	Breckenridge	218-643-2311		
MN0810CN					
Norman	Star of the North	Gary	218-356-8300	30	
MN1312CN					
Rice	Werner Seed Company	Dundas	507-645-7995	30	
MN1807CN					
Rice	Werner Seed Company	Dundas	507-645-7995	28	25
ND17009GT					
Kittson	Oak Grove Seed & Supply LLC	Hallock	218-526-0239		75
Marshall	Hagen Farm of Gatzke, Inc	Gatzke	218-459-3344		75
ND-Pembina County	Kotchman, James W	Pembina	701-825-6821		
Pennington	Barth, Brad (Brad Barth Farms)	Goodridge	218-681-4236		300
Roseau	Manna Farms	Lancaster	218-782-3777		80
ND21008GT20					
Pennington	Barth, Brad (Brad Barth Farms)	Goodridge	218-681-4236	80	

Timothy

CLAIR					
Lake of the Woods County	Northern Excellence Seed LLC	Williams	218-783-2228		

Triticale

934271498					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		
FORAGE FX 1001					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		

Wheat

AP MURDOCK					
Clay	Petermann Seeds, Inc	Hawley	218-483-3302		
Clay	Tobolt Seed	Moorhead	218-287-2904		
Grant	Thiel Seed Service	Wendell	218-458-2415		
Kittson	Petersen, Ronald L	Lake Bronson	218-754-4631		
Marshall	Bakke, Deland	Newfolden	218-874-7911		
Pennington	Trontvet, Erick	Thief River Falls	218-686-1797		
Polk	AgriMAX	Fisher	218-891-2211		
Polk	Capistran Seed Company	Crookston	218-891-7840		
Polk	Fosston Tri-Coop	Fosston	218-435-6222		
Renville	Finish Line Seed, Inc	Bird Island	320-365-3674		
Roseau	Kukowski, Jim	Strathcona	218-781-2478		
Wilkin	Beyer Seed Farm	Kent	701-640-2222		
AP SMITH					
Clay	Petermann Seeds, Inc	Hawley	218-483-3302		
Clay	Tobolt Seed	Moorhead	218-287-2904		
Grant	Thiel Seed Service	Wendell	218-458-2415		
Kittson	Petersen, Ronald L	Lake Bronson	218-754-4631		
Polk	AgriMAX	Fisher	218-891-2211		
Polk	Capistran Seed Company	Crookston	218-891-7840		
Roseau	Kukowski, Jim	Strathcona	218-781-2478		
Wilkin	Beyer Seed Farm	Kent	701-640-2222		
BOLLES					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161	14	67
Swift	Falk's Seed Farm	Murdock	320-875-4341	36	64
CANNON					
Clay	Krabbenhoft Seed & Supply LLC	Sabin	218-789-7219		156
Polk	Balstad, Scott	Fosston	218-435-6311		110
Polk	Capistran Seed Company	Crookston	218-891-7840	53	588
Wilkin	Friederichs Seed Farm	Foxhome	218-205-8759		80
FALLER					
Polk	Balstad, Scott	Fosston	218-435-6311		125
GLENN					
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161	47	
LANG-MN					
Brown	Cunningham Seed Farms	Sleepy Eye	507-794-7323		39
Meeker	Smith, Steven	Darwin	320-221-8255		18
Redwood	Sawvell's Seed, Inc	Clements	507-692-2240		28
LCS BUSTER					
Marshall	Jensen Farms	Stephen	218-478-3397		
Polk	Capistran Seed Company	Crookston	218-891-7840		
Wilkin	Friederichs Seed Farm	Foxhome	218-205-8759		
LCS TRIGGER					
Marshall	Jensen Farms	Stephen	218-478-3397	20	160
Polk	Balstad, Scott	Fosston	218-435-6311		185
Wilkin	Friederichs Seed Farm	Foxhome	218-205-8759		70
LINKERT					
Clay	Tobolt Seed	Moorhead	218-287-2904	40	95
Grant	Red River Marketing Co	Elbow Lake	218-685-6100		130
Kittson	Johnson Farms, Inc, Lloyd	Karlstad	218-436-2817		128
Kittson	Oak Grove Seed & Supply LLC	Hallock	218-526-0239		215
Mahnomen	Haugo Farms	Waubun	218-473-2254		242
Mahnomen	Pazdernik Farms, Inc	Waubun	218-766-9531	22	80
