Carrington REC Crop Research Update: **Selected Production Management Studies**

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EXTENDING KNOWLEDGE ›› CHANGING LIVES

NDSU | EXTENSION

Presentation content

1. Winter rye as a cover crop preceding soybean
2. Tolerance of broadleaf crops to preplant, low-rate dicamba for early season weed control
3. Corn response to P and Zn
4. Prior-year P for soybean
5. Durum intensive management
6. 2023 research and demo plans

Winter rye cover crop planting dates and rates preceding soybean

(Carrington; 2019-**2023**)

- What is the recommended rye plant density as a preplant cover crop for soybean based on fall planting dates (two: mid and late fall) and rates (three: 25, 50, and 75 lb/A) to achieve farmer goals?
  - Ground cover and weed suppression
  - Soybean performance

Seeding date and rate impact on winter rye stand and ground cover, Carrington, 2019-22 (4-year average)

Rye planting treatment		Rye[1]		
	Rate	Plant density		Ground cover
Date	lb/A	plt/A	plt/ft^2	%
First: Oct 2, 2018 Sept 26, 2019 Sept 17, 2020 Sept 22, 2021	25	172,370	4	21
	50	364,780	8	21
	75	**598,270**	**14**	**27**
Second: Oct 31, 2018 Nov 1, 2019 Oct 8, 2020 Oct 8, 2021	25	137,790	3	9
	50	372,950	9	17
	75	569,390	13	18

[1]Rye plant density measured and ground cover visually evaluated in May prior to planting soybean.

Foxtail suppression in soybean among winter rye planting dates and rates, Carrington, 2020-22[1] (3-year average)

Rye planting treatment		**Rye**		**Weed suppression** (prior to POST herbicide app)
	Rate	Plant density (first-half May)		Foxtail
Date	lb/A	plt/A	plt/ft^2	%
Sept 26, 2019 Sept 17, 2020 Sept 22, 2021	25	185,240	4	66
	50	377,720	9	63
	75	**592,800**	**14**	**73**
Nov 1, 2019 Oct 8, 2020 Oct 8, 2021	25	170,460	4	51
	50	441,290	10	53
	75	681,750	16	56

[1]Rye (tillering to boot stages) terminated with glyphosate near soybean planting date ('green-planted').

Winter rye cover crop planting date and rate impact on soybean, Carrington, 2019-22 (4-year average)

- Soybean plant development (emergence, flower and maturity) and canopy closure generally were similar among treatments

Rye planting treatment[1]		Soybean	
	Rate	Plant density	Seed yield
Date	lb/A	plt/A	bu/A
First: Oct 2, 2018 Sept 26, 2019 Sept 17, 2020 Sept 22, 2021	25	**153,300**	**51.9**
	50	**159,200**	**50.9**
	75	**151,400**	**52.1**
Last: Oct 31, 2018 Nov 1, 2019 Oct 8, 2020 Oct 8, 2021	25	**164,200**	**53.0**
	50	**164,700**	**52.3**
	75	**163,900**	**51.4**

[1]Timing of rye termination with glyphosate: 1 week before to 2 days after soybean planting.

Summary

- **Winter rye cover crop planting dates and rates**

  (Preliminary)

  - **Ground cover**
    - First date at 75 lb/A (>0.5 million plants/A or ≥12 plants/ft^2)
  - **Weed suppression** (73-83%)
    - First date with 75 lb/A for foxtail (>0.5 million plants/A); 50-75 lb/A for kochia (>0.75 million plants/A or ≥18 plants/ft^2)
  - **Soybean plant development and seed yield**
    - Similar among treatments

Summary of weed control with winter rye as preplant cover crop in soybean and pinto bean, Carrington REC, 2018-22

Weed	Control (%)[1]		Number of research trials
	Average	Range[2]	
Foxtail	**70**	**0-99**	**10**
Horseweed	31	22-40	1
Kochia	47	0-89	2
Common lambsquarters	72	66-97	1
Redroot and prostrate pigweed	69	54-81	1
Wild buckwheat	79	64-94	1

[1]Visual evaluation at soybean or pinto bean planting to one month after planting.
[2]Among all trial treatments with rye.


