Crop Production Clinics

Variety Testing: Approaches, Analysis, and Modern Tools

Dr. Amanda Easterly and Dr. Cody Creech

Session Goals

At the end of this session, participants will:

- know how variety testing is conducted, how varieties/hybrids are entered, limitations of variety testing, and who to contact with questions about the program;
- be able to identify key elements in the presentation of variety testing data, and see the value of multi-year data;
- be introduced to new technologies used in conducting the variety tests;
- and get a sneak-peek of an update coming to the way data is stored and presented, allowing for more flexibility in visualizing data.

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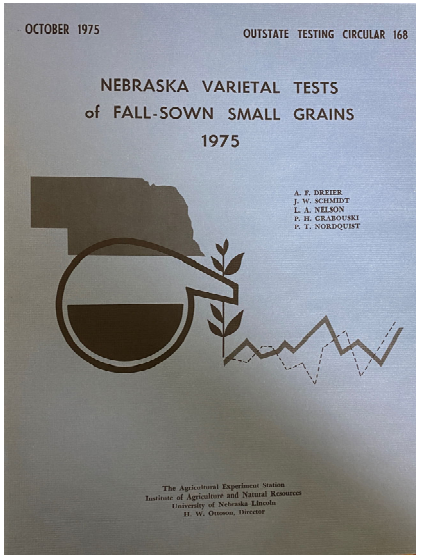
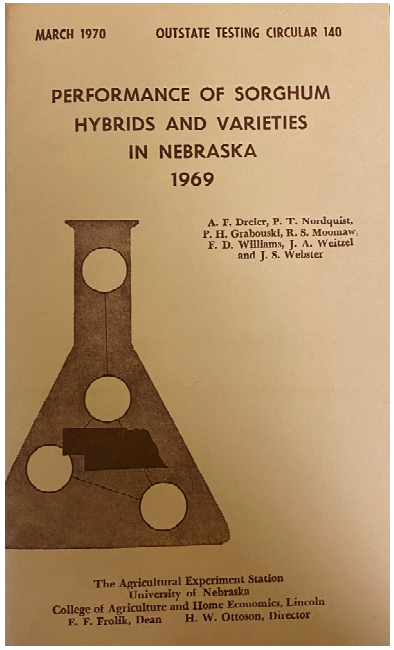
Introduction to Variety Testing



- Begun in the 1940s based on an act from the Nebraska Legislature
- Goal is to provide unbiased crops testing across the state and provide data to farmers and industry
- Currently, the primary crop tested is winter wheat, and corn, grain sorghum, and spring wheat are also tested
- Team collaborates with others to report on trials for sunflower, field pea, and proso millet



Introduction to Variety Testing

Photo credit: Dave Ostdiek

- In 2019, the program was relocated to the High Plains Ag Lab near Sidney, NE
- Variety testing team members:
  - Dr. Amanda Easterly (located at HPAL)
  - Dr. Cody Creech (PHREC)
  - Dr. Brian Maust (UNL-East Campus)
  - Stephan Geu and Bill Struckmeyer (HPAL)
  - a number of undergraduate interns/workers and graduate students

How Variety Testing Works

- Letters/forms are sent to industry representatives
- Companies pay for varieties/hybrids for regions/sites and ship seed to HPAL

NEBRASKA WINTER WHEAT PERFORMANCE TESTS LOCATION INFORMATION

Location (See attached map)	1	2	3	4	5	
	East	South Central	West Central	Panhandle	Irrigated	
County	Saunders Lancaster	Clay Saline Harlan	Keith Red Willow Lincoln Perkins	Deuel Kimball Cheyenne Box Butte Scottsbluff	Box Butte Chase	Lbs. seed needed total per variety
Cost/Entry	$ 400	$ 600	$ 800	$ 1,000	$ 400	
Lbs. of seed needed/entry	7	8	10	12	7	
Variety Name (List below):						

How Variety Testing Works

- Calculations are made for the number of seeds per plot based on the region and type/management of crop
- Packets are prepared for each plot and seed is packaged and organized