Marshall	Hagen Farm of Gatzke, Inc	Gatzke	218-459-3344	30	
Marshall	Thompson, Jake	Middle River	218-469-9384		144
Meeker	Anderson Seeds	Dassel	320-286-2700		75
Norman	Chisholm, Keith, Bill & Nick	Gary	218-356-8300	20	
Norman	Spring Creek Seed & Consulting	Ulen	218-261-1647		104
Pennington	Barth, Brad (Brad Barth Farms)	Goodridge	218-681-4236		287
Pennington	Scholin Farms	Thief River Falls	218-964-5268	40	
Polk	Fosston Tri-Coop	Fosston	218-435-6222		110
Red Lake	Myhre Farms	Red Lake Falls	218-698-4615		107
Red Lake	Swenson Seed Farm	Brooks	218-796-5285	112	841
Red Lake	Vatthauer Farm	Red Lake Falls	218-253-2490		146
Roseau	CHS Northland Grain – Greenbush	Greenbush	218-782-2111		370
Roseau	Kukowski, Jim	Strathcona	218-781-2478	140	
MN-TORGY					
Brown	Cunningham Seed Farms	Sleepy Eye	507-794-7323		20
Clay	Brakke, Luke	Moorhead	701-238-2965		202
Clay	Krabbenhoft Seed & Supply LLC	Sabin	218-789-7219	60	125
Clay	Ness, Larry & Matt	Fargo	218-585-4179		142
Clay	Olsgaard, Inc, Harold	Moorhead	218-585-4535		80
Clay	Tande, Harmen	Moorhead	701-429-0541	27	
Clay	Tobolt Seed	Moorhead	218-287-2904	80	382
Clay	Wetterlin, Jerry & Aaron	Glyndon	218-494-3339		148
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161		45
Grant	Adams Seed	Wendell	218-458-2151	20	175
Grant	Backman Seeds, Inc	Herman	320-677-2231		94
Grant	Red River Marketing Co	Elbow Lake	218-685-6100	40	363
Grant	Thiel Seed Service	Wendell	218-458-2415		224
Kittson	Aakre, Adam	Karlstad	218-688-2346		67
Kittson	Hunt Seed Company	Hallock	218-843-2327		277
Kittson	Johnson Farms, Inc, Lloyd	Karlstad	218-436-2817		570
Kittson	Lake Bronson Elevator, Inc	Lake Bronson	218-754-4200		383
Kittson	Larson Farms, Michael J	Drayton	701-520-1033	57	102
Kittson	MN Wiese Partnership (Neil & Mark Wiese)	Humboldt	218-843-1282		247
Kittson	Oak Grove Seed & Supply LLC	Hallock	218-526-0239	24	359
Kittson	Peterson, Noel	Hallock	218-843-2865		38
Kittson	Schwenzfeier, Ryan	Kennedy	218-843-1394		310
Lincoln	Jerzak, Jerome & Tim	Ivanhoe	507-694-1582	23	
Mahnomen	Haugo Farms	Waubun	218-473-2254		260
Mahnomen	Pazdernik Farms, Inc	Waubun	218-766-9531	22	60
Marshall	Anderson, Luther H	Stephen	218-455-3305		
Marshall	Bakke, Deland	Newfolden	218-874-7911		303
Marshall	Green, Carl M	Strandquist	218-597-2861		154
Marshall	Hagen Farm of Gatzke, Inc	Gatzke	218-459-3344	40	150
Marshall	Holte, Steven and Andrew	Grygla	218-294-6537		187
Marshall	Jensen Farms	Stephen	218-478-3397	40	500
Marshall	Kowalski, John & Darrin	Stephen	218-478-4119		150
Marshall	Liedberg, Jerad	Warren	701-219-3309		187
Marshall	Peterson Farms of Warren, Inc, D L	Warren	218-745-4077	40	
Marshall	Peterson, Maynard	Stephen	218-478-3859		305
Marshall	Riopelle, Brent	Argyle	218-201-2133		297
Marshall	Riopelle Seed/Joshua David Kostrzcwski	Argyle	218-478-4069	74	162
Marshall	Thompson, Jake	Middle River	218-469-9384	91	76
McLeod	Thalmann Seeds, Inc	Plato	320-238-2185		40
Norman	Borge, Brian & Jon	Ada	218-784-2168		130
Norman	Chisholm, Keith, Bill & Nick	Gary	218-356-8300	40	
Norman	Spring Creek Seed & Consulting	Ulen	218-261-1647		80
Norman	West Central Ag Service	Ulen	218-596-8830		210
Otter Tail	Walkup, John S & Chad	Campbell	218-739-2580		208