Broadleaf Crop
Tolerance to
Preplant
Dicamba

Tolerance of broadleaf crops to preplant (PP) low-rate **dicamba** for early season weed control

- Limited number of PP burndown herbicides available for conservation-till dry bean and sunflower that control early season broadleaf weeds at low cost.
- Dicamba
  - G-E: wild buckwheat, nightshade, ragweed, biennial wormwood and lambsquarters; F-E: horseweed; F-G: pigweed species (kochia?)

  - ➢ waiting periods between dicamba application and planting plus annual rainfall restrictions generally restrict use, due to *potential* crop injury

Objective and Description of Research Study, 2021-22

- **Primary objective**
  - **Build a ND crop response database that provides a reference for farmers and crop advisers considering use of this strategy.**

- **Locations**
  - **Carrington** (irrigated site) **and North Central (Minot) RECs, and Prosper**
- **Crops**
  - Soybean (non Xtend)**, pinto bean and sunflower**.
- **Treatments**
  - **untreated crop checks**
  - **PP dicamba** (Clarity or generic) **applied at <u>4 fl oz product/A</u>**
    - **planting date <1 wk after dic app and no rain;**
    - **planting date >2 wk after dic app plus rainfall (irrigation) <u>≥</u>1”**

Pinto bean injury (June 14, 2021; Carrington): Dic app May 13; 'ND Palomino' planted May 19

SUMMARY: Tolerance of broadleaf crops to PP low-rate dicamba, ND, 2021-22

- **Pinto bean** generally moderate to high plant injury and stand reduction with first planting dates; *low to moderate injury and minimal stand reduction with second planting dates. Seed yield maintained* with second planting dates but loss likely with no rain and prompt planting after dicamba.

- **Sunflower** had *no to moderate plant injury and stand reduction with first planting dates; no to low with second planting dates. Seed yield not impacted by dicamba.*

Carrington REC Research Overview:

Corn response to preplant incorporated, starter and post-applied fertilizer

NORTH DAKOTA CORN COUNCIL

Center Points (April 10, 2023)

Center Points is a weekly newsletter produced by the Carrington Research Extension Center.

Update on Carrington REC Corn Fertilizer Research: Phosphorus and Zinc

NDSU recommends starter phosphorus (P) fertilizer for corn, regardless of P soil level. Corn is expected to respond to zinc (Zn) fertilizer if soils levels are below 1 ppm. The Carrington Research Extension Center began a corn field study in 2007 to document response to starter P fertilizer, primarily using 10-34-0 with various application methods and rates on loam soil generally testing medium or less for P. In 2016, the research focus transitioned to tests with Zn and specialty fertilizers.

SUMMARY: Corn grain yield response with starter P fertilizer (10-34-0), Carrington REC

- Corn grain yield was similar with band- or IF-applied 10-34-0 (2.5-6 gpa), and starter fertilizer increased yield 4-5%, compared with the untreated check (8 site-years).
- Yield was similar between the 3- and 6-gpa rates of IF-applied 10-34-0 (6 site-years).
- Yield did not improve with a split application of 10-34-0 using band plus IF placement, compared with similar rates of only band- or IF-applied fertilizer (3 site-years).
- Deep-band (5 to 6 inches deep, fall or spring placed) or deep-band plus IF-applied 10-34-0 had similar yield as the planting-time band-applied fertilizer (3 site-years).
- Yield was similar between IF-applied 10-34-0 and the low-salt fertilizer 6-24-6 at similar P rates (3 site-years).
- Yield was similar between IF- and soil-surface-applied 10-34-0 (rain totaling ≥0.3 inches for incorporation of surface-applied fertilizer was delayed ≥5 days after application among years; 4 site-years).

A1851 (Revised April 2022)

Corn Response to Phosphorus Starter Fertilizer

in North Dakota

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Mike Ostlie, Carrington Research Extension Center Director and Research Agronomist

The acres of corn planted in North Dakota for grain increased from about 1 million in 2000 to more than 4 million in 2021, and averaging 2.4 million per year since 2000. Field trials in North Dakota continue to evaluate starter fertilizer recommendations derived from other north-central U.S. land-grant universities.

NDSU recommends phosphorus (P) starter fertilizer be placed within 2 inches of the seed in-furrow (also called "pop-up") or banded near the seed at planting time (Franzen, 2017). The P starter fertilizer provides the potential to increase early season plant growth by increasing nutrient uptake, and ultimately increase grain yield and test weight.

