PRACTICAL FARMERS OF IOWA
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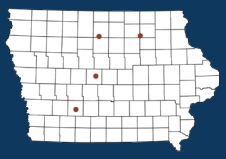
EXPERIMENT



2024

Cereal Rye and Triticale Variety Trial 2024

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In a Nutshell:

- Eleven cereal rye varieties and one triticale variety were screened at four Iowa State University research farms.

Key Findings:

- Across sites and varieties, average cereal rye yield was 89 bu/ac, higher than any of the six previous trial years.
- Hybrid cereal rye varieties Serafino and Receptor were among the three highest yielding varieties at all four sites. Other high yielding rye varieties included SU Performer, SU Cossani, and Tayo.
- Tulus (triticale) and SU Bebop (new this year) were the top yielding open-pollinated varieties across all sites.

Cooperators

ISU Northern Research Farm (Matt Schnabel) – Kanawha

ISU Northeast Research Farm (Ken Pecinovsky) – Nashua

ISU Ag Engineering and Agronomy Research Farm (Matt Schnabel) – Boone

ISU Southwest Research Farm (Matt Schnabel) – Greenfield

Funding

USDA-NIFA

Albert Lea Seed House

Green Cover

North Dakota State University

KWS

FP Genetics

BACKGROUND

This was the sixth year that Practical Farmers of Iowa coordinated cereal rye variety trials at Iowa State University research farms at Kanawha (north-central Iowa) and Nashua (northeast Iowa); it was the fourth year of trials at ISU research farms at Boone (central Iowa) and Greenfield (southwest Iowa). In 2024, we once again included one winter triticale variety (Tulus) along with 11 cereal rye varieties (**Table 1**), including three new cereal rye varieties: SU Bebop, SU Cossani and SU Performer.

In 2023, a historic drought, the average cereal rye yield across the four research farms was 42.6 bu/ac.[1] In contrast, cereal rye variety trials conducted by the University of Minnesota reported an average yield of 91.9 bu/ac in 2023.[2] In 2022, the average cereal rye yield across the four research farms was 81.3 bu/ac.[3] In 2021, the average cereal rye yield across the four research farms was 65.3 bu/ac.[4] In the previous five years of rye variety trials on ISU farms, Bono, Brasetto, Receptor, Serafino and Tayo have consistently been among the top yielding varieties across sites [1, 3, 4, 5, 6]. Bono and Brasetto varieties are no longer commercially available.

METHODS

Variety trials were conducted at four locations in 2024: ISU Northern Research Farm in Kanawha; ISU Northeast Research Farm in Nashua; ISU Ag Engineering and Agronomy Research Farm in Boone; ISU Southwest Research Farm in Greenfield. Production characteristics and some breeding history about each of the trialed varieties can be found in **Table 1**. Information on winter hardiness, days to heading, plant height and ergot susceptibility can be sourced from the University of Minnesota. [2]

Rye and triticale management information is provided with the results from each location. No herbicide, insecticide or fungicide were applied at any location. Rye and triticale were planted at seeding rates (lb/ac) listed in **Table 1** to achieve seeding rates of 25 seeds/ft^2 for open-pollinated varieties and 18.4 seeds/ft^2 for hybrid varieties. All varieties were planted on 7.5 in.

Heads of rye just before harvest.

row spacing at 1.25 in. depth. Each location measured grain yield, grain test weight, plant height at harvest, and estimated % lodging. Reported yields are corrected to 14% moisture content. Cumulative monthly precipitation and average monthly temperature during the rye growing season are provided for each location from the NASA POWER dataset [7, 8].