County	Producer	City	Phone	R	C
Pennington	Barth, Brad (Brad Barth Farms)	Goodridge	218-681-4236	80	749
Pennington	Farmers Co-op Grain & Seed	Thief River Falls	218-681-6281		80
Pennington	Miller, Aaron	Goodridge	218-378-4145		255
Pennington	Scholin Farms	Thief River Falls	218-964-5268	70	20
Polk	AgriMAX	Fisher	218-891-2211		100
Polk	Balstad, Scott	Fosston	218-435-6311		120
Polk	Broadwell, Jeff	Fosston	218-435-2194		93
Polk	Brule, David A	Crookston	218-289-0067	155	283
Polk	Capistran, Kevin	Crookston	218-891-7840		85
Polk	Fosston Tri-Coop	Fosston	218-435-6222	44	340
Polk	Novak, James	Angus	701-215-3844		240
Polk	Peterson, Inc, D.W.	Warren	218-745-4507	50	570
Polk	Roed Farms	Fosston	218-435-1705		80
Polk	Sonstelie Farms	Winger	218-938-4189	25	
Polk	Tiedemann, Gene R	Euclid	218-281-6723		618
Red Lake	Myhre Farms	Red Lake Falls	218-698-4615		165
Red Lake	Swenson Seed Farm	Brooks	218-796-5285	134	992
Red Lake	Vatthauer Farm	Red Lake Falls	218-253-2490		295
Roseau	CHS Northland Grain – Greenbush	Greenbush	218-782-2111		320
Roseau	C & S Habstritt Inc	Roseau	218-463-1193		26
Roseau	Haugen Family Farms	Roseau	218-242-0497		60
Roseau	Kukowski, Jim	Strathcona	218-781-2478	370	
Roseau	Magnusson Farms	Roseau	218-463-2374		360
Swift	Falk's Seed Farm	Murdock	320-875-4341		178
Swift	Lee's Seed Farm	Benson	320-843-2857		89
Traverse	Triple J Seed	Wheaton	320-563-4509		62
Wilkin	Beyer Seed Farm	Kent	701-640-2222		
Wilkin	Etzler Farms, Inc	Foxhome	218-643-1361		335
Wilkin	Friederichs Seed Farm	Foxhome	218-205-8759	80	145
Wilkin	Haugrud Seed Plant	Rothsay	218-493-4275	52	360
Wilkin	Nelson, Bradley	Wolverton	218-995-2299		78
Wilkin	Torkelson, Brent	Foxhome	218-736-7086		75
Wilkin	Wolverton Farm Supply (Ross E Aigner)	Wolverton	701-367-4133	38	180
MN-WASHBURN					
Koochiching	Benike Farms, Inc	Baudette	218-244-9751		139
Marshall	Holte, Steven and Andrew	Grygla	218-294-6537		157
Marshall	Jensen Farms	Stephen	218-478-3397		530
Pennington	Barth, Brad (Brad Barth Farms)	Goodridge	218-681-4236		140
Pennington	Scholin Farms	Thief River Falls	218-964-5268		150
Polk	Fosston Tri-Coop	Fosston	218-435-6222	47	209
Roseau	C&S Habstritt Inc	Roseau	218-463-1193		240
Roseau	Haugen Family Farms	Roseau	218-242-0497		165
Swift	Lee's Seed Farm	Benson	320-843-2857		62
ND FROHBERG					
Polk	Balstad, Scott	Fosston	218-435-6311	45	
SHELLY					
Kittson	Oak Grove Seed & Supply LLC	Hallock	218-526-0239		189
Marshall	Bring, Sharon	Strandquist	218-874-3713		83
Marshall	Hagen Farm of Gatzke, Inc	Gatzke	218-459-3344	40	
Marshall	Jensen Farms	Stephen	218-478-3397		130
Marshall	Thompson, Jake	Middle River	218-469-9384		255
Red Lake County	Myhre Farms	Red Lake Falls	218-698-4615		170
Red Lake County	Vatthauer Farm	Red Lake Falls	218-253-2490		229
Traverse	Triple J Seed	Wheaton	320-563-4509		40
Wilkin	Haugrud Seed Plant	Rothsay	218-493-4275	40	285
SY INGMAR					
Wilkin	Haugrud Seed Plant	Rothsay	218-493-4275		
SY VALDA					
Clay	Petermann Seeds, Inc	Hawley	218-483-3302		
Grant	Backman, Michael	Herman	320-304-2232		
Grant	Backman, Tim	Herman	320-677-2231		
Kittson	Petersen, Ronald L	Lake Bronson	218-754-4631		
Marshall	Newfolden Co-op Elevator Assn	Newfolden	218-874-7465		