This publication summarizes results of NDSU P-based starter fertilizer trials conducted in east-central North Dakota that evaluated corn grain yield response, primarily with liquid ammonium phosphate (10-34-0) applied using different methods and rates.

Materials and Methods

Location and years: NDSU Carrington Research Extension Center; 2007-21.

Soil: Heimdal-Emrick and Fram-Wyard loams; 2.6% to 3.8% organic matter; 5.9 to 8.2 pH (primarily 7.5 or greater); 3 to 20 parts per million (ppm) P (Olsen test; most sites in the low to medium range at 8 ppm or less).

Standard treatments: 10-34-0 applied in a 2x0" band (2 inches horizontally placed from planted seed) with a single-disk coulter or in-furrow with seed (Photo 2). P application rates were based on NDSU corn fertilizer recommendation tables (Franzen, 2017).

Photo 2. Planter set for in-furrow fertilizer placement. (Greg Endres, NDSU)

Experimental design: Randomized complete block with four replications.

General: The dryland trials were conducted using strip- or conventional-tillage systems. Responses did not appear to relate to the tillage system used. Corn row spacing was 22 or 30 inches. The starter fertilizer treatments included ammonium-N in the formulation, which has been shown to increase plant P

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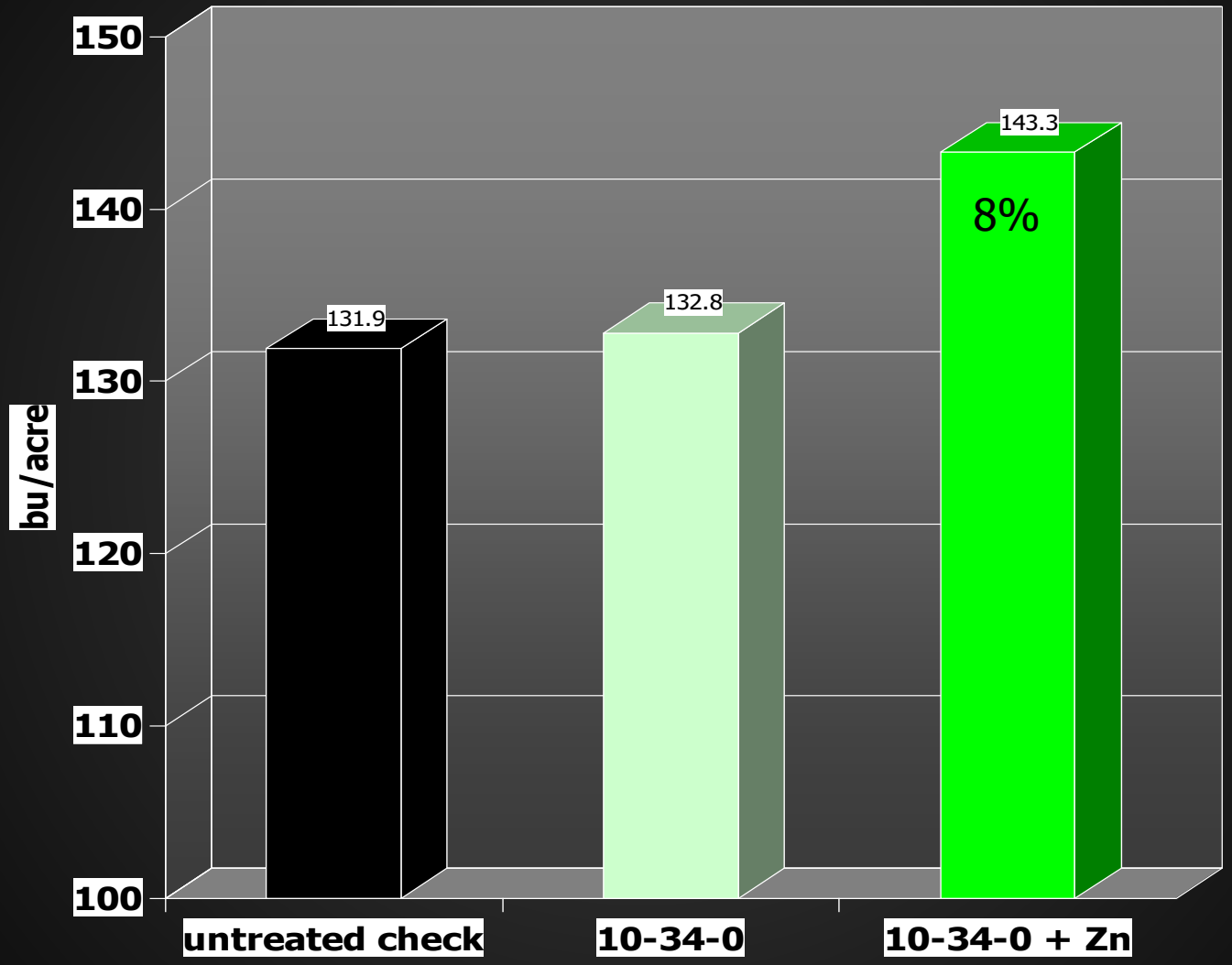
North Dakota State University, Fargo, North Dakota

