2022
Field Day

USDA-ARS Central Great Plains Research Station

Akron, Colorado

August 10, 2022

USDA Agricultural Research Service

Colorado State University

Contents

Agenda

2022 Field Day
Wednesday, August 10, 2022
USDA-ARS Central Great Plains Research Station
Highway 34, Four Miles East of Akron, Colorado

INDOOR FIELD DAY BUILDING – MACHINERY SHED

8:00 Registration, Coffee, Donuts

8:30 Welcome, Vision for the Central Great Plains Research Station
Kyle Mankin (Acting Research Leader, CGPRS, Akron; Research Leader, WMSRU, Fort Collins)
Peter Kleinman (Research Leader, SMSBRU, Fort Collins)

8:45 Weather Update – 2022 Precipitation and Temperature Analysis
Wayne Shawcroft (Collaborator)

9:00 2020 Macroburst
Russ Schumacher (Colorado State University)

9:15 Factors Affecting Long-term Trends in Wheat
Grace Miner, Cathy Stewart (USDA-ARS, Fort Collins)

9:30 Sunflower on Cover Crop Research
Nevin Lawrence, Cody Creech (University of Nebraska, Lincoln)

OUTDOOR FIELD TOUR – PEOPLE-MOVER WAGONS
Please join one of the two sets of wagons parked outside the machinery shed to tour research sites.

TOUR 1	TOUR 2	*** Starts Here**
10:00*	11:40	2022 Crops Testing Sorghum Research Activities and Information Sally Jones-Diamond (Colorado State University)
10:20	12:00	Forage Pea Production in Long-Term Compost Management Practices Maysoon Mikha (USDA-ARS, Fort Collins)
10:40	***10:00****	Wheat Stem Sawfly Adam Osterholzer (Colorado State University; Punya Nachappa Lab) Jeff Bradshaw (University of Nebraska, Lincoln) Tatyana Rand (USDA-ARS, Sidney, MT)
11:00	10:20	Irrigation Management of Cowpea for NE Colorado Joel Schneekloth, Jessica Davis (Colorado State University)
11:20	10:40	Corn Nitrogen x Water Study Tyler Donovan, Bo Stevens, Josh Wenz (USDA-ARS, Fort Collins; Louise Comas Lab)
11:40	11:00	Precision Nitrogen Application on Corn Tyler Untiedt, Dave Poss, Kyle Mankin (USDA-ARS, Akron)
12:00	11:20	Rye: Alternative crop to wheat or a perpetual weed? Dave Poss (USDA-ARS, Akron)

LUNCH – INDOOR FIELD DAY BUILDING

12:20 – 1:00 *Provided by our sponsors!*

SAWFLY SOCIAL

1:00 *Cool down with ice cream and learn all we know about sawfly. Ask your questions directly to the experts from the Great Plains Wheat Stem Sawfly Coalition!*
Tatyana Rand (USDA-ARS, Montana)
Jeff Bradshaw (University of Nebraska, Lincoln)
Adam Osterholzer (Colorado State University)

2:00 Done!

Our Staff

Scientists

Dr. Kyle Mankin, Research Leader (acting), Agricultural Engineer
Dr. Peter Kleinman, Research Leader, Soil Management & Sugar Beet Research Unit
Dr. Maysoon Mikha, Soil Scientist

Support Scientist

David Poss, Soil Scientist

Technicians

Paul Campbell, Biological Science Tech.
Cody Hardy, Agricultural Sci. Research Tech.
Stacey Poland, Agricultural Sci. Research Tech.
Kelsey Strand, Biological Science Lab Tech.
Tyler Untiedt, Agricultural Sci. Research Tech.

Administrative

Travis Vagher, Administrative Officer (acting)
Carolyn Brandon, Secretary Office Automation

Seasonal Technicians

Hunter Molt
Susan Pieper
Conner Jesse (CSU)
Levi Kipp (CSU)
Cameron Lyon (CSU)
Molly Porteus (CSU)
Nadalyn Poss (CSU)
Hailey Strozier (CSU)
Vashti Winter (CSU)
Sara Wylie (CSU)

CSU Staff

Joel Schneekloth
Sally Jones-Diamond
Ed Asfeld
Candace Talbert

Thank You Sponsors!

Bayer Crop Science

CHS-M&M Co-Op Colorado

Colorado Corn Administrative Committee

Colorado Wheat Administrative Committee

Cope Soil Conservation District

Culligan

Eastern Colorado Seeds

Global Harvest Foods

Gowan Company, LLC

Ison Oil CO

J&H Auto Carquest

Sukup Quality Irrigation

Soil & Crop Sciences, CSU

Stockmens Bank of Colorado Springs

Ward Laboratories

West Plains Company

Y-W Electric Association

Setting the Stage: Akron's USDA Research Program

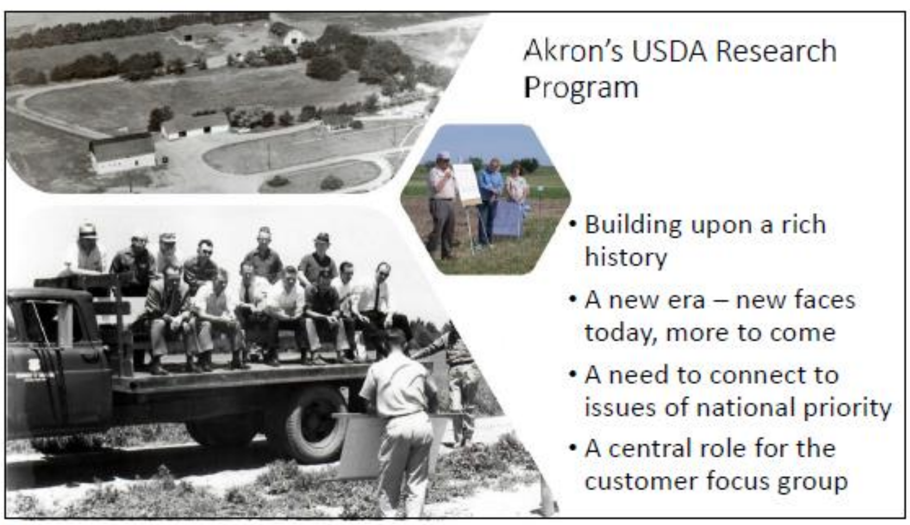
Dr. Pete Kleinman

Research Leader, Soil Scientist
USDA-ARS, Soil Management & Sugar Beet Research Unit, Fort Collins, CO

Dr. Kyle Mankin

Research Leader, Agricultural Engineer
USDA-ARS, Central Great Plains Research Station, Akron, CO
USDA-ARS, Water Management & Systems Research Unit, Fort Collins, CO

1



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Local and National Contexts

- *Akron's research must address issues of <u>local</u> and <u>national</u> priority*
- *We do that through our own personnel and our partners*

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Akron as key to Central/Western Great Plains Dryland Production Systems

USDA NRCS's Western Great Plains Range and Irrigated Region (G)

USDA NRCS's Central Great Plains Winter Wheat and Range Region (H)

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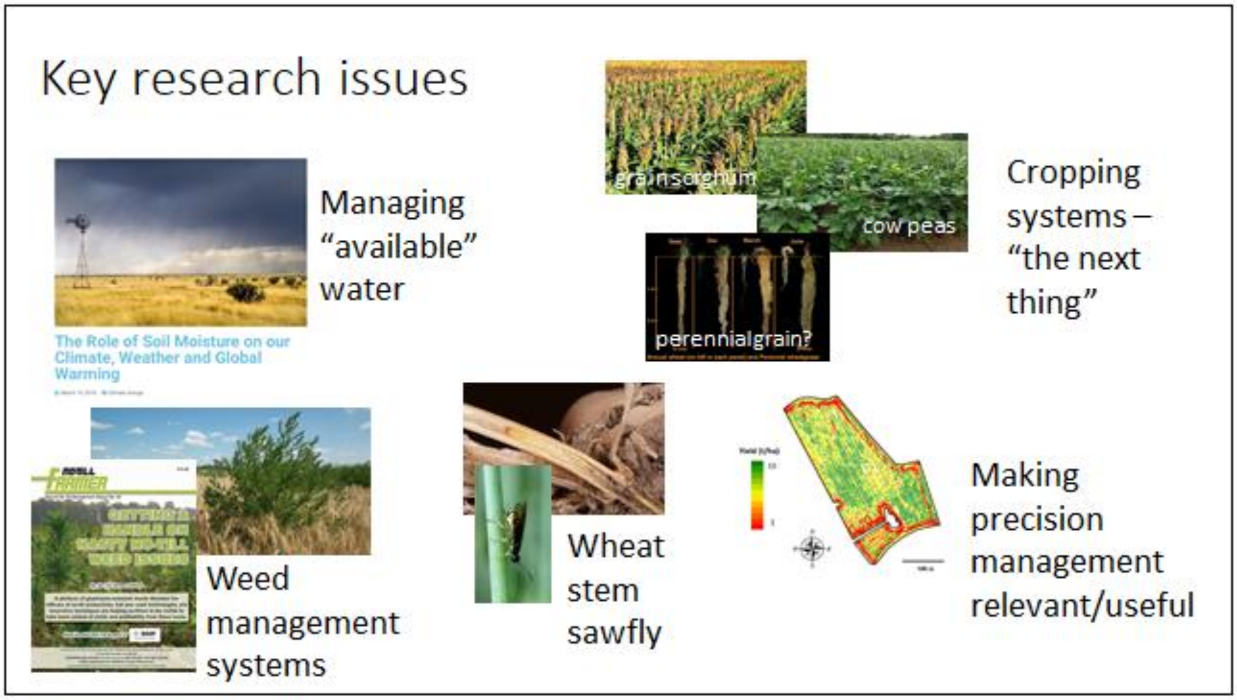
Key research issues
Managing "available" water
The Role of Soil Moisture on our Climate, Weather and Global Warming
grain sorghum
cow peas
perennial grain?
Cropping systems – "the next thing"
Weed management systems
Wheat stem sawfly
Making precision management relevant/useful

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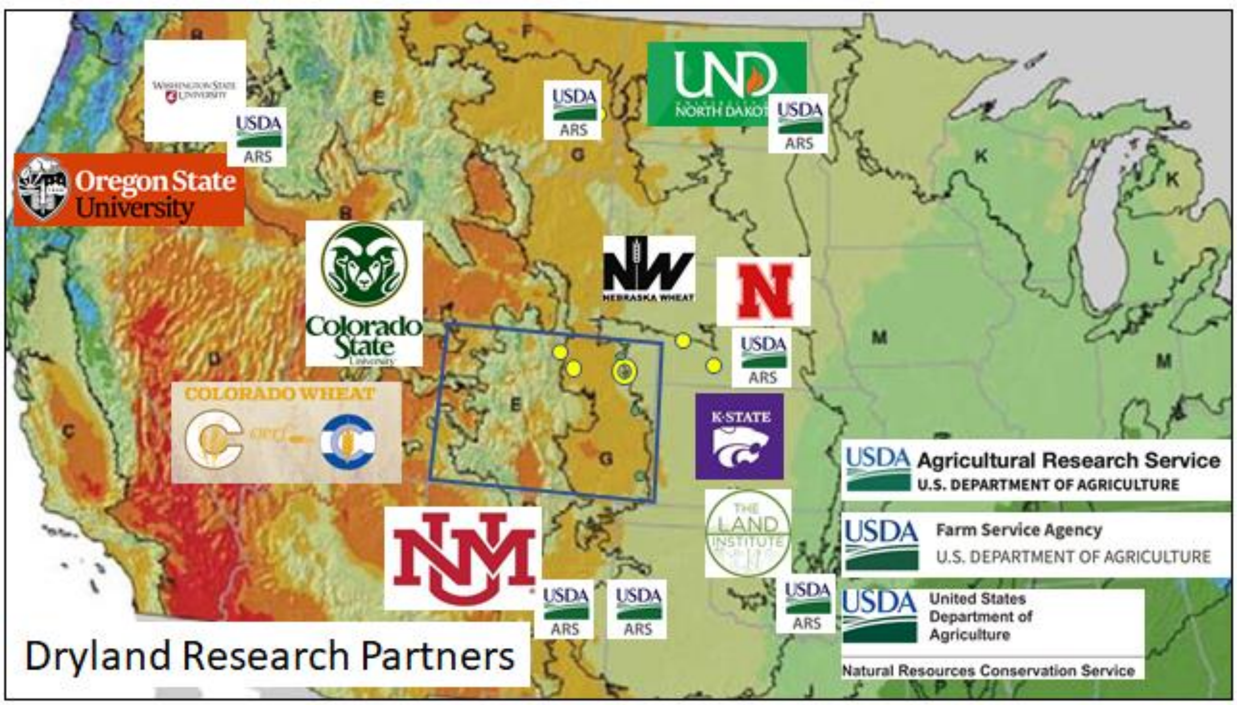

Dryland Research Partners
Oregon State University
USDA ARS
UND
Colorado State University
COLORADO WHEAT
NEBRASKA WHEAT
N
K-STATE
THE LAND INSTITUTE
USDA Agricultural Research Service U.S. DEPARTMENT OF AGRICULTURE
USDA Farm Service Agency U.S. DEPARTMENT OF AGRICULTURE
USDA United States Department of Agriculture
Natural Resources Conservation Service

6

Knowledge co-production
expanding our research on farms

Share data from yield monitors

- Understand mechanisms
- Track long-term outcomes
- Explore new options

On farm monitoring, experiments and data sharing

Farm tours!