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How Variety Testing Works

- Planting based on conditions and recommended dates
- Data collection during the growing season
  - plot data
  - metadata

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How Variety Testing Works

- Harvest is conducted using a specialized plot combine
- Grain samples used to test for other traits
- Data is evaluated for quality and analyzed
- Summaries prepared and posted on the website and seed guide published

Key Elements in a VT Report

- How do I find data?
- Where do I start?
- What tells me if two varieties are different?
- What is a CV value and what does it mean?
- Other types of variety testing…
- Value and use of multi-year and multi-location summaries

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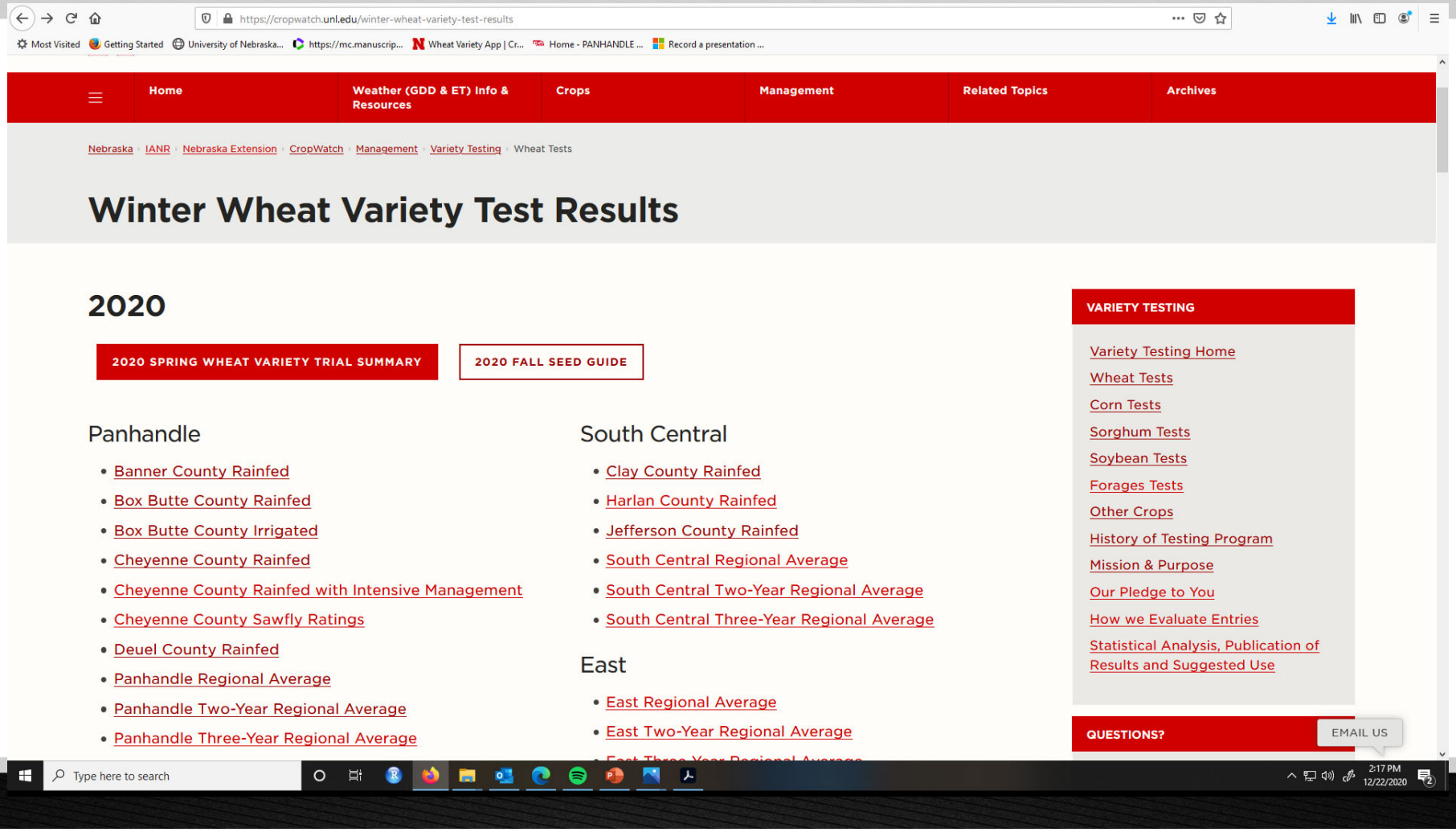