Corn P and **Zinc** Fertilizer Application Study, Carrington REC, 2017-22

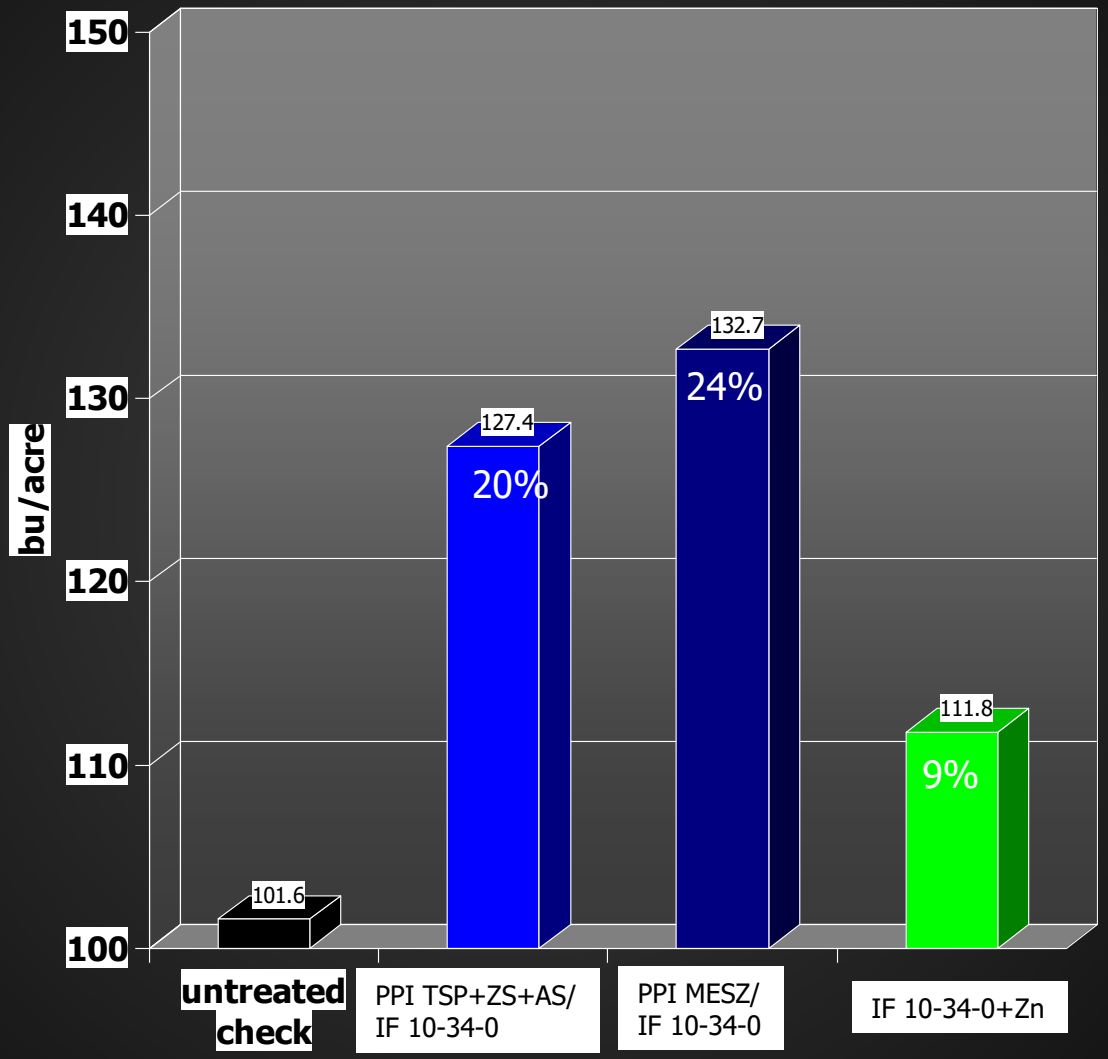
- Fertilizer treatments (include in-furrow [IF] 10-34-0)
  - Preplant incorporated (PPI) 80 lb P + 20 lb S + 2 lb Zn/acre
    - triple super phosphate = 0-46-0 plus ammonium sulfate = 20-0-0-24 plus zinc sulfate = 35.5% Zn + 17.5% S
    - MESZ (Microessentials SZ) = 12-40-0 10S 1Zn
  - IF and foliar Zn
    - Ammend (CHS) = 8% N + 9% chelated EDTA zinc