7

Akron – 4 full time scientists (and counting…)

Soil management
Maysoon Mikha

Available water management

New

Weed management

New

Fertility management

New

8

Great Plains Wheat Stem Sawfly Coalition

- Improving existing and developing novel, resistance technologies
- Developing conservation biological control approaches for natural enemies
- Developing cropping-system diversification strategies to improve system resistance
- Developing and testing new insecticides, entomopathogens, and RNAi systems

Coalition: USDA-ARS, Colorado State Univ., Univ. of Nebraska, North Dakota State Univ., Kansas State Univ.

Stakeholders: CO/NE/ND Wheat, Akron Customer Focus Group

9

Akron Initiatives – bringing in new resources

Western "sentinel" network

– weather, soil, pests

Research farm of the future

– Akron as a trial ground for "smart" technologies

CARR – Fort Collins

– Daren Harmel, Director

Long Term Agroecosystem Research Network

- *sustainable intensification*
- *critical infrastructure*

10

Kyle Mankin

kyle.mankin@usda.gov

Pete Kleinman

peter.kleinman@usda.gov

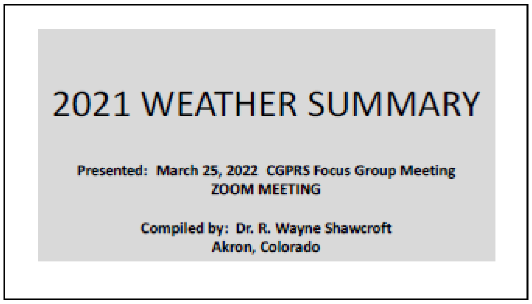
11

2021 Weather Summary:
Central Great Plains Research Station, Akron, Colorado

Dr. R. Wayne Shawcroft

Regional Extension Irrigation Agronomist (Retired)
Colorado State University

[Slides from Field Day will be added, and the updated Booklet will be available on our Webpage: https://www.ars.usda.gov/plains-area/akron-co/cgprs/news/annual-field-day/.]



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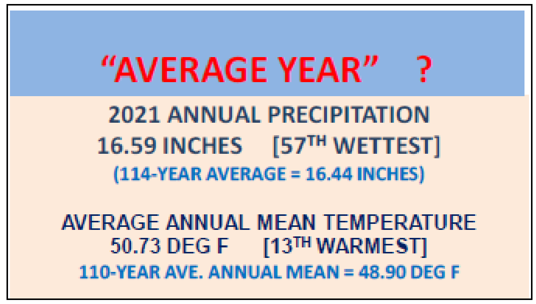

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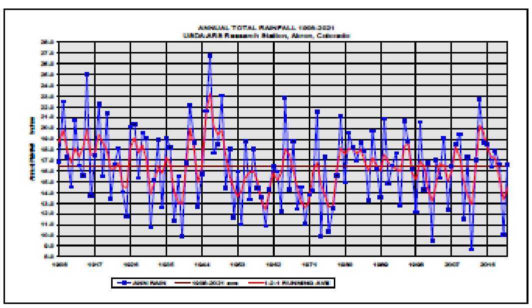

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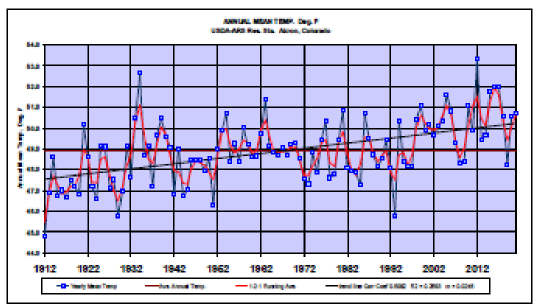

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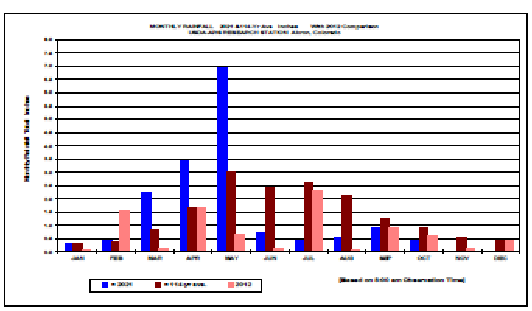

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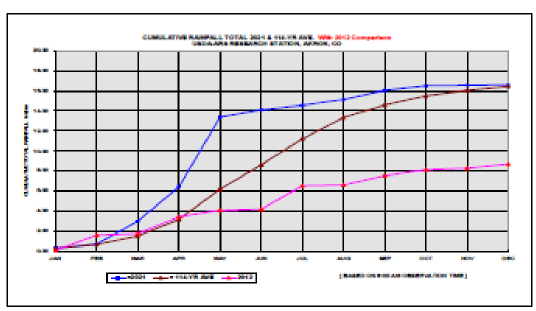

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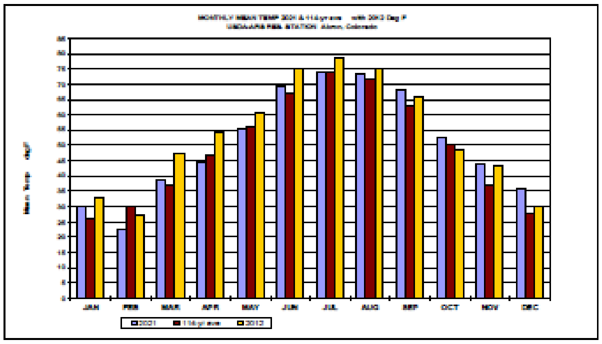


7

Rainfall Distribution
81% or 13.38 inches
by the end of May

JAN-MAY PERIOD
3 of the 5 months had AVE. MONTHLY MEAN
BELOW the Long-term Average

8

JUNE-DECEMBER RAINFALL
ALL 7 MONTHS BELOW AVERAGE

JUNE-DECEMBER MONTHLY AVERAGE
TEMPERATURES
ALL 7 MONTHS ABOVE AVERAGE

9

2021 WEATHER YEAR
DESIGNATED AS….

THE

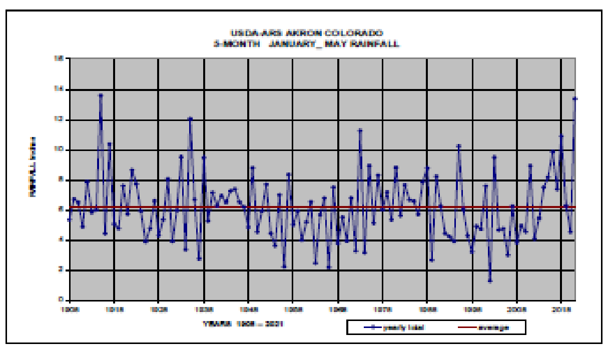
" 5 BY 7 " YEAR

10

JAN-MAY 5-MONTH PRECIPITATION
13.38 inches
Ranked as: 2nd WETTEST of 114-year Record
(114-YEAR AVE. = 6.21 inches)

JUNE-DECEMBER 7-MONTH PRECIPITATION
3.21 inches
Ranked as: DRIEST of 114-Record
(114-YEAR AVE. = 10.23 inches ...62% of Annual Ave.)

11



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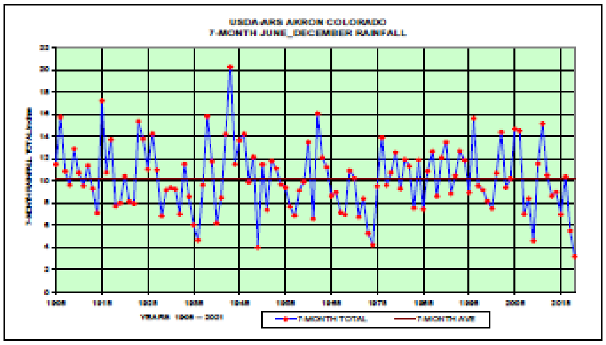


13

JAN-MAY 5- MONTH MEAN TEMPERATURE

38.24 deg F

Ranked as: 38th Coldest..or..74th warmest

111-Year Ave. = 39.22 deg F

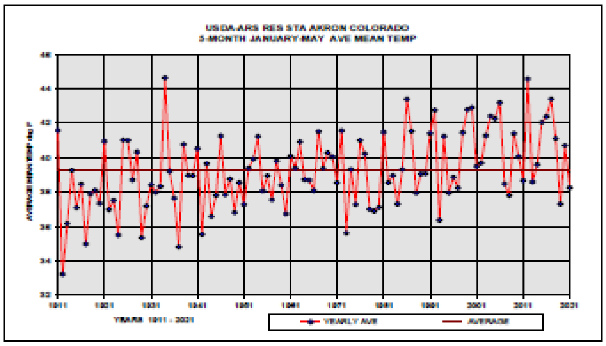
JUNE-DECEMBER 7-MONTH MEAN TEMP.

59.65 deg F

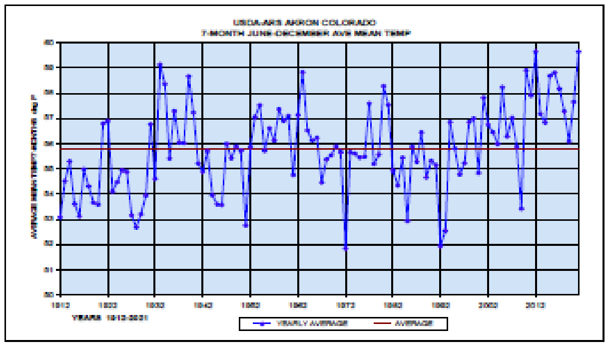
RANKED AS: WARMEST of RECORD

111-Year Ave. = 55.81 deg F

14



15



16

AKRON DATA 2021

<u>26 RECORDS SET or TIED</u>

15 new high temperature records

Sept. 4th Warmest ...record Max of 91 27th , 90 max on 28th

Nov. 4th Warmest;

Dec. Tie 3rd Warmest

75 deg Max on Dec. 3rd Tied for All-Time Record for Dec.

Dec. 2021 Ave. Maximum 51.85 deg F NEW RECORD

(11.36 DEG F ABOVE THE AVERAGE)

<u>11 new low temperature records</u>

Feb. 13th – 16th ...Four new Record low Maximums including -1 & -5

New Record low minimum of -24 on 14th

Two new Record low means of -5.5 & -14.5 on 14th & 15th

17

RAINFALL NOTES 2021

MAY 6.94 inches 3rd Wettest

July 0.46 inches 6th Driest

August 0.57 inches 12th Driest

Nov. (one rain) & Dec. 0.05 inches each:

with only 0.7 inches of snow total

2021 Calendar Year SNOW 26.1 inches

Winter (Jan-May) 25.4 in.

Fall (Sept-Dec) 0.70 in.

18

Highest Maximum 101 deg F
101 deg F June 16th : 100 deg F July 8th

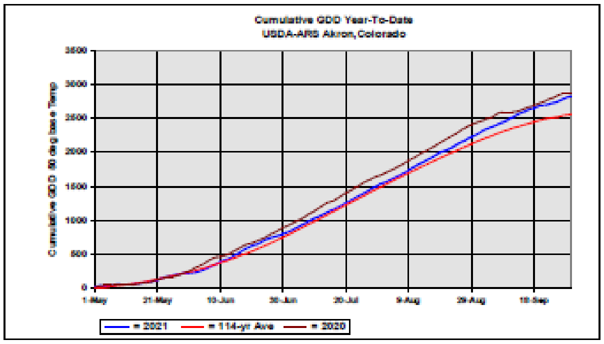
Number of days 90 or above = 52
(Ranks tied for 16th in number 90-plus days or 34% of days)
(Average number 90 or above = 44)

Number of minimums 55 or less = 74
(Average number 55 or less = 98)
[Fewer number 55 or less implies WARMER minimums]

19

GROWING DEGREE-DAY INDEX

20



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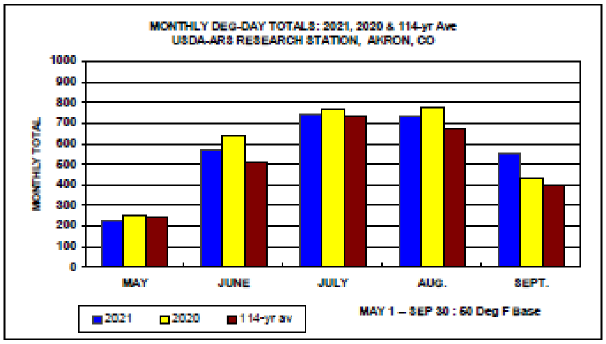


22

FROST FREE PERIOD (32 deg)

155 days May 12-October 14
Ranked as the **24th** longest frost-free period
(14 days longer than ave: Average is 141 days)
The range is from 76 days in 1910 to 179 days in 1949
Last 32 deg AVERAGE-date May 11
First 32 deg AVERAGE-date Sept. 30

23

2022 PREDICTION

Storm Track Improved ??
(Mountains vs. Plains) ??