County	Producer	City	Phone	R	C
Pennington	Farmers Co-op Grain & Seed	Thief River Falls	218-681-6281		
Polk	Capistran Seed Company	Crookston	218-891-7840		
Polk	Fosston Tri-Coop	Fosston	218-435-6222		
Roseau	Kukowski, Jim	Strathcona	218-781-2478		
TCG-HEARTLAND					
Norman	West Central Ag Services	Ulen	218-596-8830		
TCG-WILDCAT					
Marshall	Jensen Farms	Stephen	218-478-3397		
Norman	West Central Ag Services	Ulen	218-596-8830		
Polk	AgriMAX	Fisher	218-891-2211		
Roseau	Premier Ag	Greenbush	218-782-2271		
TW STARLITE					
Clay	Thunder Seed	Dillworth	218-422-9011		
WB9479					
Grant	Adams Seed	Wendell	218-458-2151		
Norman	West Central Ag Services	Ulen	218-596-8830		
Polk	AgriMAX	Fisher	218-891-2211		
Polk	Capistran Seed Company	Crookston	218-891-7840		
Polk	Peterson, Douglas	East Grand Forks	218-779-1993		
Polk	Thorson Farming JV	East Grand Forks	218-893-2285		
WB9590					
Clay	Krabbenhoft Seed & Supply LLC	Sabin	218-789-7219		
Clay	Tobolt Seed	Moorhead	218-287-2904		
Grant	Adams Seed	Wendell	218-458-2151		
Grant	Backman Seeds, Inc	Herman	320-677-2231		
Kittson	Weinlaeder Seed Company	Drayton	701-454-6427		
Marshall	CHS Ag Services	Warren	218-745-4166		
Norman	West Central Ag Services	Ulen	218-596-8830		
Polk	AgriMAX	Fisher	218-891-2211		
Polk	Capistran Seed Company	Crookston	218-891-7840		
Polk	TDS Fertilizer, Inc.	Fertile	218-945-6021		
Polk	Thorson Farming JV	East Grand Forks	218-893-2285		
Roseau	Premier Ag	Greenbush	218-782-2271		
WB9719					
Grant	Adams Seed	Wendell	218-458-2151		
Norman	West Central Ag Services	Ulen	218-596-8830		
Polk	AgriMAX	Fisher	218-891-2211		
WB-MAYVILLE					
Polk	AgriMAX	Fisher	218-891-2211		
Polk	TDS Fertilizer, Inc.	Fertile	218-945-6021		