Where do I start?
(Hint: The END)

SITE INFORMATION

Collaborator:	Chris Cullan, Cullan Farms; Hemingford, NE
Planting Date:	September 18, 2019
Seeding Rate:	800,000 seeds/acre
Harvest Date:	July 16, 2020
Fertility:	60 lb N, 30 lb P, 5 lb S, 1 lb Zn fall preplant; 20 lb N topdress in spring
Herbicide/Fungicides:	2,4-D, Powerflex, fungicide with topdress
Soil Type:	Alliance/Rosebud silt loam
GPS:	41.566797, -103.728659
Notes:	Conventional tillage in fallowed corn field. Some damage from spring freezes, wheat stem sawfly, and a hailstorm in June.

Where do I start?
(Hint: The END)

	Yield (bu/a)	Test Weight (lb/bu)	Plant Height (inches)	Protein (%)
Standard Error	2.9	1.1	1.3	1.0
LSD[3]	4.8	1.8	2.1	1.6
Mean[4]	51.8	51.7	28.5	13.5
CV[5]	8.2	3.0	7.4	7.9
Reps	4	4	4	2

How to tell if the differences are real?

UNIVERSITY of NEBRASKA LINCOLN

Box Butte County Rainfed
2020 Winter Wheat Variety Trial

Name	Company	Yield (bu/ac)[1]	Test Weight (lb/bu)	Height (in)	Protein (%)[2]
WB4462	WestBred	62.1	51.6	30.3	13.1
LCS Valiant	Limagrain Cereal Seeds	61.6	52.3	28.5	12.2
CP7909	CROPLAN by Winfield United	58.5	54.1	27.8	10.9
WB4595	WestBred	56.3	54.8	29.3	11.9
Spur	AgriPro-Syngenta	56.2	48.3	29.0	13.7
SY Legend CL2	AgriPro-Syngenta	55.6	51.3	29.3	14.7
SY Monument	AgriPro-Syngenta	55.4	52.1	28.5	11.8
NE14691	UNL-Experimental	55.2	51.8	28.8	13.4
Crescent AX	PlainsGold	55.1	54.1	29.3	11.5
AP 18AX	AgriPro-Syngenta	55.0	52.5	28.3	11.7
SY 517CL2	AgriPro-Syngenta	55.0	53.6	28.5	13.7
LCS Link	Limagrain Cereal Seeds	54.8	51.7	28.3	13.4
NHH144913-3	UNL-Experimental	54.8	50.5	30.3	13.8
Canvas	PlainsGold	54.5	52.9	27.5	12.4
CP7050AX	CROPLAN by Winfield United	54.4	54.2	27.8	13.7
Wesley	Husker Genetics	54.1	48.8	25.5	13.4
Long Branch	Dyna-Gro Seeds	54.0	50.2	28.0	12.5
SY Wolverine	AgriPro-Syngenta	53.8	52.6	27.5	14.4

Recall the LSD values:

- 4.8 bu/a for yield
- 1.8 lb/bu for test weight
- 2.1” for height
- 1.6% for protein

What is a CV?

CV: Coefficient of Variation

$$CV = \left(\frac{\sigma}{\mu}\right) * 100$$

The CV basically is a measure of how variable the data are compared to the mean value.

When looking at results, use the CV to decide how reliable the data are.