Heat, Temps. Wind ??

24

2020 Macroburst

Dr. Russ Schumacher
Colorado State University

The Akron, Colorado macroburst of June 9, 2020

Russ S. Schumacher,
Samuel J. Childs, Rebecca D. Adams-Selin

ATMOSPHERIC SCIENCE COLORADO STATE UNIVERSITY | COLORADO CLIMATE CENTER | aer A Verisk Business

An intense downburst occurred just after midnight on 9 June 2020, causing extensive damage in Akron. A gust of 113 mph (50.45 m/s) at 10 m above ground, measured at the USDA research center, was the strongest *measured* thunderstorm wind gust on record for Colorado.

Photos from NWS Boulder: https://www.weather.gov/bou/20200609Macroburst

WHAT HAPPENED?

Thunderstorms initiated behind a strong cold front, organized into a line, and soon began producing severe wind gusts. With the passage of the line, temperature and pressure exhibited strong wave-like fluctuations. Five separate weather stations in Akron measured wind gusts > 35 m/s (79 mph) over approximately 3 minutes.

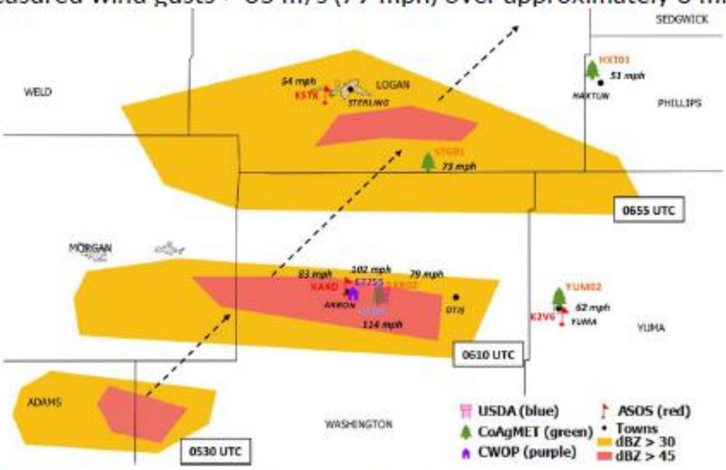


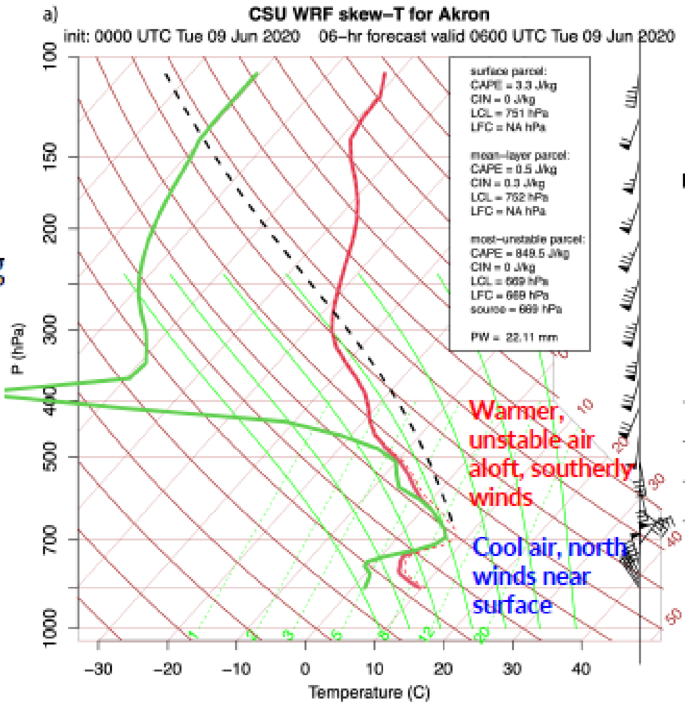
Illustration of the progression of the convective line and observed severe gusts

How do downbursts usually work, and why was this one different?

Downbursts are fairly common in eastern Colorado –when an afternoon thunderstorm forms, rain starts to fall into dry air and evaporates, making that air cooler and more dense, and it rapidly sinks to the ground.

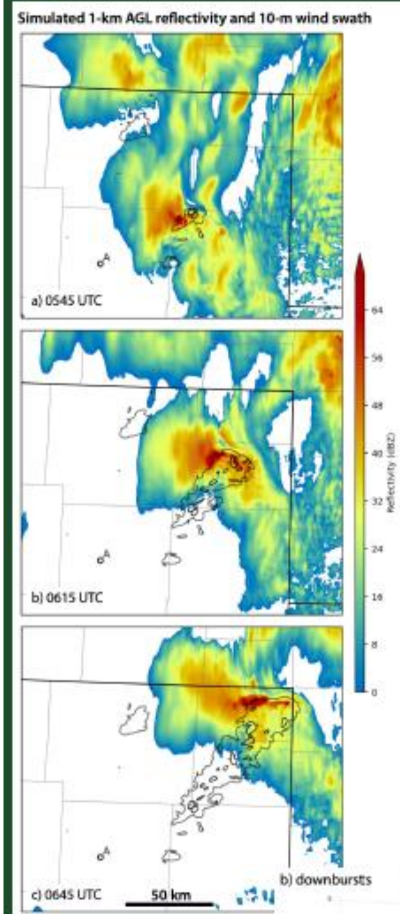
But the Akron downburst was quite different:

- It happened in the middle of the night, not the afternoon
- It happened behind a strong cold front, so temperatures were only in the 60s, rather than in warm, dry conditions that are more common
- Winds were especially strong, and affected a large area, qualifying this to be a "macroburst"



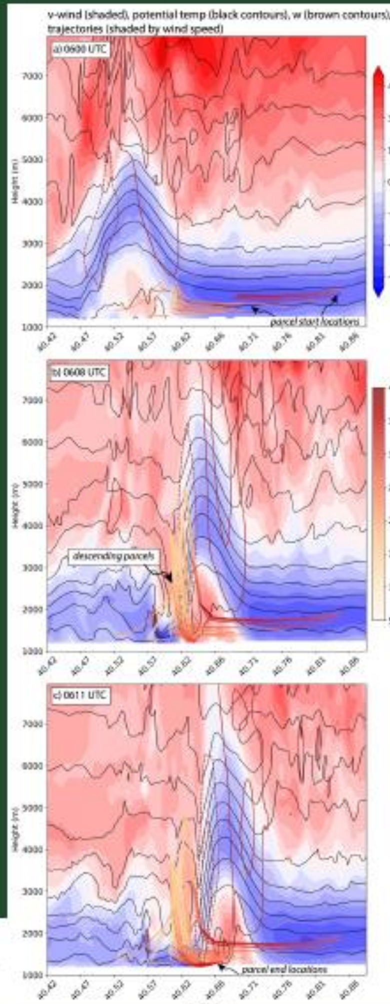
Questions?
russ.schumacher@colostate.edu

We ran high-resolution atmospheric models (similar to those used for weather forecasting) to simulate the storms that produced the macroburst

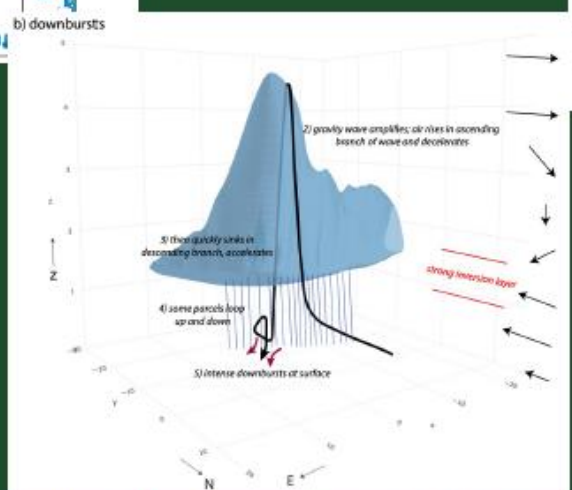


In the model, a line of storms developed and produced very intense winds through northeastern Colorado, although not exactly in the right location

Unlike downbursts that form from evaporation of raindrops in dry air, in this event a wave developed in the atmosphere which broke, leading to rapidly sinking air and intense surface winds

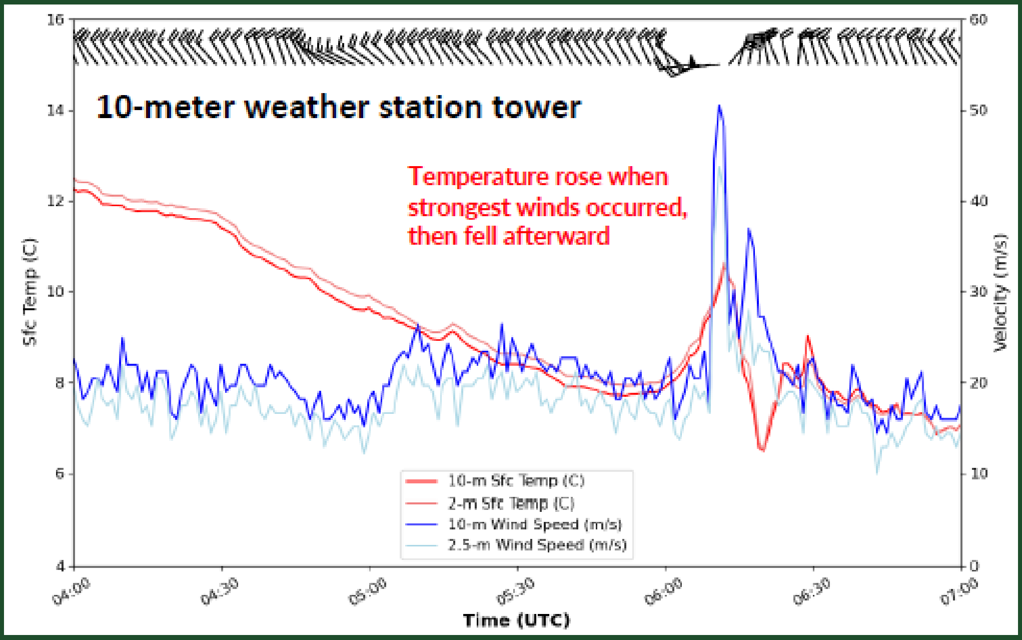


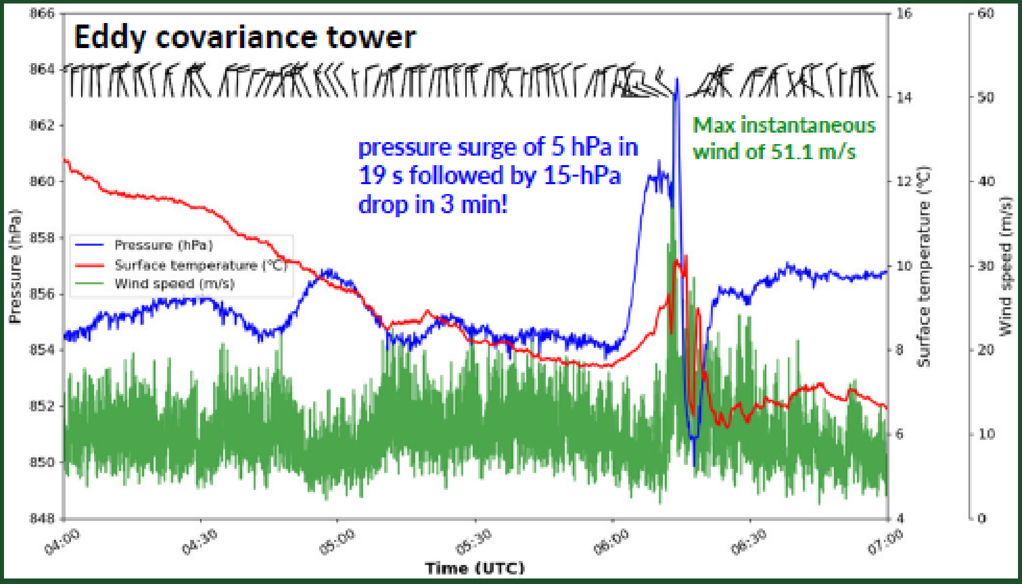
Vertical cross-section through the simulated line, showing the amplification and breaking of the wave, and rapid descent of air producing downbursts



Schematic depiction of the processes associated with the macroburst

Incredible variations in pressure, temperature, and wind as the downburst occurred!