We analyze and report variety results separately for each trial location. At each location, the 3-year average yield is provided for individual varieties that have been trialed at the site in previous years. A "% of site average" is also included to aid in comparing yields of varieties within each location; this is the 2024 yield of a variety divided by the average yield across all varieties grown at the site in 2024. We used Analysis of Variance (ANOVA) followed by a Tukey's Significant Difference test to determine if there were statistically significant differences in yield, test weight, plant height, lodging, and straw yield (Nashua only) across varieties at individual sites. Tukey's test calculates a statistic called the Minimum Significant Differences (MSD); if the difference in yield, etc. between two varieties is greater than the MSD, we consider the yields significantly different. Statistical significance is determined at the 90% confidence level, meaning that if the experiment were repeated, we would expect to see the same results nine times out of ten.

RESULTS AND DISCUSSION

Across all sites and varieties, average 2024 rye variety trial yield was 89 bu/ac, up from 43 bu/ac in 2023 but similar to the 81 bu/ac achieved in 2022. Overall, yields in our variety trials have been varied quite a bit between years, likely due to weather conditions and the retention and addition of higher performing varieties in the trials [1, 3, 4, 5, 6]. Precipitation was well below average in Fall 2023 when rye was planted and above average in Spring and Summer 2024 at all trial locations. December 2023 and February 2024 were hotter than average, but mean temperature was similar to the 10-year average throughout the rest of the growing season.

Serafino and Receptor were two of the three highest yielding varieties at all four sites this year. Other high yielding varieties at individual sites included SU Performer and SU Cossani, new varieties added this year, as well as Tayo and Tulus, the only included triticale variety. All of these highest-yielding varieties are hybrids, with the exception of Tulus (triticale). Kanawha and Greenfield both saw some varieties make test weight (56 lb/bu), including Receptor and Serafino at both sites. Notably, this year at Kanawha, three OP varieties (Aroostook, Hazlet and SU Bebop) made test weight. Lodging was an issue in many open-pollinated varieties at Kanawha and Nashua this year and across almost all varieties in Boone and Greenfield, though most severely in open-pollinated varieties.

In 2024, hybrid rye varieties averaged 108 bu/ac while non-hybrid varieties averaged 70 bu/ac across all sites and varieties, excluding Tulus (triticale). Hybrid rye varieties also averaged about 7 in. shorter than non-hybrids. Tulus and SU Bebop were consistently the highest yielding open-pollinated varieties across all sites this year. Over six years of trials, non-hybrid varieties (average 51 bu/ac) have consistently yielded about 40% less than hybrid varieties (average 84 bu/ac), have been consistently taller than hybrid varieties and have experienced more lodging issues.

TABLE 1. Origin, characteristics and seeding rate of cereal rye and triticale varieties trialed in 2024.

VARIETY	SPECIES	AGENT OR BREEDER	PVP [a]	TYPE	SEEDING RATE (lb/ac)[c]
Aroostook	Cereal rye	USDA-ARS	None	Open-pollinated	99.2
Elbon	Cereal rye	Oklahoma St. Univ.	None	Open-pollinated	57.6
Hazlet	Cereal rye	SeCan	None	Open-pollinated	93.9
ND Dylan	Cereal rye	North Dakota St. Univ.	PVP(94)	Open-pollinated	61.3
ND Gardner	Cereal rye	North Dakota St. Univ.	PVP(94)	Open-pollinated	74.0
Receptor	Cereal rye	KWS	N/A[b]	Hybrid	54.1
Serafino	Cereal rye	KWS	N/A[b]	Hybrid	53.9
SU Bebop	Cereal rye	FP Genetics	PVP(94)	Open-pollinated	87.7
SU Cossani	Cereal rye	FP Genetics	None	Hybrid	61.9
SU Performer	Cereal rye	FP Genetics	None	Hybrid	78.0
Tayo	Cereal rye	KWS	N/A[b]	Hybrid	49.8
Tulus	Triticale	Nordsaat Saatzucht GmbH, Germany	None	Open-pollinated	109.6

[a] PVP = Plant Variety Protection. The PVP Act provides a certificate to the developer of a variety granting exclusive rights for reproducing and marketing the seed.

[b] Hybrids from KWS are protected from propagation by license agreements entered into with KWS upon seed purchase.