Multi-year and Multi-location Data

"There are no wasted years in plant breeding"

Looking at multiple years of data and data across the region as a whole is like diversifying your stock portfolio:

- Balances risk
- Allows you to see how variable locations can be
- Minimizes short term effects (hail, poor precipitation, disease and pest pressure)

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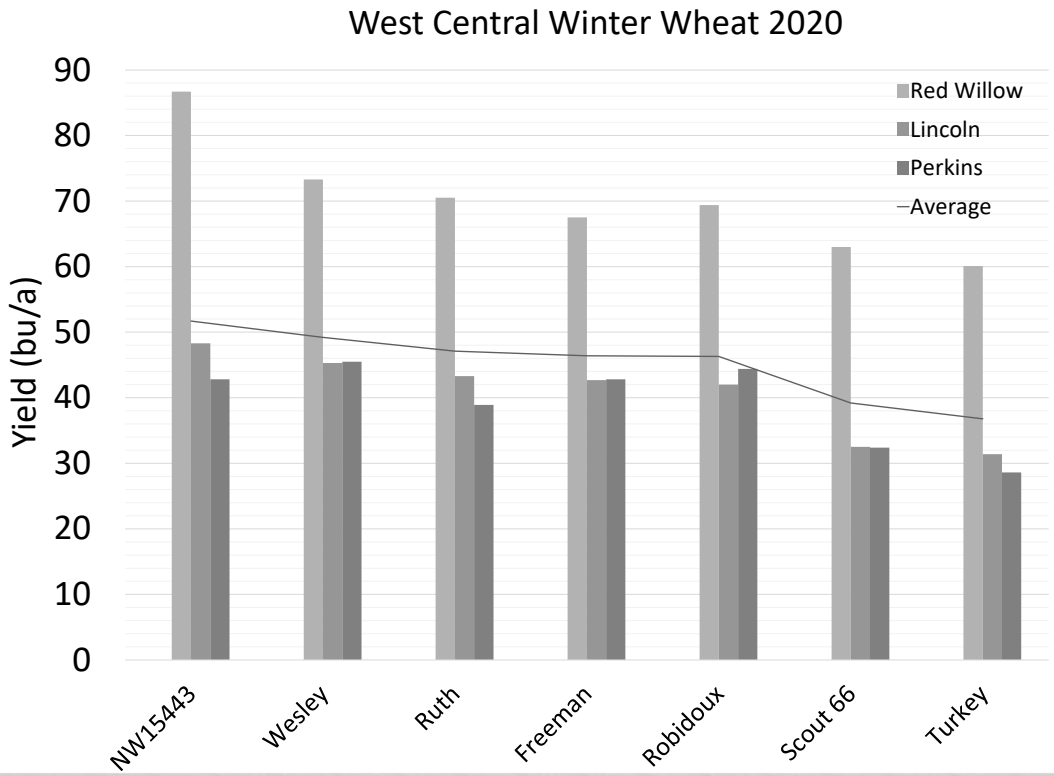
Multi-year and Multi-location Data



Looking at All Types of Data

There are all sorts of variety trials, so how do we evaluate those?

- Other universities/public institutions
- Co-Ops and third-party agronomists
- Seed industry

Other types of trials:

- Management
- Strip Trials

Photo: https://agcrops.osu.edu/newsletter/corn-newsletter/some-tips-evaluating-corn-hybrid-demonstration-plots

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New Technology in Variety Testing

Combine (purchased 2018) that incorporates better data collection, in-cab sampling, and quicker harvesting

New Technology in Variety Testing

- Use of barcodes and enhanced data management strategies
- Equipment to test protein in-house