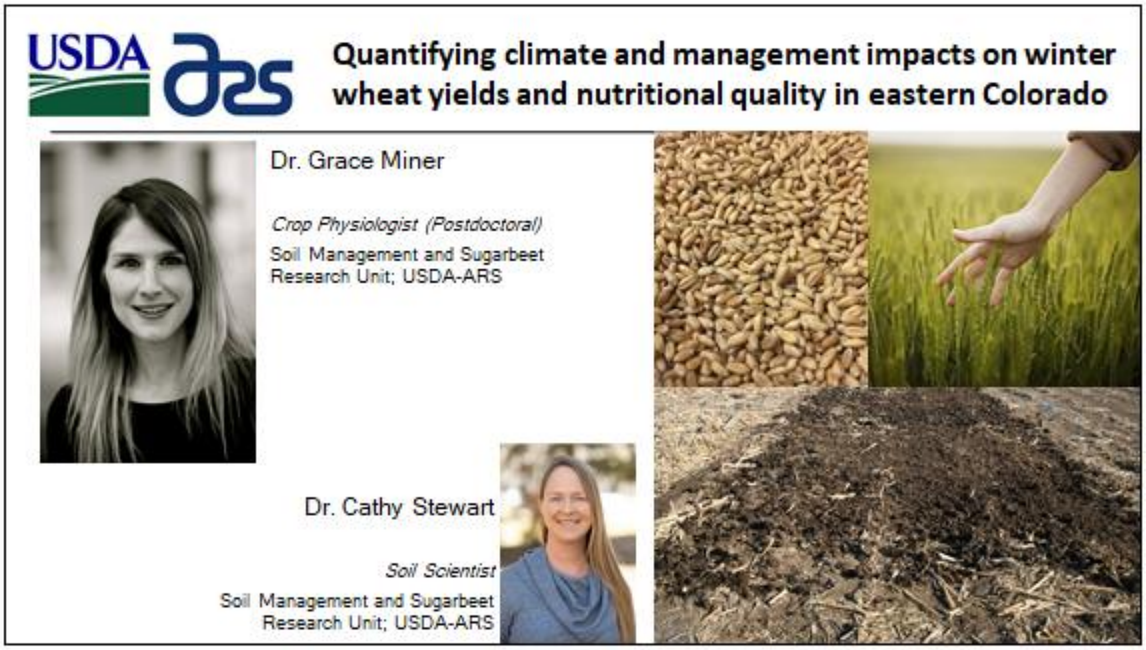
Time series at 10Hz from the USDA eddy covariance tower (2.3 m AGL) in Akron, CO

ACKNOWLEDGMENTS

This work was supported by the National Science Foundation (NSF) Grants AGS-1636663 and AGS-1636667 as well as the USDA National Institute of Food and Agriculture and Colorado Agricultural Experiment Station Project COL00703B. Data from the 10-m and EC towers at the USDA site belong to and used with permission by David Poss with USDA and John Tatarko of the Rangeland Resources and Systems Unit in Fort Collins. High-performance computing performed on Cheyenne (doi:10.5065/D6RX99HX) provided by NCAR's Computational and Information Systems Laboratory, sponsored by the National Science Foundation.

Factors Affecting Long-term Trends in Wheat

Dr. Grace Miner, Dr. Cathy Stewart
USDA-ARS, Soil Management & Sugar Beet Research Unit, Fort Collins, CO



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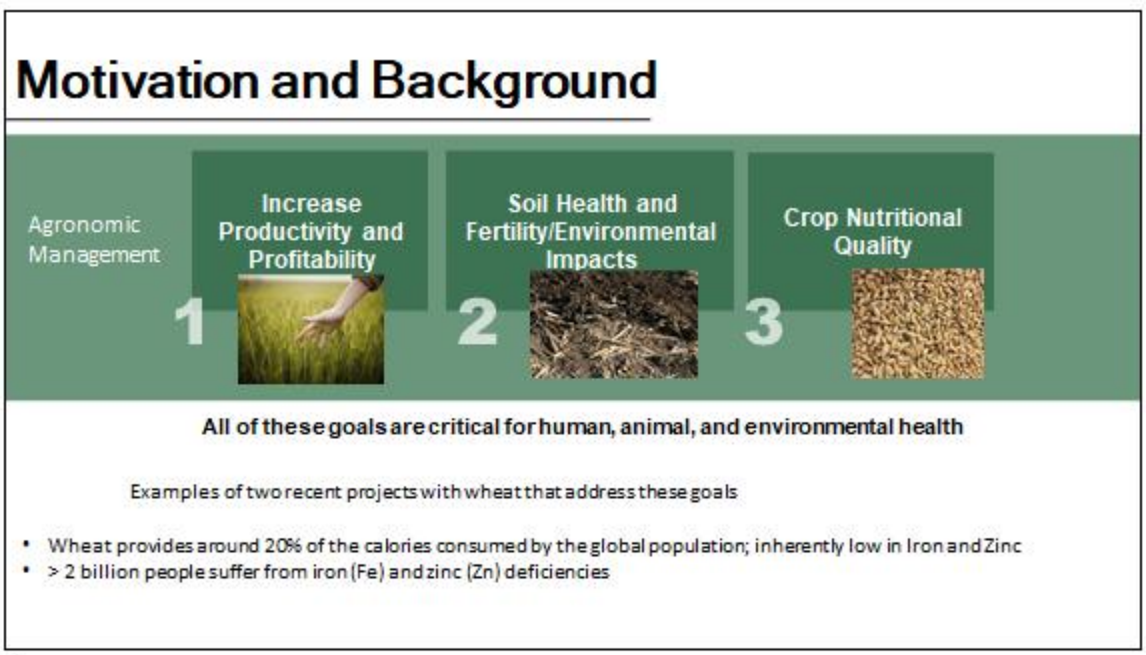

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Study 1:

Wheat grain micronutrients and relationships with yield and protein in the U.S. Central Great Plains

Grace L. Miner[a,1,*], Jorge A. Delgado[a], James A. Ippolito[b], Jerry J. Johnson[b], Danica L. Kluth[b], Catherine E. Stewart[a]

[a] Soil Management and Sugar Beet Research, USDA Agricultural Research Service, 2150 Centre Ave., Fort Collins, CO 80526, United States
[b] Department of Soil and Crop Sciences, Colorado State University, Fort Collins, CO 80523, United States

Q: How are grain protein, Zinc, & Iron impacted by:

- Soil fertility
- Yield
- Variety
- N fertilization
- Protein

3

METHODS

- 6 sites
- 2 N rates (Farmer Trt, FT + 90 N lb N/acre)
- 3 Varieties (Canvas, Langin, Snowmass 2.0)
- Soil sample pre-plant Fall 2018; Harvest 2019

4

Site	Available Zn mg kg^{-1}	P mg kg^{-1}	SOC %	pH
Akron	0.25 (0.05)	14.7 (2.87)	0.66 (0.10)	7.37 (0.13)
Arapahoe	0.16 (0.03)	6.06 (1.55)	0.73 (0.05)	8.08 (0.04)
Burlington	0.15 (0.02)	7.27 (1.74)	0.75 (0.04)	8.15 (0.06)
Roggen	0.25 (0.04)	9.57 (2.12)	0.42 (0.07)	8.17 (0.09)
Sheridan Lake	0.12 (0.03)	3.81 (0.55)	0.33 (0.08)	8.20 (0.05)
Yuma	0.27 (0.05)	15.7 (4.76)	0.62 (0.07)	8.11 (0.11)

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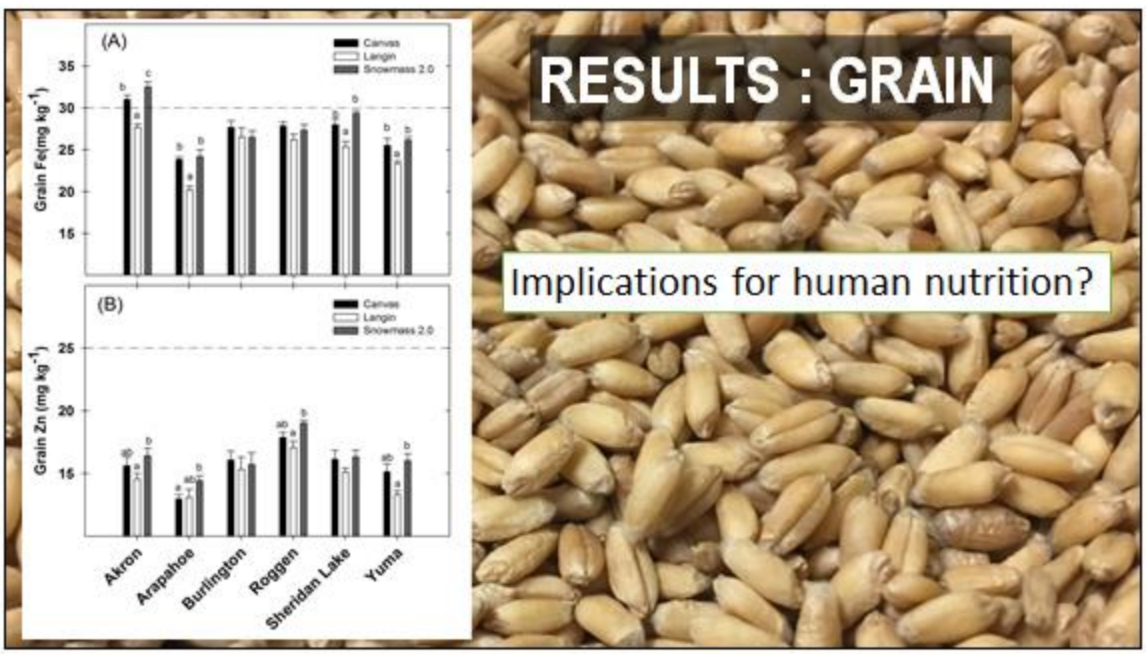

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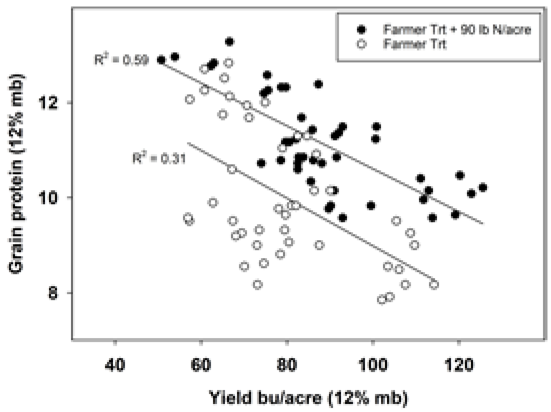
RESULTS: PROTEIN-YIELD



- Only a small yield boost of additional N at a few sites
- Improved grain protein, but at what cost economically, environmentally?

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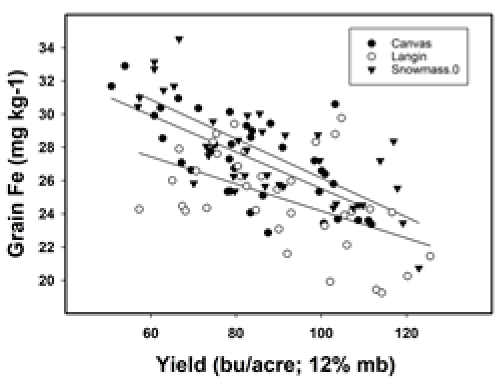
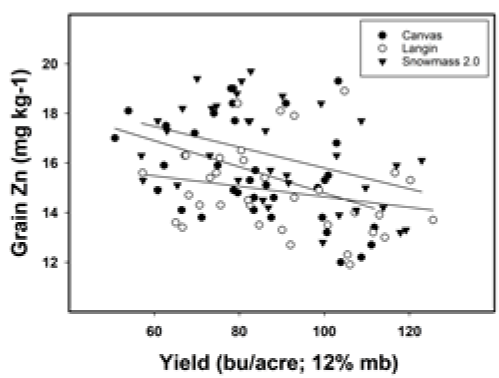
RESULTS: IRON/ZINC YIELD





- Very nominal varietal differences
- Larger yield dilution of Iron than of Zinc

8

CONCLUSIONS

- Extremely low available soil Zinc at all sites! Updated and refined research on what constitutes 'sufficiency' for micronutrients is needed
- It is possible Zn is limiting yields in hidden ways – another role of SOC?
- Complex tradeoffs between productivity and nutritional quality

9

Study 2: Quantifying precipitation, temperature, and management impacts on wheat yields and quality

Grace L. Miner[a*], Catherine E. Stewart[a], Merle F. Vigil[a], David Poss[b], Scott D. Haley[c], Sally Jones-Diamond[c], and Esten Mason[c]

Q 1: How have precipitation and temperatures historically impacted wheat yields at Akron?