[c] Calculated from seed lot weights (no. seeds/lb) and germination rates (%) to achieve target populations of 25 seeds/ft^2 (open-pollinated) or 18.4 seeds/ft^2 (hybrid).

ISU NORTHERN RESEARCH FARM, KANAWHA

Previous crop: Soybean
Replications: 3
Harvested plot size: 5 ft X 57 ft
Fertilizer applied: 18.7 lb S/ac on Oct. 11, 2023
35 lb N/ac on Mar. 13, 2024
Planting date: Sept. 30, 2023
Harvest date: Jul. 16, 2024

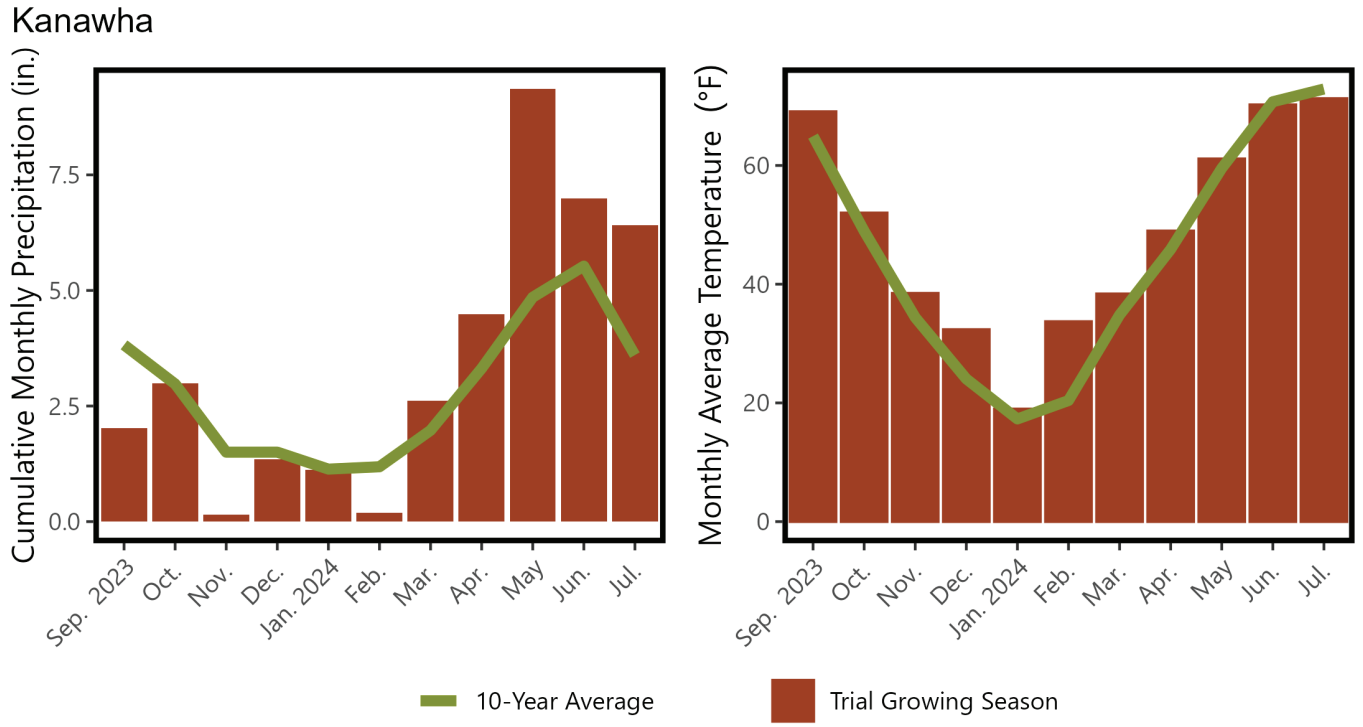

TABLE 2. 2024 Cereal Rye & Triticale Variety Trial at ISU Northern Research Farm, Kanawha.