New Technology in Variety Testing

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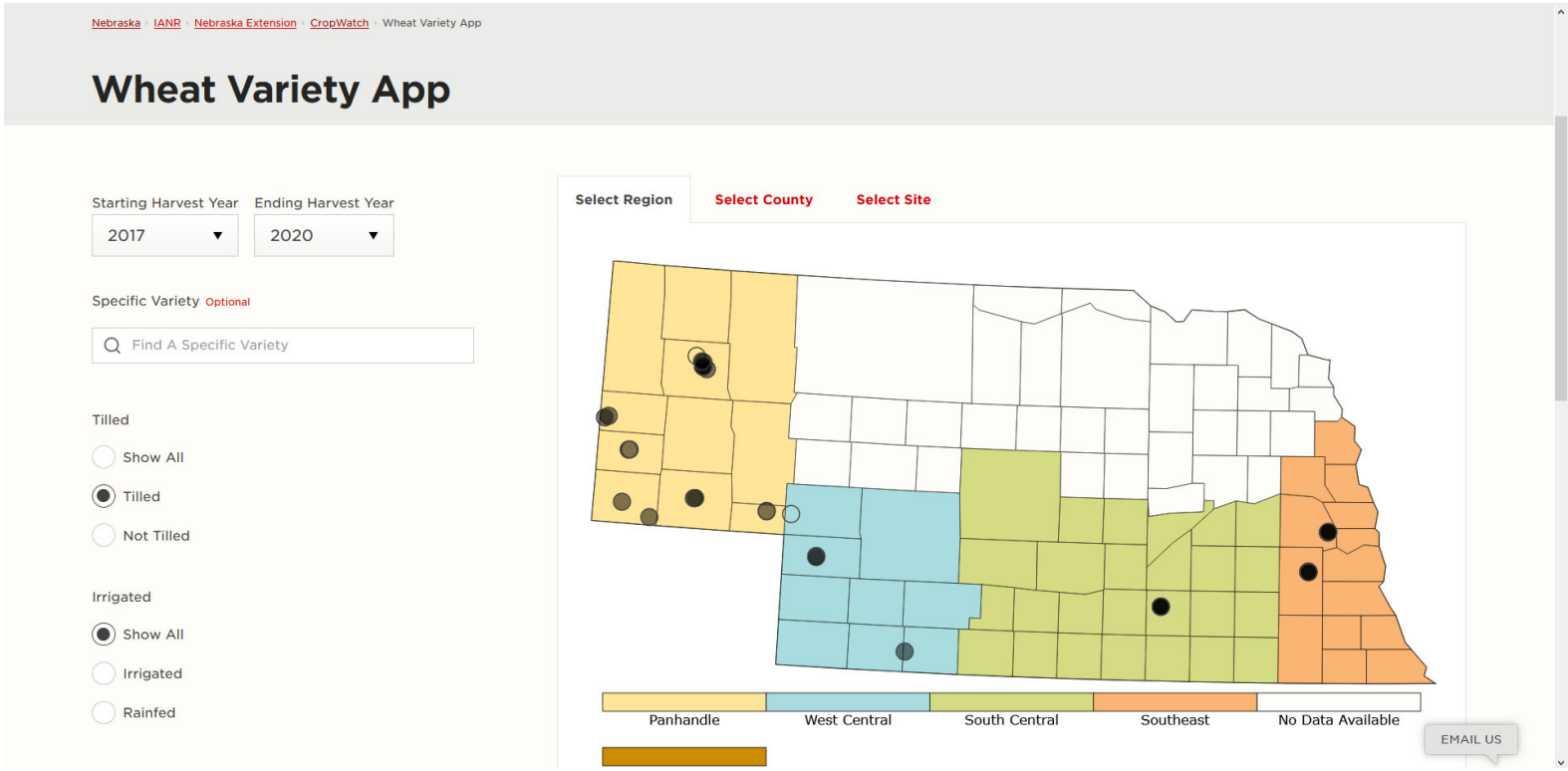
Coming soon…



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Coming soon…

Variety Trial Results

Summarized trial results for the Panhandle region between 2017-2020.
Note: A trial must be successful in all years to be included.