Q 2: How do no-till/fallow mitigate weather impacts on yield?

Q 3: Do high-yielding varieties show lower heat tolerance than low-yielding varieties?

10

METHODS

- Yield data from USDA ARS ACR plots (1993 – 2015); wheat in 7 different rotations (no-till, conv. Till, with and without fallow)
- Robust on-site weather data aggregated into monthly intervals of precipitation or temperature exposure
- Yield data from CSU Variety trials
- Statistical model selection

11

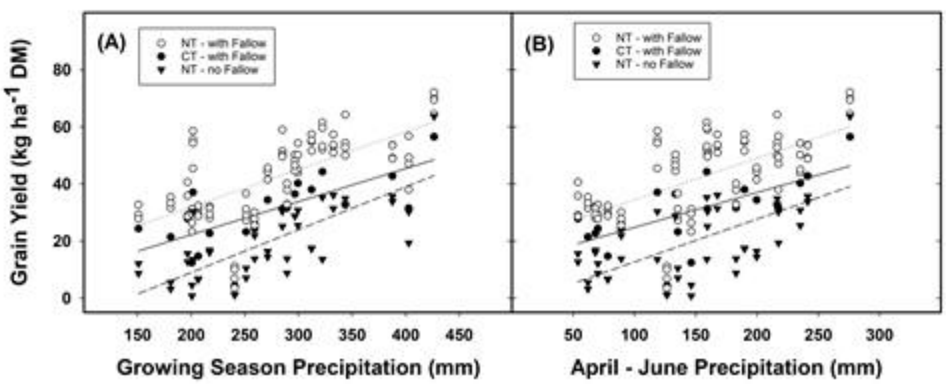
RESULTS

Q 1: What factors have historically impacted wheat yields at Akron?

Spring precipitation as predictive of wheat yields as growing season precipitation

Q 2: How do no-till/fallow mitigate climate impacts on yield?

Consistent increase in intercept, but no difference in slopes of response



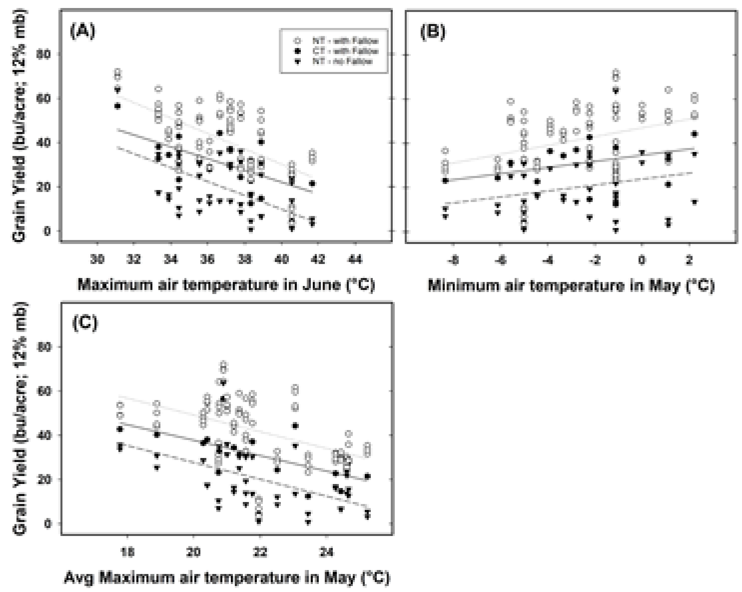
For panel A, model $R^2 = 0.65$. For panel B, model $R^2 = 0.60$

12

RESULTS

Q 1: What weather factors have historically impacted wheat yields at Akron?

Maximum temperature in June as predictive of yields as precipitation

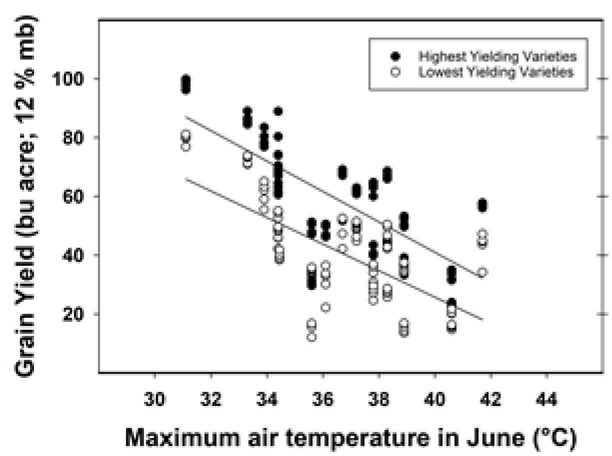


13

RESULTS

Q3: Do high-yielding varieties show lower heat stress tolerance than low-yielding varieties?

We find no evidence for this.



14

CONCLUSIONS

- Dryland agroecosystems are already operating at the extremes of precipitation and temperature.
- Historic May and June daytime temperatures in eastern Colorado are above optimum.
- No-till and fallow inclusion represent management adaptation to this climate that have been historically critical to maintaining viable wheat yields and mitigating risk (Complex Trade-offs).
- We found no evidence for adaptation to heat stress via alternative variety selection, at least from historical breeding lines.

15

Sunflower on Cover Crop Research

Dr. Nevin Lawrence, Dr. Cody Creech
University of Nebraska, Lincoln

[Slides from Field Day will be added, and the updated Booklet will be available on our Webpage: https://www.ars.usda.gov/plains-area/akron-co/cgprs/news/annual-field-day/.]

2022 Crops Testing Sorghum Research Activities and Information

Sally Jones Diamond

Colorado State University

CSU Sorghum Field Day at Akron on September 13, 2022 (8:30 a.m.) will include a plot tour of the variety trial, agronomy trials, and updated information from seed companies on new technologies.

2022 Projects Overview

Funded by in-part by the Colorado Sorghum Growers Association (Checkoff)

- Grain sorghum performance trials at four dryland locations (including Akron) and three limited-irrigation locations (new sites at Brush and Rocky Ford).
  - We are testing 40 different hybrids from seven seed brands across the seven total locations.
- Dryland hybrid by seeding rate by planting date study at Akron and Sheridan Lake (2nd year)
  - Two hybrids (DKS28-05 and Dyna-Gro M54GR24) at three seeding rates (20,000, 40,000, and 60,000 seeds/acre), and two planting dates (optimum in late-May and late in mid-June).
- Microbiologicals Product Application (2nd year at Akron, Sheridan Lake, and Seibert)
  - Testing five products (in-furrow and seed applied) from three different companies compared to a no-product check treatment.

Funded by National Sorghum Checkoff

- Row Spacing comparing 30” rows to skip-row (60” spacing) at a single planting rate (1st year)

Sorghum Maturity

- Days to mid-bloom information provided in seed brochures is not exact and usually is not adjusted for our high elevation and higher latitude growing region
  - Add at least 10 days to advertised days to mid-bloom, and keep in mind hybrids need an additional 30-45 days after mid-bloom to reach maturity or black layer
- Consider the average frost date for your location and the importance of maintaining test weight
- Plant early or medium-early maturity hybrids
- Seed heads turning color does not mean grain is mature

Herbicide Tolerance Technologies (non-GMO)

More information on these technologies is available from sorghumcheckoff.com, under the Farmers tab, and Agronomy Insights

- igrowth® from Advanta (Alta Seeds)
    - Hybrids with tolerance have IG after initial product number
    - Pre- or post-emergence control of broadleaf and grass weeds, longer residual
        - Should be used in a system with other herbicides
    - Companion herbicide by UPL is called IMIFLEX™ (imazamox, group 2 ALS inhibitor)
        - Pre-emerge application rate is labeled at 9 oz/ac
        - Post emerge rate is labeled at 6 oz/ac
    - Currently five hybrids in their lineup with this herbicide tolerance, one potentially adapted to our short season

- Double Team™ from S&W (Sorghum Partners)
    - Hybrids with tolerance have DT after initial product number
    - Post-emergence control of grassy weeds
    - Companion herbicide by ADAMA is called FirstAct™ (quizalofop, group 1 ACCase inhibitor)
        - Max application rate of 12 oz/ac in a single application and 21 oz/ac per year
        - Recommended to apply after plant height has reached 11", don't mix with broadleaf herbicides or effectiveness will be reduced
        - Use COC and apply minimum of 10 gal/ac of water, or 15 gal/ac of water under drought conditions
    - Pilot launch in 2021, currently five hybrids in lineup with this herbicide tolerance
        - Maturity ranges from very early to medium, will know more about adaptability and performance after 2022 season

- Inzen™ from Corteva (Pioneer Seed)
    - Post-emergence control grass weeds and (limited) broadleaf, use pre-emergence herbicide first for best results
    - Companion herbicide is called Zest™ (nicosulfuron, group 2 ALS inhibitor)
    - Sandbur, foxtail, crabgrass, barnyard grass
    - Very limited seed supply in 2022, mainly large demo plots

- The plant-back restriction on sorghum is 18 months for Zest and IMIFLEX due to stewardship and not herbicide carryover, and 4 months for FirstAct (cannot plant FirstAct tolerant sorghum in consecutive years).

2021 Dryland Grain Sorghum Hybrid Performance Trial at Akron

More results available at www.csucrops.com

Brand	Hybrid	Grain Yield[a]	Yield	2-Year Average Yield	Test Weight	Emerged Plant Population	50% Bloom	Maturity Group[b]	Grain Color
		bu/ac	% of test average	bu/ac	lb/bu	plants/ac	days after planting		
Golden Acres	GA 2730B	**74.7**	119%	72	59	42,000	71	ME	Bronze
Hoegemeyer Seed	H6020	**72.6**	116%	-	59	41,000	68	ME	Red
Dekalb	DKS29-28	**71.7**	115%	76	59	44,800	71	E	Bronze
Golden Acres	GA 2620C	**71.7**	115%	76	59	32,900	71	ME	Cream
Sorghum Partners	SP 31A15	**70.8**	113%	73	57	38,600	72	ME	Bronze
Alta Seeds	ADV G1329	**70.5**	113%	-	58	32,300	71	E	Cream
Dyna-Gro Seed	M59GB57	**69.9**	112%	72	59	36,100	67	E	Bronze
Channel Seed	5B27	68.7	110%	-	58	41,500	65	ME	Red
Dyna-Gro Seed	M59GB94	68.7	110%	66	58	31,200	74	E	Bronze
Alta Seeds	AG1201	67.2	107%	-	58	34,700	70	E	Red
Dekalb	DKS28-05	65.7	105%	71	58	40,500	68	E	Bronze
Dekalb	DKS29-95	65.4	104%	-	58	37,400	72	E	Dark Red
Golden Acres	GA 1510C	65.4	104%	-	58	43,400	69	E	Cream
Channel Seed	5C76	64.5	103%	-	60	34,800	73	ME	Cream
Warner Seed	W5501	64.2	103%	-	58	37,000	67	E	Bronze
Dyna-Gro Seed	GX20973	63.9	102%	-	60	34,400	71	ME	Bronze
Sorghum Partners	KS310	63.9	102%	-	59	28,700	71	ME	Bronze
Alta Seeds	AG1101	62.4	100%	-	58	40,200	66	E	Red
Dyna-Gro Seed	M60GB88	62.1	99%	70	58	39,600	74	ME	Bronze
Sorghum Partners	SP 43M80	62.1	99%	66	59	30,200	73	ME	Bronze
Dyna-Gro Seed	M54GR24	58.8	94%	67	59	37,200	65	E	Red
Alta Seeds	ADV G1120IG	58.2	93%	-	56	31,200	86	ME	Red
Dyna-Gro Seed	M60GB31	57.0	91%	41	58	28,000	81	ME	Bronze
Dekalb	DKS27-80	56.7	91%	-	59	40,700	68	E	Bronze
Sorghum Partners	251	55.2	88%	-	59	35,100	65	E	Red
Sorghum Partners	SP 25C10	54.6	87%	61	60	37,900	66	E	Cream
Alta Seeds	ADV G1153	53.7	86%	-	57	30,600	86	ME	Red
Alta Seeds	ADV XG015IG	12.9	21%	-	54	32,900	111	E	Red
Average		**62.6**		**68**	**58**	**36,200**	**73**		
[c]LSD (.30)		5							
[c]LSD (.05)		10							

[a]Yields adjusted to 14% moisture and hybrids ranked by yield. Hybrid yields in bold are in the top LSD group (.30).