Corn grain yield with IF 10-34-0 and 10-34-0 plus Zn, Carrington, 2016-18 and 2020-22 (6-year average)*



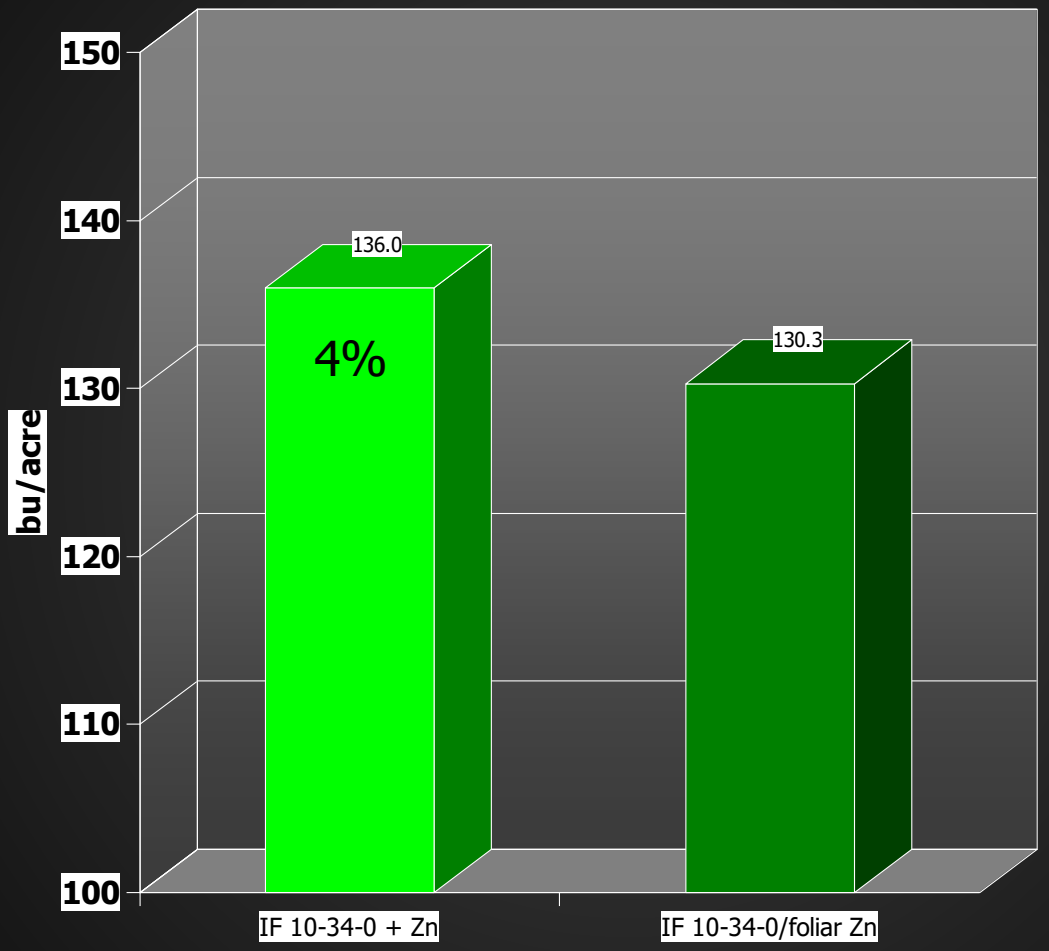
*Soil: P=2-8 ppm (very low-med); Zn=0.26-0.65 ppm (low). 10-34-0 at 2.75-3 gpa; Zn at 0.25 gpa.