VARIETY	YIELD (bu/ac) 2024	YIELD (bu/ac) 3-Year Average[a]	YIELD (% of 2024 site mean)	TEST WEIGHT (lb/bu)	PLANT HT at HARVEST (in.)	LODGING (%)
Aroostook	80	75	84%	56	58	28
Elbon	59	61	62%	55	59	67
Hazlet	80	82	83%	56	57	38
ND Dylan	65	59	67%	52	59	68
ND Gardner	73	68	77%	53	56	80
Receptor	123	110	128%	57	55	8
Serafino	119	111	123%	57	53	3
SU Bebop	100	--	104%	57	54	7
SU Cossani	112	--	117%	58	50	5
SU Performer	123	--	128%	55	52	3
Tayo	115	106	120%	56	53	2
Tulus	104	92	108%	48	41	0
MSD (90%)	35	--	--	5	8	43
MEAN	96	85	--	55	54	26

By response variable, if the difference between any two entries is greater than the minimum significant difference (MSD) the entries are considered statistically different with 90% confidence.

[a] Average yield of each variety from the past three years at ISU Northern Research Farm, including 2024. '--' indicates a variety new to the trial this year.

ISU NORTHEAST RESEARCH FARM, NASHUA

Previous crop: Soybean
Replications: 3
Harvested plot size: 8.125 ft x 50 ft
Fertilizer applied: 31 lb P/ac and 200 lb K/ac on Nov. 7, 2023
25.25 lb S/ac on Nov. 19, 2023
30 lb N/ac on Mar. 7, 2023
Planting date: Oct. 6, 2023
Harvest date: Jul. 18, 2024