Name	Brand	Grain Yield (bu/ac)	Bushel Weight (lbs/bu)	Plant Height (in)	Percent Protein (%)	Kernel Weight (grams/1000)
Turkey	Check	47.4	54.1	33.5	15.1	0
N Goodstreak	Husker Genetics	41.1	54.8	31.8	14.9	0
N Panhandle	Husker Genetics	49.9	54	31.7	14.8	0
N Robidoux	Husker Genetics	56	52.8	28.8	14.7	0
N NE15410	UNL-Experimental	39.6	52.8	27.9	14.6	0
N NE16562	UNL-Experimental	43.2	52.2	27.8	14.5	0
SY Legend CL2	AgriPro Syngenta	52.2	53.8	29.4	14.5	0
N Pronghorn	Husker Genetics	39.3	56	34.3	14.4	0
N Siege	NuPride Genetics	58.8	54.6	27.7	14.4	0
N Ruth	Husker Genetics	63	55	28.8	14.3	0
Guardian	PlainsGold	48	55.1	28.6	14.3	0
N Freeman	Husker Genetics	43.8	52.4	27.7	14.2	0
SY 517 CL2	AgriPro Syngenta	47.1	55.1	27.6	14.2	0
N NE14691	UNL-Experimental	46.9	52.5	29.5	14.2	0
N NE14434	UNL-Experimental	50.8	53.9	28.3	14.1	0

EMAIL US

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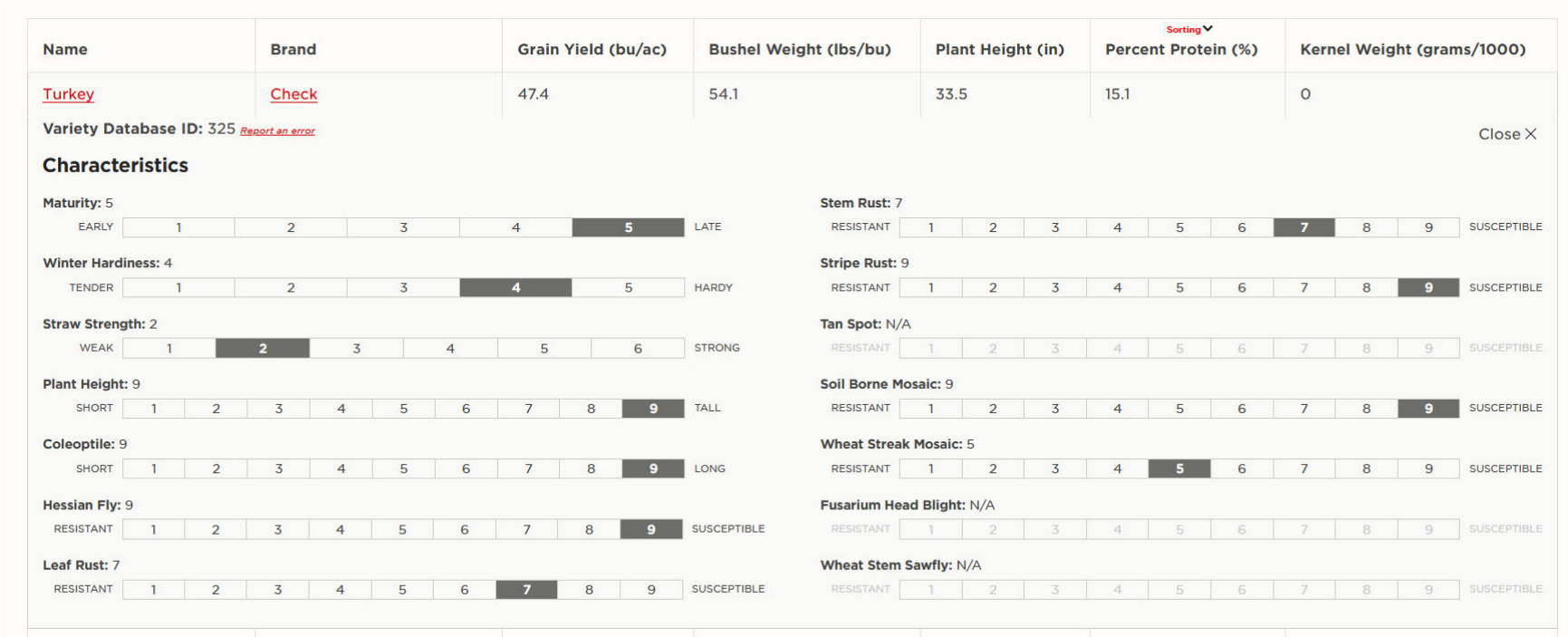
Coming soon…