Corn grain yield with PPI vs. IF P and Zn, Carrington, 2020-22 (3-year average)*



*Soil: P=2-8 ppm (very low-med); Zn=0.26-0.65 ppm (low). 10-34-0 at 2.75-3 gpa; Zn at 0.25 gpa; TSP+AS+ZS at 174+83+5.6 lb/A; MESZ at 200 lb/A.

Corn grain yield between IF and foliar Zn, Carrington, 2017-18 and 2020-22 (5-year average)*



*Soil: P=2-8 ppm (very low-med); Zn=0.26-0.65 ppm (low). 10-34-0 at 2.75; Zn at 0.25 gpa, foliar app at V4-7.

Web search:
"NDSU soybean fertility"

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In the central U.S. Corn Belt, P fertilizer commonly is applied to corn only in a corn-soybean rotation. This practice tends to provide good benefits to soybean and corn because the soil P levels are most often in the "high" range. In North Dakota, the P test is much lower, so P should be applied to soybean in a separate application. Fertilizing each crop is important until the field P test reaches the high availability range.

N, P, K, S and Fe.

Nitrogen

Nodulation

Although the atmosphere is 78% nitrogen (N) gas, plants cannot use it directly. Plants can use only ammonium-

Nitrogen-fixing bacteria are attracted to soybean roots by chemical signals from the soybean root in the form of flavenoid compounds (1). Once in contact with the root hairs, a root compound binds the bacteria to the root hair cell wall. The bacteria releases a chemical that causes curling and cracking of the root hair, allowing the bacteria to

Soybean response to prior-year application of phosporus

(Carrington, 2021-**23**; Minot, 2022)

- Evaluate soybean yield response to prior-year broadcast application of P (for corn and soybean) compared to P application each year
  a) Study
     - Initial P soil analysis
       - **Carrington: 2-7 ppm (very low to low);** Minot: 8 ppm (medium)
     - P fertilizer (0-46-0) applied at NDSU Extension recs
  b) Potential benefits
     - Eliminate fertilizer application and incorporation costs during year of soybean production