Winter Wheat

EMERSON				
McLeod	Thalmann Seeds, Inc	Plato	320-238-2185	28
EXPEDITION				
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161	77
Le Sueur	DS Construction & Packaging LLC	Kilkenny	507-595-3331	64
Le Sueur	Stangler Seed Co LLC	Kilkenny	507-595-2883	50
IDEAL				
Polk	Fosston Tri-Coop	Fosston	218-435-6222	70
REDFIELD				
Meeker	Smith, Steven	Darwin	320-221-8255	18
SY WOLF				
Freeborn	Albert Lea Seed House, Inc	Albert Lea	507-373-3161	
THOMPSON				
Rice	Werner Seed Company	Dundas	507-645-7995	11

2021 Alfalfa field crop trial results

Selecting alfalfa varieties with high forage yield potential and persistence is fundamental to profitability. Yield potential of public and privately developed alfalfa varieties has been continually evaluated in research trials at the University of Minnesota over the past 80 years. As participation from alfalfa marketers and developers has declined, we have reduced the numbers of trials. This is the final year of the alfalfa variety testing program.

Yield results are for alfalfa varieties currently tested at Rosemount, Minn. This is the final year of the 2018 trial. Varietal yield difference tends to increase with stand age. To choose a variety for short-term stands, consider yield performance the first and second years after seeding

There are many other alfalfa variety traits important for growers to consider in selecting a variety. These include winter survival, disease resistance, and leafhopper resistance. Variety comparisons for these traits provided by alfalfa marketers are described in

the National Alfalfa and Forage Alliance's Alfalfa Variety Ratings leaflet at https://www.alfalfa.org/pdf/2021_Alfalfa_Variety_Leaflet.pdf.

Winter Survival

The potential of severe winters makes winter survival a primary consideration in variety selection for most areas of Minnesota. Winter survival potential of varieties is difficult to determine because winter injury can occur as a result of weather events that cause varied responses in alfalfa plants of differing ages. A test has been developed to determine relative levels among varieties. Winter survival levels of alfalfa varieties are shown at https://www.alfalfa.org/varietyratings.php.

Forage Yield

Yield results for alfalfa varieties tested in current Minnesota trials are presented in Table 1. Yields are expressed as a percentage of check variety yields; for example, "113" means the variety had 13 percent greater yield than the average of the check varieties. Within the table, varieties are ranked according to their average performance across ALL current trials in which they have been tested (2018 seeding years). LSD numbers beneath yield columns indicate whether the difference between yields is due to genetics or to other factors, such as variations in the environment. If the yield difference between two entries exceeds the LSD value, the higher-yielding entry was superior in yield.

Varietal yield difference tends to increase with stand age. Thus, to choose a variety for short-term stands, consider yield performance the first and second years after seeding (e.g., yield performance in 2019 and 2020 for a 2018 seeding year).

Potato Leafhopper Tolerance

Potato leafhoppers (PLH) are usually the most damaging insect pest of alfalfa in Minnesota. Despite their potential for significant damage, PLH are not a problem in every harvest, year, and region of Minnesota. Variety resistance to potato leafhopper is available at https://www.alfalfa.org/varietyratings.php.

Disease Resistance

Alfalfa root and crown diseases occur in most Minnesota soils. The most important diseases are Bacterial wilt, Phytophthora root rot, Fusarium wilt, Anthracnose, Verticil-

ALFALFA:
Continued on page 24

UNIVERSITY OF MINNESOTA
Driven to Discover®

SMALL GRAINS

MN-TORGY WHEAT

NEW!

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

MN-WASHBURN WHEAT

High yielding
Good straw strength
Resistant to pre-harvest sprouting
Excellent overall disease resistance
Carries BYDV resistance gene

OTHER UNIVERSITY OF MINNESOTA DEVELOPED VARIETIES:

WHEAT

Linkert - Strong Straw
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.