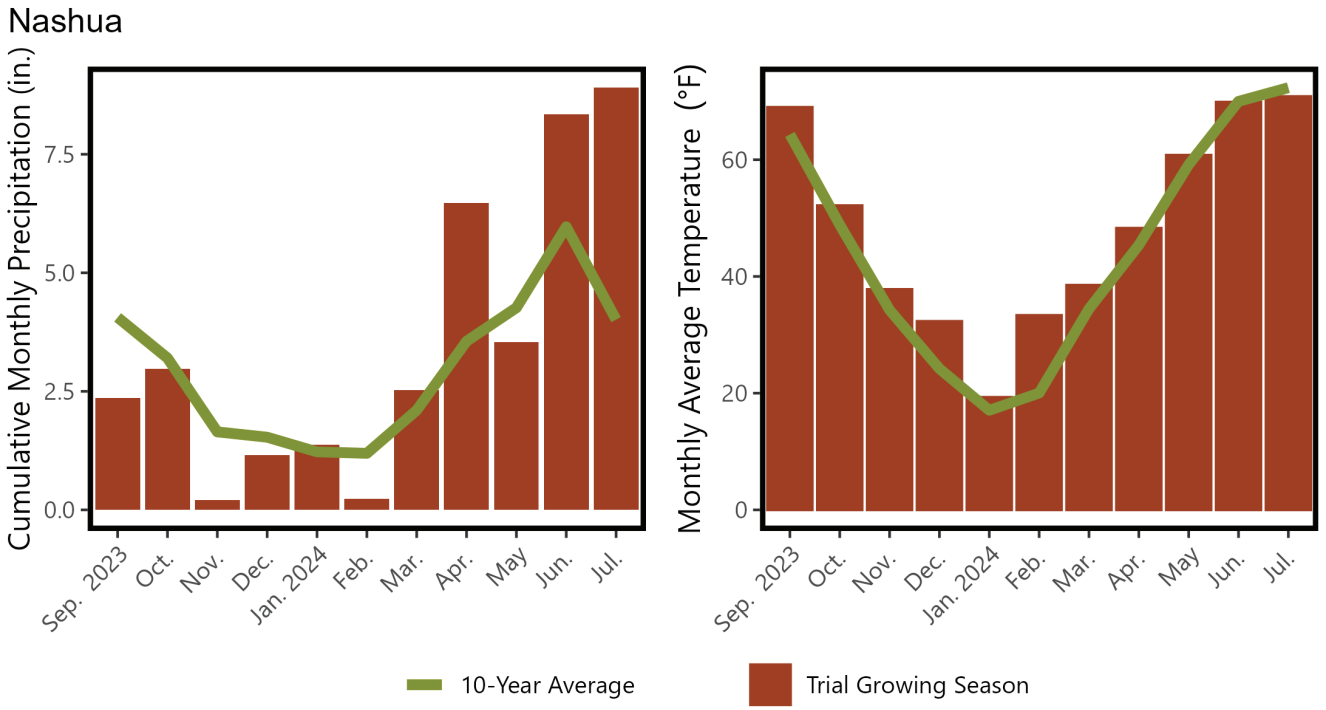

TABLE 3. 2024 Cereal Rye & Triticale Variety Trial at ISU Northeast Research Farm, Nashua.

VARIETY	YIELD (bu/ac) 2024	YIELD (bu/ac) 3-Year Average[a]	YIELD (% of 2024 site mean)	TEST WEIGHT (lb/bu)	PLANT HT at HARVEST (in.)	LODGING (%)	STRAW YIELD (ton/ac)
Aroostook	69	57	82%	54	57	5	2.8
Elbon	54	48	65%	54	57	13	2.7
Hazlet	70	62	84%	54	58	2	2.7
ND Dylan	69	60	82%	54	58	7	2.8
ND Gardner	62	55	74%	53	57	23	2.7
Receptor	99	84	118%	54	47	0	2.5
Serafino	107	87	128%	55	49	0	2.8
SU Bebop	82	--	98%	54	52	0	2.5
SU Cossani	99	--	117%	54	50	0	2.9
SU Performer	97	--	115%	54	48	0	2.5
Tayo	95	85	113%	54	48	0	2.4
Tulus	91	71	108%	47	37	0	2.1
MSD (90%)	14	--	--	1	2	8	0.4
MEAN	84	68	--	53	51	4	2.6

By response variable, if the difference between any two entries is greater than the minimum significant difference (MSD) the entries are considered statistically different with 90% confidence.

[a] Average yield of each variety from the past three years at ISU Northeast Research Farm, including 2024. '--' indicates a variety new to the trial this year.

ISU AG ENGINEERING AND AGRONOMY RESEARCH FARM, BOONE

Previous crop: Soybean
Replications: 3
Harvested plot size: 58 ft x 13.5 ft
Fertilizer applied: 39 lb N/ac, 100 lb P/ac, 40 lb K/ac and 37 lb S/ac applied on Apr. 10, 2024
Planting date: Oct. 9, 2023
Harvest date: Aug. 7, 2024