[b]Maturity group: E=early; ME=medium-early. Groupings are based on company provided information and may not align with the observed flowering dates in the trial due to the relatively high elevation of the trial site, 4,537 ft.

[c]Farmers selecting a hybrid based on yield should use the LSD (.30) to protect themselves from false negative decisions. Companies or researchers may be interested in the LSD (.05) to avoid false positive conclusions.

Site Information

Collaborator:	USDA-ARS Central Great Plains Research Center
Planting Date:	May 28, 2021 at 43,600 seeds/ac to a planting depth of 1.25 in. to 1.5 in.
Harvest Date:	October 26, 2021 with a harvest area of 10 ft. by 30 ft.
Fertilizer:	N at 49 lb/ac and P at 14 lb/ac
Herbicide:	Pre-plant: Buccaneer plus at 2 qt/ac, Aim at 2 oz/ac, Explorer at 3.5 oz/ac, Brawl at 1.2 pt/ac, Atrazine at 2 pt/ac, Superb HC at 12.8 oz/ac, and Class Act at 64 oz/ac
Soil Type:	Weld silt loam
GPS Coordinates:	40.15498, -103.14245
Trial Comments:	Trial planted into excellent moisture. Very good stands and emergence, heavy wheat stubble in field. Plants were at V5 growth stage on June 30th. Most hybrids were not showing drought stress as of mid-August,even though conditions in July and early August were hot and dry. Trial was starting to flower in early August. Killing freeze on Oct. 13th. Field received 4.4" of rain in May, 0.65" in June, 0.42" in July, 0.5" in August, 0.83" in Sept., and 0.24" up to harvest in Oct. 26th.

2021 Dryland Corn Hybrid Performance Trial at Akron

More results available at www.csucrops.com

Brand	Hybrid	Insect and Herbicide Technology Traits[a]	Grain Yield[b]	Yield	Relative Maturity[c]	Moisture	Test Weight	Ear Height	Population
			bu/ac	% of test avg.		percent	lb/bu	in	plants/ac
102-108 Relative Maturity									
Hoegemeyer Hybrids	7404 Q	Q, LL, RR2	56	112%	104	18	58	19	17,800
Hoegemeyer Hybrids	7322 AML	AML, LL, RR2	54	107%	103	16	58	18	16,600
Dyna-Gro Seed	D48QV22	3330, RR2	53	105%	108	18	58	22	15,800
Dyna-Gro Seed	D44SS54	STX, LL, RR2	53	105%	104	14	59	24	17,300
Pioneer	P0622AML	AML, LL, RR2	50	99%	106	15	59	22	15,500
Dyna-Gro Seed	D45TC55	TRE, RR2	47	93%	105	18	59	18	15,500
Dyna-Gro Seed	D43SS81	STX, LL, RR2	47	92%	103	13	59	20	16,100
94-101 Relative Maturity									
Dekalb	DKC51-20RIB	DG, VT2PRIB, RR2	56	111%	101	14	60	22	17,800
Channel	194-49	DG, VT2P, RR2	51	101%	94	15	60	19	15,000
Channel	199-45	VT2P, RR2	50	98%	99	13	59	24	10,900
Dyna-Gro Seed	D39VC40	VT2P, RR2	47	94%	99	14	60	23	12,800
Dyna-Gro Seed	D37SS64	STX, LL, RR2	42	83%	97	14	60	25	17,300
		Average	**51**		**102**	**15**	**59**	**21**	**15,700**
		[d]LSD (0.30)	NS						
		[d]LSD (0.05)	NS						

[a]Technology trait designations: 3330=Agrisure Viptera 3330 E-Z Refuge; AML=AcreMax Leptra; DG=DroughtGard; LL=LibertyLink; Q=QROME; RR2=Roundup Ready 2; STX=SmartStax; TRE=Trecepta; VT2P=VecTran Double Protection; VT2PRIB=VecTran Double Protection Refuge in the Bag Complete. For a list of specific pests controlled by each trait, please click here.

[b]Yields corrected to 15.5% moisture. Hybrid yields in bold are in the top LSD group (0.30).

[c]Relative maturity is provided by the respective companies and is the approximate time from planting to harvest maturity. The method of calculation of the relative maturity ratings may vary among companies.

[d]Yield trial data could not be interpreted due to the high degree of field variability. The yield results should not be used for selecting superior hybrids.

Site Information

Collaborator:	Central Great Plains USDA-ARS Research Station
Planting Date:	May 21, 2021
Harvest Date:	October 18, 2021
Fertilizer:	In-Season: N at 49, P at 14 lb/ac;
Herbicides:	Buccaneer plus at 2 qt/ac, Aim at 2 oz/ac, Explorer at 3.5 oz/ac, Brawl at 1.2 pt/ac, Atrazine at 2 pt/ac, Superb HC at 12.8 oz/ac, and Class Act at 64 oz/ac
Soil Type:	Weld silt loam
Trial Coordinates:	40.15498, -103.14304
Trial Comments:	Planted into excellent moisture and heavy wheat stubble. Excellent stands and emergence. Trial received 0.65" of rain in June, 0.4" in July, 0.5" in August, and 0.83" in September. Plants were showing signs of drought stress in early August. Field variation due to high pH areas caused a high degree of variability in yield data.

Forage Pea Production in Long-Term Compost Management Practices

Dr. Maysoon Mikha

Soil Microbiologist

USDA-ARS, Central Great Plains Research Station, Akron, CO

INTRODUCTION

Forage pea are one of the important legume crops that characterized with high-yielding, short-term growing season, and high protein content. Peas grow in a wide range of environments and can be found on a wide range of soils from sandy loams to heavy clays provided the soils are well-drained. They are generally used as a whole crop for silage as they provide both protein and starch to the diet. Legume crop do not require N fertilization because of their symbiotic relationship with Rhizobium bacteria that fixed atmospheric N and form root nodules. The Rhizobium bacteria extract atmospheric N and convert it to plant-available N forms within legume roots. Inside the nodules, bacteria convert atmospheric N to ammonia (NH_3), which the legume used as protein source. After harvest, the nodule decomposes and provide N for subsequent crop.

Beef compost manure is a good source of nutrients for plant production. It contains a full spectrum of essential plant nutrients such as micro and macronutrients that are absent in synthetic fertilizers. Beef compost released nutrients slowly throughout the growing seasons which could reduce nutrients losses. As an organic amendment, compost could enhance soil aggregation and improve soil structure stability that contribute to enhance soil water holding capacity, pore continuity, air and nutrients circulation, and reduce soil compaction.

OBJECTIVES

Evaluate long-term (8 years) of beef compost manure application at two rates 10 and 50 t/ac on forage peas production with:

1) Applied beef compost manure at 10 t/ac treatment.
2) Residual treatment after 3 years of discontinued beef compost manure application at two rates 10 and 50 t/ac.

MATERIALS AND METHODS

This study was initiated in spring of 2010 on dryland sod area at Akron, CO to address the effects of transitioning from grassland to cropland using different rates of beef compost manure application. From 2010 to 2018, beef compost manure was added biannually (2010, 2012, 2014, 2016, and 2018) at 10 t/ac and 50 t/ac. The control treatment at 0 t/ac was also included. Two crop rotations were implemented, wheat-fallow (W-F) and winter triticale or winter pea-fallow (T/P-F) rotation. Each phase of the crop rotation accrued each year. The beef compost treatments represent the main plots and it was replicated four times. The beef compost plots were split to accommodate the rotation phases. The crop rotation plot sizes were

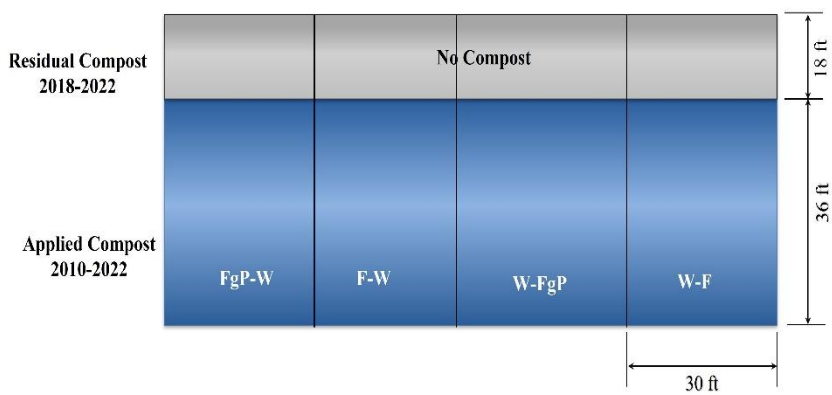


Figure 1. Field diagram shows the plot split for beef compost manure treatments, crop rotations, and plot's dimensions.

54 ft long by 30 ft wide. After 2018 to 2021 the beef compost was not applied to the study site, but the crop rotations were maintained. In 2022, the beef compost manure plots (main plots) were further split for the residual nutrients study **(Figure 1)**. The beef compost was applied at the rate of 10 t/ac (10/10 and 50/10) to all beef compost treatments and no compost added (0 t/ac) as a control treatment was maintained within the study. The crop rotation was changed to forage pea-wheat (FgP-W) and wheat-fallow (W-F) rotation. All phase of each rotation accrues every year.

RESULTS AND DISCUSSION

Forage pea biomass was influenced by beef compost treatments. The applied compost treatment has more forage pea biomass production than the residual treatment. At 10 t/ac, the forage pea production was approximately 1.9 times higher with applied beef compost than the residual. While at 50/10 t/ac, the biomass production was about 2.2 times higher with applied beef compost than the residual. The control treatment exhibit higher forage pea biomass by approximately 13.6% than the applied and by twice than the residual beef compost treatments. The weed infestation was high with beef compost treatments that overshadow the forage pea biomass with both applied and residual study plots. However, the control treatment (0 t/ac beef compost) exhibit lower weed infestation which contribute to biomass enhancement compared with beef compost treatments. The 50/10 t/ac beef compost treatment contained more weed than the 10/10 t/ac beef compost which cause higher forage pea biomass production than the 50/10 t/ac beef compost treatment.

CONCLUSIONS

- In 2022 growing season, weed infestation prevent us from seeing the benefits of beef compost manure on forage pea biomass production.
- The 50/10 t/ac beef compost treatment exhibit lower biomass production which could be related to higher weed infestation compared with 10/10 t/ac treatment.
- The residual treatments exhibit lower yield than the applied that could be related to weed infestation that compete with the forage pea over the available water and nutrients.
- Soil available nutrients and plant nutrients uptake are being processed and will be presented at the future meetings.

Wheat Stem Sawfly

Dr. Adam Osterholzer
Colorado State University

Dr. Jeff Bradshaw
University of Nebraska, Lincoln

Dr. Tatyana Rand
USDA-ARS, Pest Management Research Unit, Sidney, MT

Irrigation Management of Cowpea for NE Colorado

Joel Schneekloth, Derek Witkze and Maria Munoz-Amatriain, Dr. Jessica Davis

Colorado State University

Cowpea are a relatively new dry bean crop for NE Colorado. Cowpea is well known for its adaptation to drought, heat and poor soils. Discussion with a consultant has expressed concern that the irrigated response of cowpea is not similar to typical dry beans grown in NE Colorado. The thought was that cowpea may have a negative response to typical full irrigation management practices for dry beans such as pintos and kidney beans grown here.

In 2021, a study was conducted utilizing a rainout shelter at Central Great Plains Research Station near Akron, CO. Use of the rainout shelter ensures that excessive precipitation events do not interfere with the potential water response and timing of water needs. The rainout shelter is connected to a tipping bucket precipitation gauge that will shut the shelter when precipitation is recorded and open after the precipitation event is over.

Four strategies were looked at within this study: Dryland, 4 inches of irrigation, 8 inches of irrigation and full irrigation practices. All plots received average weekly precipitation amounts weekly via a drip system on the plots. The 4-inch and 8-inch irrigation treatments were targeted towards the reproductive growth stages of cowpea with 2 inches of water applied per week either on a bi-weekly basis or weekly basis. The final treatment was full irrigation management which targeted maintaining plant available soil moisture between 50 and 80% during the growing season.

Results:

Irrigation did increase yield compared to dryland to a point (Table 1). Increasing irrigation past the 8-inch allocation did not increase yields. Yields increased from 968 to 2484 lb ac^{-1} from dryland to 8 inches of applied irrigation. Additional irrigation beyond 8 inches did not increase yield but did increase evapotranspiration (ET) (Figure1). Most crops generally have a yield response of increasing yield as ET increases. Yields increased by 222 lbs per inch of ET.