Name	Brand	Grain Yield (bu/ac)	Bushel Weight (lbs/bu)	Plant Height (in)	Percent Protein (%)	Kernel Weight (grams/1000)
Turkey	Check	47.4	54.1	33.5	15.1	0

Sorting

Variety Database ID: 325 Report an error

Close ×

Characteristics

Maturity: 5
EARLY 1 2 3 4 **5** LATE

Winter Hardiness: 4
TENDER 1 2 3 **4** 5 HARDY

Straw Strength: 2
WEAK 1 **2** 3 4 5 6 STRONG

Plant Height: 9
SHORT 1 2 3 4 5 6 7 8 **9** TALL

Coleoptile: 9
SHORT 1 2 3 4 5 6 7 8 **9** LONG

Hessian Fly: 9
RESISTANT 1 2 3 4 5 6 7 8 **9** SUSCEPTIBLE

Leaf Rust: 7
RESISTANT 1 2 3 4 5 6 **7** 8 9 SUSCEPTIBLE

Stem Rust: 7
RESISTANT 1 2 3 4 5 6 **7** 8 9 SUSCEPTIBLE

Stripe Rust: 9
RESISTANT 1 2 3 4 5 6 7 8 **9** SUSCEPTIBLE

Tan Spot: N/A
RESISTANT 1 2 3 4 5 6 7 8 9 SUSCEPTIBLE

Soil Borne Mosaic: 9
RESISTANT 1 2 3 4 5 6 7 8 **9** SUSCEPTIBLE

Wheat Streak Mosaic: 5
RESISTANT 1 2 3 4 **5** 6 7 8 9 SUSCEPTIBLE

Fusarium Head Blight: N/A
RESISTANT 1 2 3 4 5 6 7 8 9 SUSCEPTIBLE

Wheat Stem Sawfly: N/A
RESISTANT 1 2 3 4 5 6 7 8 9 SUSCEPTIBLE

Take Home Points

- Variety testing is a useful tool in identifying options for your operation, especially when used in conjunction with recommendations for management from your trusted agronomy consultants
- The entries in variety tests are those that are selected by the seed industry and/or public plant breeders, and may not include all potential options
- Whenever possible, consult multi-year averages to get the best sense of how varieties perform over time
- Refer to the footnotes and trial summary information to understand how management and data variability might affect results
- Newer tools will soon be available that allow producers/agronomists to filter data in multiple ways such as by yield or protein or test weight

Acknowledgements

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- Dr. Jennifer Clarke and team for “Big Data” help and IANR Media/CropWatch for app development and website updates
- Cooperators and farmers who provide field space and support
- Commodity boards, especially the Nebraska Wheat Board and Nebraska Sorghum Board
- **Our stakeholders**

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Find us at:

- @AC_Easterly
- @NE_DrylandCrops
- https://cropwatch.unl.edu/varietytest
- aeasterly2@unl.edu, ccreech2@unl.edu

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Frequently Asked Questions

1. Why wasn't RoundUp (or other selective herbicides) used in the trial?

   A: Often, the trials include entries that may not have common herbicide traits (such as RoundUp Ready) in the genetics, particularly if entries are targeted for specialty production (like organic corn).

2. Why wasn't X hybrid in the trial?

   A: With the exception of a couple 'check' varieties (such as Turkey and Scout 66 in the wheat trials), all of the varieties/hybrids in a test are selected by the seed company and are not our choice.

3. What if a trial has a really high CV? Should I even look at the data?

   A: A high CV can be a result of a number of things: damage to the plot from insects/hail/pests/weed pressure. The data is still presented because the averages can be helpful to compare, but in the case of a high CV, always consider multiple sources of information to make a decision!

4. When will the new Wheat App be available?

   A: We hope to have the app available to the public in July/August 2021, after we have finished beta testing it and finalizing the updates to the database. We can't wait, either!