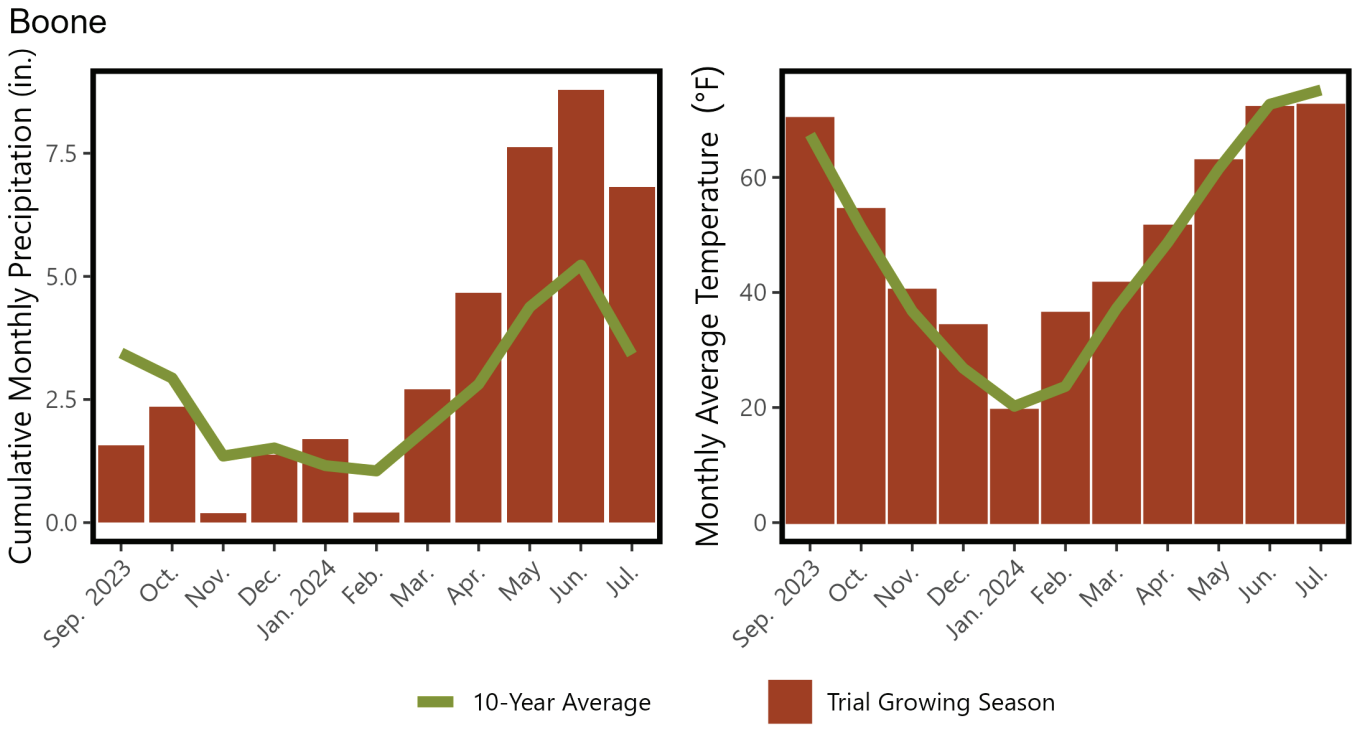

TABLE 4. 2024 Cereal Rye & Triticale Variety Trial ISU Ag Engineering and Agronomy Research Farm, Boone.

VARIETY	YIELD (bu/ac) 2024	YIELD (bu/ac) 3-Year Average[a]	YIELD (% of 2024 site mean)	TEST WEIGHT (lb/bu)	PLANT HT at HARVEST (in.)	LODGING (%)
Aroostook	81	58	94%	52	59	72
Elbon	52	37	59%	52	60	95
Hazlet	77	55	88%	53	57	47
ND Dylan	64	51	73%	52	61	93
ND Gardner	62	45	72%	52	62	97
Receptor	106	79	122%	51	48	23
Serafino	134	85	154%	51	47	12
SU Bebop	77	--	89%	51	50	27
SU Cossani	96	--	110%	53	52	3
SU Performer	99	--	114%	52	51	28
Tayo	88	75	101%	53	47	12
Tulus	101	67	116%	51	36	2
MSD (90%)	70	--	--	4	7	52
MEAN	87	61	--	52	53	43

By response variable, if the difference between any two entries is greater than the minimum significant difference (MSD) the entries are considered statistically different with 90% confidence.

[a] Average yield of each variety from the past three years at ISU Ag Engineering and Agronomy Research Farm, including 2024. '--' indicates a variety new to the trial this year.