Increases in biomass increased with ET. Even though yields did maximize at a lower ET, biomass increased with more ET (Figure 2). Biomass increased at 391 lbs per inch of ET across all water applications. Since yield maximized at 8 inches of irrigation or approximately 14.5 inches of ET, additional water was only utilized for additional plant biomass growth.

One of the factors to look at is how irrigation impacted yield components such as pods per plant, seed/pod and seed size. Irrigation did not significantly increase seeds per pod. The number of seeds per pod ranged from about 5 to 5.9 for dryland and irrigated respectively.

The two major impacts due to irrigation was pods per plant as well as seed size or seeds per lb. Irrigation at 4 inches seasonally did not increase pods per plant but did significantly increase seed size compared to dryland. The number of seeds per lb was reduced by approximately 20%. Approximately the same number of seeds were produced per acre but it required fewer seeds to produce one pound of yield.

As irrigation increased to 8 inches from 4 inches or dryland, pods per plant increased to generate the increased yield per acre. Adding additional irrigation did not increase pods per plant, seeds per pod or seed size compared to the 8-inch allocation.

Harvest index is the amount of seed produced compared to the total plant biomass production on a dry basis. This is an indication of the efficiency of the plant to produce seed as compared to total biomass. As with yield, the harvest index increased with irrigation up to the 8-inch allocation. Additional irrigation above 8 inches did increase biomass production but did not increase seed production resulting in a slightly lower harvest index. Increased biomass production typically results in greater crop water use or ET. The measured increase in ET for full irrigation compared to the 8-inch allocation was slightly greater than 3 inches of water use. This shows the potential savings in irrigation for cowpea with limited irrigation.

Overall, dryland cowpea did produce 968 lbs per acre. This has the potential to either replace fallow or become another crop within the rotation for dryland producers. For irrigated producers, the potential of this crop for water savings with either limited water supplies or low capacity wells could prove beneficial in a cropping system to spread limited water. Overall, 14.5 inches of ET maximized yield of cowpea. An estimate of ET for a dry bean crop such as pinto is 19.5 inches, according to CoAgMet calculations. This is an approximate 5-inch savings of water overall in the system.

Conclusion:

Cowpea appear to be a viable alternative crop for dryland and limited irrigation. Economics appear favorable in a dryland or limited irrigation cropping practice. Cowpea did show that it appears to not increase yield with additional ET. Addition of a broadleaf crop into the system can increase the herbicide options available for weed control. Harvest is early enough to also integrate wheat within the cropping system.

Table 1. Yield components, yield, and ET of cowpea under 4 irrigation management strategies.

Water Treatment	Pods/Plant	Seed/Pod	Seed Size (seed/lb)	Yield (lbs/ac)	Harvest Index (yield/biomass)	ET (inches)
Dryland	4.0	4.9	2,185	1,028	0.36	7.8
4 Inches	4.3	5.9	1,753	1,594	0.42	10.5
8 Inches	7.3	5.5	1,941	2,663	0.46	14.5
Full	6.8	5.9	1,935	2,572	0.41	17.8

Figure 1. Yield-ET relationship for cowpea in 2021.

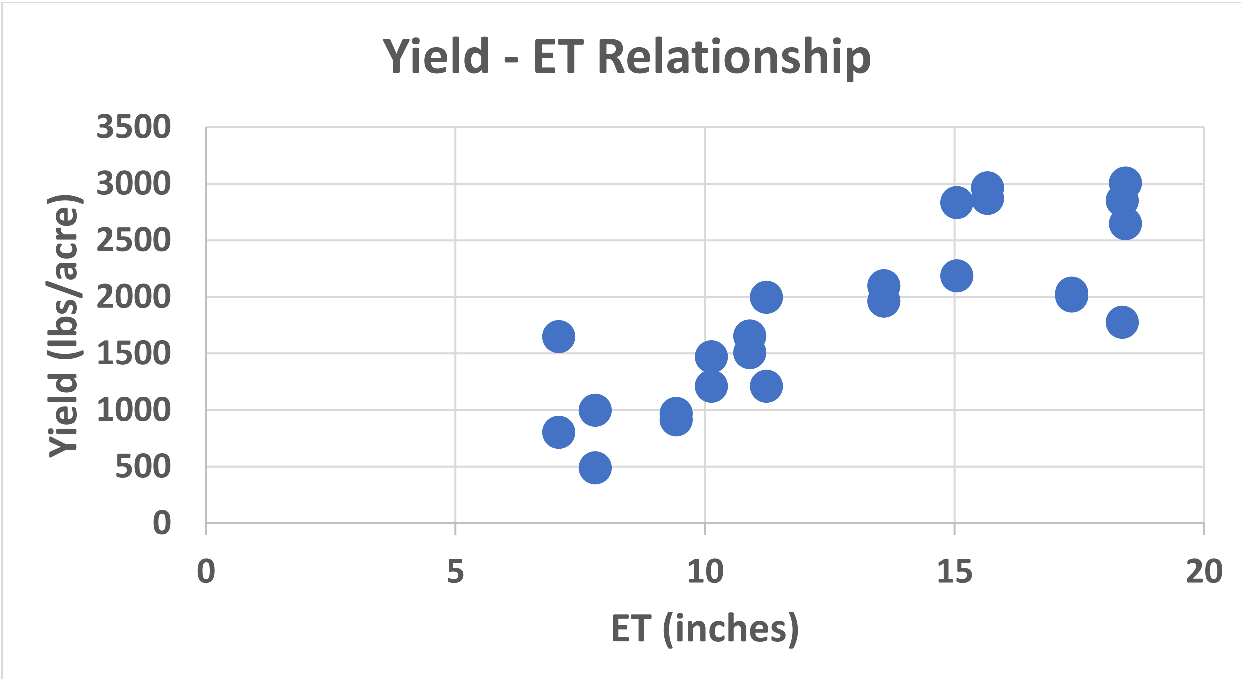
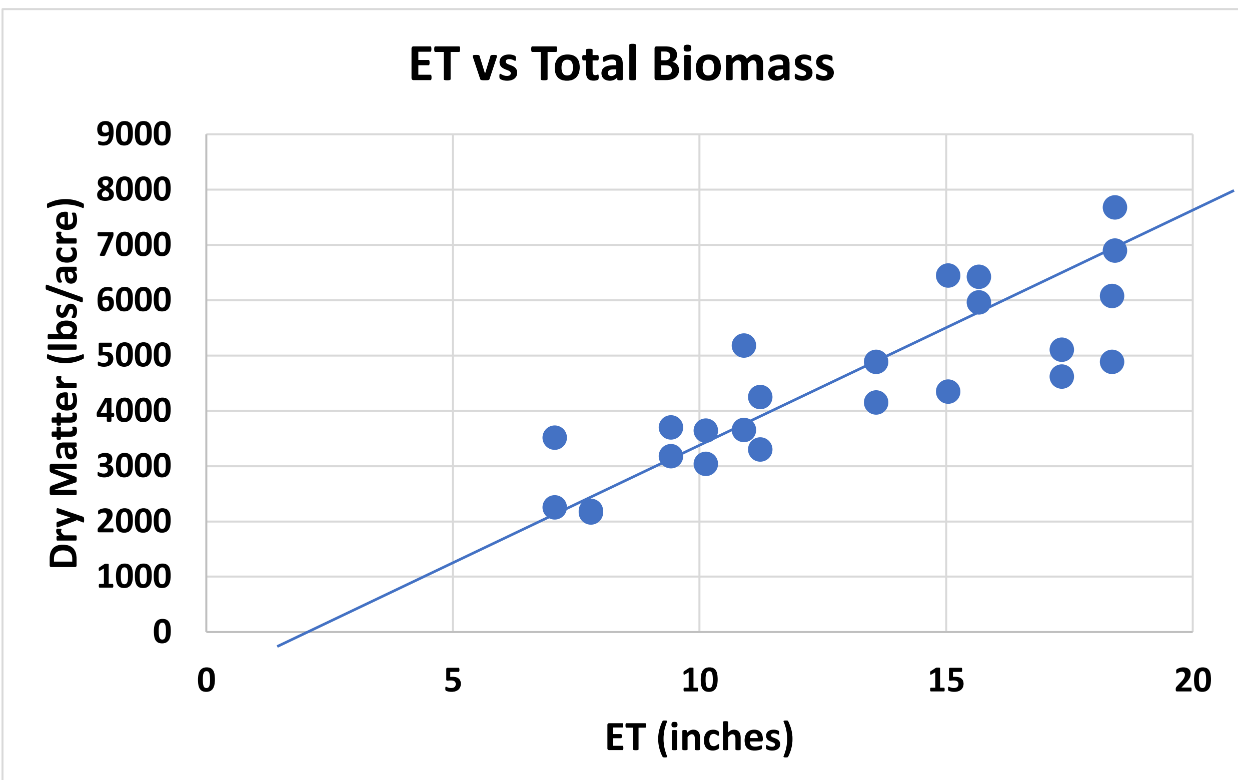


Figure 2. ET-Biomass relationship for cowpea in 2021



Corn Nitrogen x Water Study

Dr. Louise Comas, Dr. Bo Stevens, Josh Wenz, Dr. Huihui Zhang, Dr. Sean Gleason, Dr. David Barnard

USDA-ARS, Water Management & Systems Research Unit, Fort Collins, CO

Stacey Poland, Dr. Maysoon Mikha, Tyler Untiedt

USDA-ARS, Central Great Plains Research Station, Akron, CO

Tyler Donovan, Joel Schneekloth, Dr. Meagan Schipanski

Colorado State University

Dr. Scott Mackay

University of Buffalo, NY

Objectives

To examine yield responses to N and water availability and their potential interactions in a maize cropping system and determine 1) how maize water productivity shifts with different levels of N availability and what plant mechanisms underpin this potential interaction, 2) how N processes in soil contribute to pools of plant available N and potential interactions between water and N, and 3) how soil health and the microbial community is affected by water and N availability.

Background

Recent studies have shown that maize gets less than 50% of its N from fertilizer applied, underscoring the importance of understanding N process in soil for crop management. Additional application of N when water is limited has been found to have both positive and negative effects on crop water productivity, with a variety of physiological mechanisms proposed to explain these effects. The studies that have examining water stress and N interactions have not included soil processes (N mineralization, interactions with soil microbes, etc.) that might contribute to the N pool available to plants in the field and affect the interactions between water and N availability. This experiment will allow us to assess the effects of nitrogen availability on crop productivity under water limitations and the mechanisms involved. Additional modeling of plant and soil responses to these treatments will allow us to explore how varying soil management targets (such as targets affecting soil carbon pools) might affect crop responses under varying N and water levels via effects on N mineralization rates, and linkages between the soil microbial community and its functioning in N processes.

Approach

Examine maize responses to a range of N (6 levels) and water (2 levels) availabilities and 3 replicates (36 plots) to analyze plant responses and potential interacting effects on these responses in a factorial experimental design under a linear move sprinkler with compounding treatment effects over the years of the experiment (treatments remain on the same plots in subsequent years). Crop water use is assessed from weekly neutron probe readings for soil moisture. Soil sampling and *in situ* incubations are taken every two weeks through the field season for plant-available soil N and mineralization. The soil microbial community is sequenced at multiple points through the season. Plant sampling is used to assess plant N accumulation through the season. Intensive plant measurements are taken over a one-week period prior to VT/R1 to assess plant functioning (such as cell membrane stability, osmotic potential, gas exchange). Unmanned aerial vehicle (UAV) images and ground-based reflectance are taken periodically to assess plant growth responses to N and water treatments.

Precision Nitrogen Application on Corn

Tyler Untiedt, Dave Poss, Dr. Kyle Mankin
USDA-ARS, Central Great Plains Research Station, Akron, CO

Why Use Split/Variable Rate N Application?

Cost of nitrogen (N) fertilizer has increased dramatically. Methods that increase N use efficiency and decrease N fertilizer application would reduce input costs and increase farmer profitability. In addition, yield potential can vary considerably within a field and from year to year, particularly in dryland cropping systems. Since crop N use is driven by crop yield, any method to increase N use efficiency and decrease N fertilizer application must consider the spatial and temporal variability in yield potential.

What is Precision Nitrogen Application?

Precision N application adjusts the rate of N fertilizer application within the field based on yield potential. In this study, we are evaluating the use of crop spectral reflectance data to assess the condition of the crop and determine the N rate that the crop needs to meet its yield potential.

Methods

Corn was planted on May 20, 2022 with four levels of N fertilizer: Non-limiting starter rate (**NL**, 100 lb/acre), Full starter rate (**F**, 70 lb/acre), Medium starter rate (**M**, 40 lb/acre), and Low starter rate (**L**, 20 lb/acre). The Non-limiting treatment (**NL**) was intended to achieve "full-potential" crop yield (no N deficiency). The Full treatment (**F**) applied all N at planting based on a typical application rate. Medium (**M**) and Low (**L**) rates were split-application treatments: two different N levels were applied at planting, and a second (split) application was planned to be based on early season estimates of yield potential using crop spectral reflectance data.