ISU SOUTHWEST RESEARCH FARM, GREENFIELD

Previous crop: Soybean
Replications: 3
Harvested plot size: 5 ft x 51 ft
Fertilizer applied: 35 lb N/ac Mar. 12, 2024
Planting date: Oct. 6, 2023
Harvest date: July 17, 2024

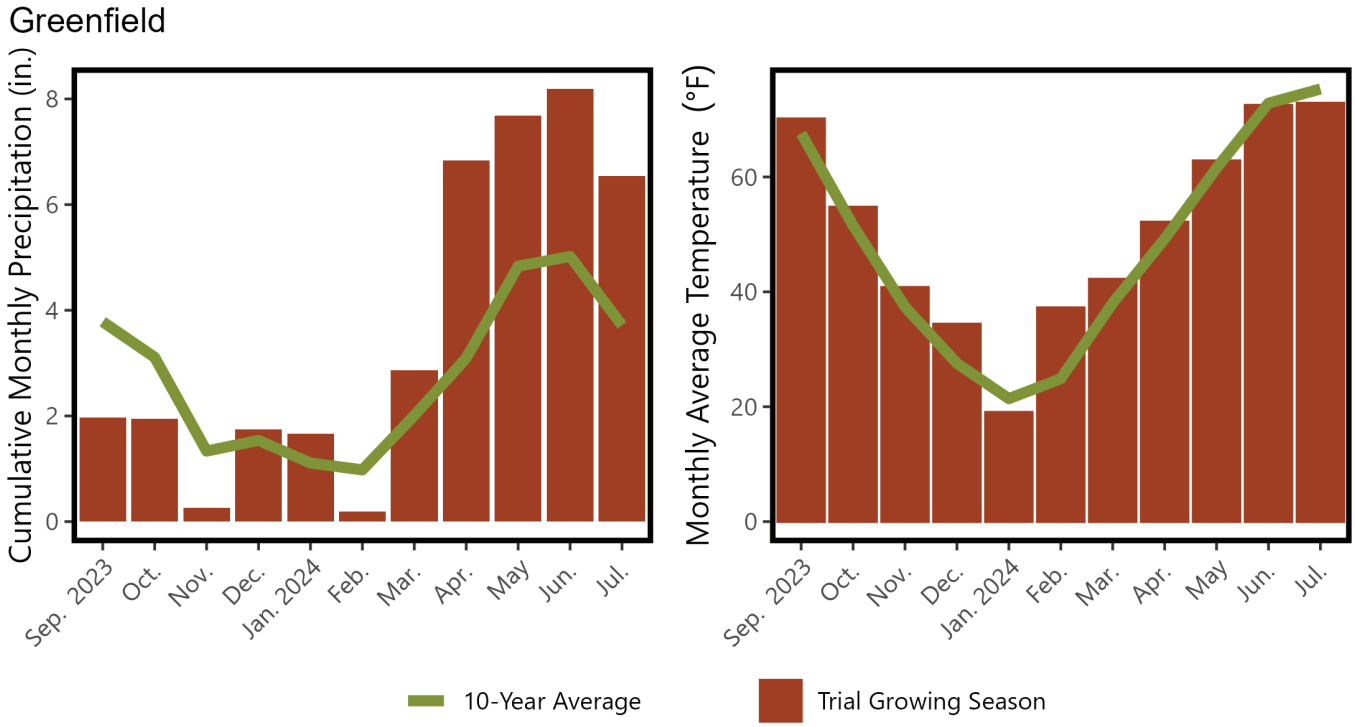

TABLE 5. 2024 Cereal Rye & Triticale Variety Trial at ISU Southwest Research Farm, Greenfield.

VARIETY	YIELD (bu/ac) 2024	YIELD (bu/ac) 3-Year Average[a]	YIELD (% of 2024 site mean)	TEST WEIGHT (lb/bu)	PLANT HT at HARVEST (in.)	LODGING (%)
Aroostook	64	55	72%	54	50	83
Elbon	63	45	72%	56	57	12
Hazlet	71	60	80%	54	54	88
ND Dylan	52	47	59%	54	60	75
ND Gardner	70	50	79%	54	59	58
Receptor	113	70	129%	56	50	17
Serafino	119	86	135%	56	53	23
SU Bebop	93	--	105%	54	50	30
SU Cossani	109	--	124%	53	49	53
SU Performer	99	--	113%	51	51	25
Tayo	116	86	131%	54	53	35
Tulus	91	75	104%	47	44	7
MSD (90%)	28	--	--	5	17	56
MEAN	88	64	--	54	52	42

By response variable, if the difference between any two entries is greater than the minimum significant difference (MSD) the entries are considered statistically different with 90% confidence.

[a] Average yield of each variety from the past three years at ISU Southwest Research Farm, including 2024. '--' indicates a variety new to the trial this year.

FUNDING ACKNOWLEDGEMENT

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We would also like to express our gratitude to Albert Lea Seed House, Green Cover, North Dakota State University, KWS and FP Genetics for donating seed for these variety trials.

REFERENCES

[1] S. Gailans, "Cereal Rye and Triticale Variety Trial 2023," Practical Farmers of Iowa, 2023. [Online]. Available: https://practicalfarmers.org/research/cereal-rye-and-triticale-variety-trial-2023/

[2] J. Wiersma, "2023 Winter Rye Field Crop Trial Results: Minnesota Agricultural Experiment Station," University of Minnesota, 2023. [Online]. Available: https://drive.google.com/file/d/11qo8BPRxJBp2x9rzAeDRTC52UQltXlez/view

[3] S. Gailans and L. English, "Cereal Rye Variety Trial 2021," Practical Farmers of Iowa, 2021. [Online]. Available: https://practicalfarmers.org/research/cereal-rye-variety-trial-2021/

[4] S. Gailans, "Cereal Rye and Triticale Variety Trial 2022," Practical Farmers of Iowa, 2022. [Online]. Available: https://practicalfarmers.org/research/cereal-rye-and-triticale-variety-trial-2022/

[5] S. Gailans and S. Carlson, "Cereal Rye Variety Trial 2019," Practical Farmers of Iowa, 2019. [Online]. Available: https://practicalfarmers.org/research/cereal-rye-variety-trial-2019/

[6] S. Gailans and L. English, "Cereal Rye Variety Trial 2020," Practical Farmers of Iowa, 2020. [Online]. Available: https://practicalfarmers.org/research/cereal-rye-variety-trial-2020/

[7] A. Sparks, "nasapower: A NASA POWER Global Meteorology, Surface Solar Energy and Climatology Data Client for R," *J. Open Source Softw.*, vol. 3, no. 30, 2018, doi: doi.org/10.21105/joss.01035.

[8] A. Sparks, *_nasapower: NASA-POWER Data from R_*. (2024). [Online]. Available: https://CRAN.R-project.org/package=nasapower

PRACTICAL FARMERS of Iowa

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PFI's Cooperators' Program helps farmers find practical answers and make informed decisions through on-farm research projects. The Cooperators' Program began in 1987 with farmers looking to save money through more judicious use of inputs.
If you are interested in conducting an on-farm trial contact Stefan Gailans @ 515-232-5661 or stefan.gailans@practicalfarmers.org.

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TABLE 1. Origin, characteristics and seeding rate of cereal rye and triticale varieties trialed in 2024.

VARIETY	SPECIES	AGENT OR BREEDER	PVP[a]	TYPE	SEEDING RATE (lb/ac)[c]
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Tulus	Triticale	Nordsaat Saatzucht GmbH, Germany	None	Open-pollinated	109.6

[a] PVP = Plant Variety Protection. The PVP Act provides a certificate to the developer of a variety granting exclusive rights for reproducing and marketing the seed.

[b] Hybrids from KWS are protected from propagation by license agreements entered into with KWS upon seed purchase.

[c] Calculated from seed lot weights (no. seeds/lb) and germination rates (%) to achieve target populations of 25 seeds/ft^2 (open-pollinated) or 18.4 seeds/ft^2 (hybrid).