Crop reflectance data (RGB [visible light] and modified RGB [modified to include near-infrared]) were collected using a Phantom 4 Pro unmanned aerial vehicle (UAV) at 10-day intervals after emergence (up to about V12 on August 2). These UAV images were used to calculate two indices: NDVI (using red and near-infrared bands) and GNDVI (using green and near-infrared bands). NDVI is often used to measure crop stress and GNDVI is often used to measure crop chlorophyll activity.

Study Objectives

We are assessing both NDVI and GNDVI to determine which might be more appropriate to predict the N fertilizer required to meet crop yield potential, when we should collect these data to provide the best estimate of yield potential, and what data spatial resolution is suitable.

Preliminary Results

Images taken early in the season (up to about V9, July 13) did not capture treatment differences with either NDVI (Figure 2) or GNDVI (Figure 3). The Non-limiting starter rate treatment (**NL**) consistently had a higher NDVI, GNDVI, or hand-held GreenSeeker (data not shown), but there were no discernible differences for the other three treatments (**F, M, L**; Table 1). We think this might be related to the general dry early-season conditions that may have limited N mobilization and uptake and thus led to minimal differences in crop response to different N fertilizer rates.

The latest image that we collected (about V12, August 2) showed treatment differences using GNDVI (Figure 6), where higher-N treatments had higher GNDVI (**NL** > **F** > **M** = **L**; Table 1). NDVI (Figure 5) still had no discernible differences among treatments. The observed N treatment differences may have been a crop response facilitated by 0.76-inch (July 25) and 1.3-inch (July 28) rainfalls the prior week.

Table 1. NDVI and GNDVI for each treatment from UAV data collected on 7/13 and 8/2/2022.

Treatment	NDVI (7/13)	GNDVI (7/13)	NDVI (8/2)	GNDVI (8/2)
Non-Limiting (NL)	0.232	0.076	0.388	0.177
Full Starter (F)	0.235	0.076	0.319	0.165
Medium/Split (M)	0.234	0.078	0.302	0.159
Low/Split (L)	0.234	0.075	0.316	0.159

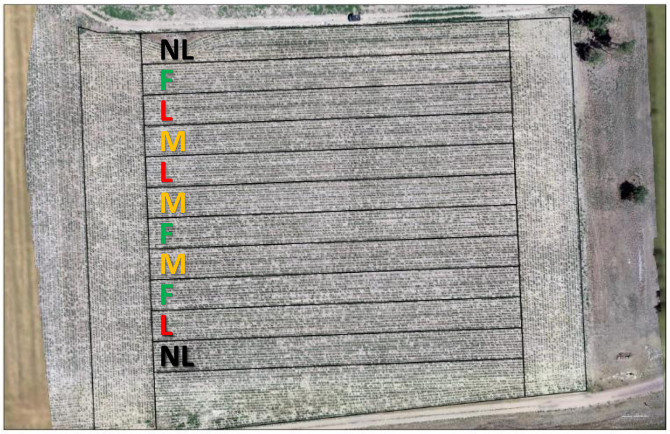


Figure 1. **RGB** (visible), 07/13/22, Variable Rate N Study, 1-cm pixels.

Feet 0 25 50 100

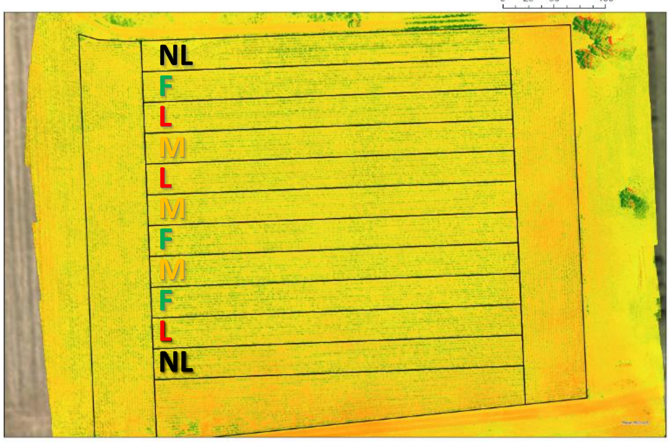


Figure 2. **NDVI** [range: 0-0.5], 07/13/22, Variable Rate N Study, 1-cm pixels. [Red=Low, Yellow=Medium, Green=High]

Feet 0 25 50 100

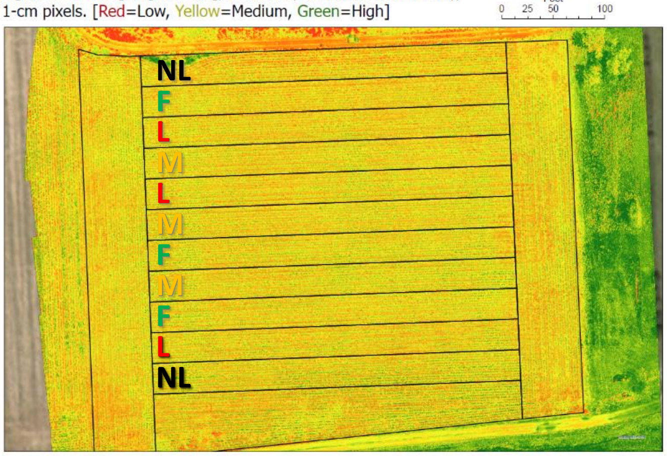


Figure 3. **GNDVI** [range: 0-0.5], 07/13/22, Variable Rate N Study, 1-cm pixels. [Red=Low, Yellow=Medium, Green=High]

Feet 0 25 50 100

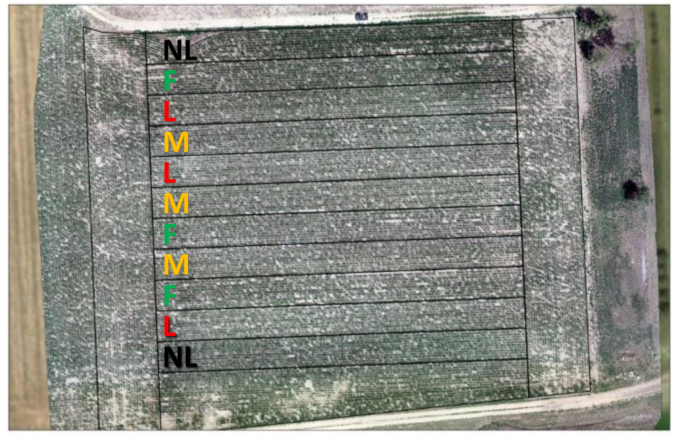


Figure 4. **RGB** (visible), 08/02/22, Variable Rate N Study, 1-cm pixels.

Feet 0 25 50 100

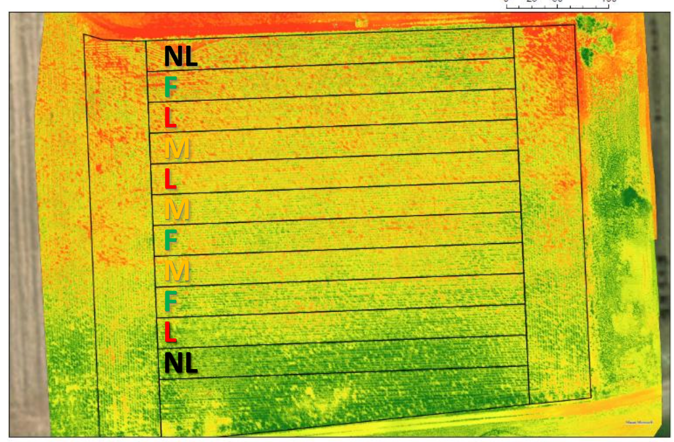


Figure 5. **NDVI** [range: 0-0.82], 08/02/22, Variable Rate N Study, 1-cm pixels. [Red=Low, Yellow=Medium, Green=High]

Feet 0 25 50 100

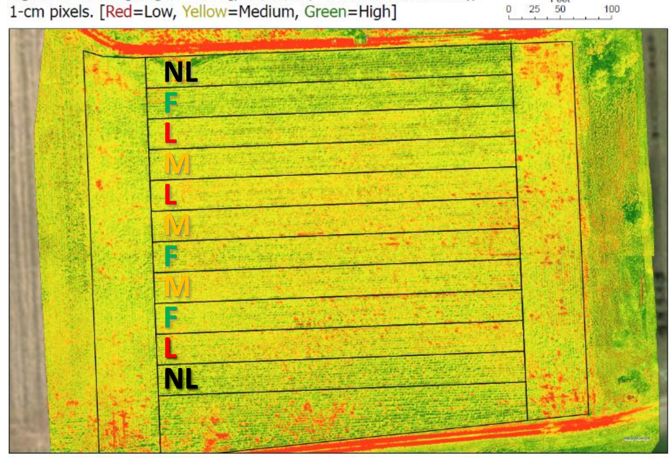


Figure 6. **GNDVI** [range: 0-0.82], 08/02/22, Variable Rate N Study, 1-cm pixels. [Red=Low, Yellow=Medium, Green=High]

Feet 0 25 50 100

Rye: Alternative crop to wheat or a perpetual weed?

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Problem:

For the past twelve years Wheat Stem Sawfly (WSSF) has been a pest causing economic losses in isolated areas in wheat in Northeastern Colorado, mostly in Weld County. However, the past five years isolated areas in Washington County have experienced losses to this pest with the problem growing to larger and larger areas each year. The 2022 winter wheat crop was devastated by the WSSF in most of Northeastern Colorado. An economic impact study by Colorado Association of Wheat Growers and Colorado State University found that the economic losses due to the WSSF are approximately $33 million annually.

Wheat breeders have focused on breeding a more solid wheat stem, hindering the WSSF from laying its eggs in the stem. One cultural practice which some producers are seeking is trying alternative crops. Rye is a small grain that could be an alternative crop to wheat. However, open pollinated cereal rye, which was planted decades ago, still lingers in some fields in the area as a weed. Producers have spent decades controlling volunteer rye by hand pulling, rotation, and more recently, with chemicals. This negative experience with this rye makes many producers reluctant to try this crop. However, according to rye plant breeders, the rye being planted more recently are hybrid ryes which volunteers no worse than the wheat varieties we plant.

Approach:

In summer 2021 it was decided to establish a study to evaluate the claim that hybrid rye does not volunteer any more than wheat. This study includes three rotations, two which are common in the area including Wheat-Corn-Millet-Fallow and Wheat-Corn-Fallow. During the ‘wheat’ phase the plots were split in half with half the plot being planted to wheat and other half being planted to rye. Then when that plot is in the ‘wheat’ phase again, wheat will be planted where rye was originally planted and rye planted where wheat was originally planted. This study went into an old study which consisted of eight plots per replication. After the above-mentioned rotations this left us with one plot. We decided to put a continuous rotation in this plot with half the plot being planted to rye, and half the plot being planted to wheat. Then the next year we would switch what is planted on each half. So, it would essentially be a Wheat-Rye rotation. A CoAXium® wheat variety will be planted in this rotation to control volunteer rye.

Results:

Since this study was just established one year ago, we have no data to demonstrate if the hybrid rye lines volunteer any differently than wheat. In summer 2023, we will have data on the amount of volunteer in the wheat-rye rotation. It will require another two or three years for this data on the other rotations.

Wheat Stem Sawfly had a significant negative impact on wheat in the area. This was true for this study as well. Plots which were split with half planted to rye and half planted to wheat had dramatic differences in lodging due to WSSF. Between differences in lodging and/or the natural tendency for the hybrid rye to yield more, rye grain yields were double the wheat yields. Why did the WSSF leave the rye alone? We don’t know the answer to this. However, stem diameters were measured using a caliper and the stem diameter of the rye was more than 50% greater than the wheat. We did not have an accurate method of measuring the interior diameter of the stem, but visually the interior diameter of the rye was more than 50% greater than the wheat (Figure 1).

Figure 1. Three wheat and three rye stems, demonstrating differences in stem diameter.

Putting the volunteer rye issue aside for a moment, let's evaluate how well rye could replace wheat in Northeastern Colorado. Hybrid rye yields have been impressive thus far. We have had a variety trial which has included rye for four years including 2017, 2018, 2019, and 2021. The first three years of the trial we did not have any wheat varieties in the trial as a comparison. While not ideal we were able to get wheat yields from a neighboring study. Starting in 2021 we have included a wheat variety in the trial. The rye yields in 2021 were 30% greater than the wheat yields in the trial (Figure 2). The yield differences were even more dramatic the previous years at 71%, 77%, and 78% greater than wheat (in nearby study) in 2017, 2018, 2019, respectively.