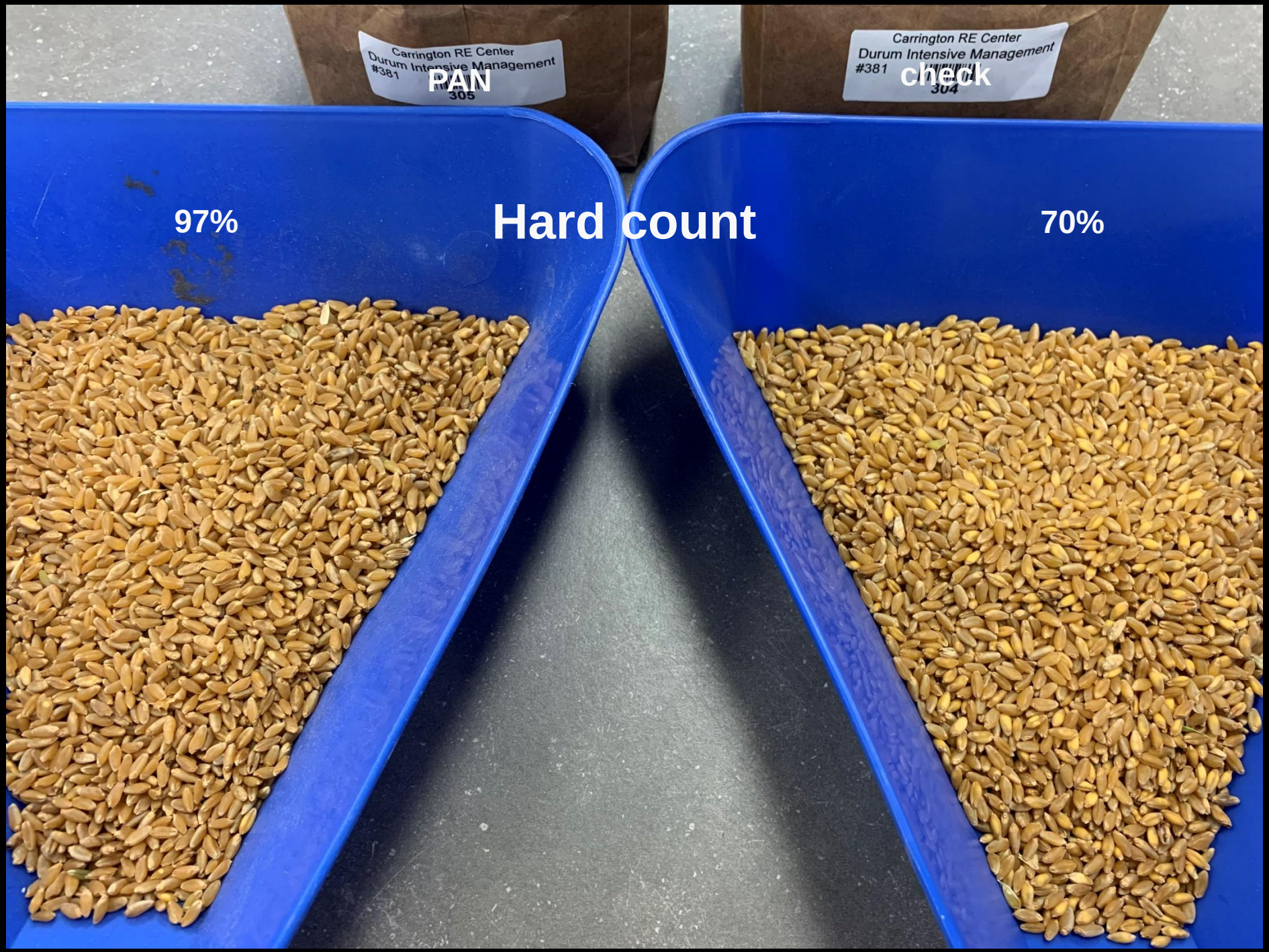
Treatments:
1) Untreated check; 2) P corn/P soy; and 3) P corn+soy (year 1)

Soybean yield (Carrington 2-yr ave; low P-testing [4-7 ppm] soil):
Check=34.8; P corn/P soy=36.2; P corn+soy=37.5 bu/A (LSD 0.10: NS)

Durum intensive management study, CREC, 2021-23

NORTH DAKOTA WHEAT COMMISSION
Building Bigger Better Markets

- Objective: Optimize seed yield and quality (vitreous kernel %) as influenced by application **timing of N**, sequential application of foliar fungicide, and seeding rates


Carrington RE Center
Durum Intensive Management
#381
305
PAN
Carrington RE Center
Durum Intensive Management
#381
304
check
97%
Hard count
70%

Durum intensive management, Carrington REC, 2022

Materials and methods:

- Irrigated 'ND Riveland'
  - May 19; 1.4 million plants/A (June 9)
- N
  1. 140 lb/A preplant soil N (trial)
  2. **30 lb/A tillering** (3-4 leaf stage)
  3. **30 lb/A post anthesis** (foliar)
- Fungicide
  1. Early anthesis (Miravis Ace)
  2. **E. anthesis <u>plus</u> 5-7 days** (Prosaro)

Durum intensive management, Carrington REC, 2022

Table. Durum wheat response to post N and foliar fungicides, Carrington, 2022.

Treatment		Plant		Seed					
		Lodge	Physiological maturity						
		17-Aug		Yield	TW	250 kwt	Count	Protein	Vitreous[2]
Input	Plant stage	0-9	Day of year[1]	bu/A	lb/bu	g	no./lb	%	
	untreated check	2	227	97.5	64.6	11.8	9,650	11.5	82
	tillering	4	229	106.0	64.2	11.8	9,645	12.2	87
N	post flower	3	229	96.8	64.2	11.6	9,805	13.3	95
CV (%)		56	0.5	5.4	0.4	1.6	2	3.7	4.7
LSD (0.05)		NS	2	6.6	0.3	NS	NS	0.6	5

Summary

- Preliminary data
  - No response to fungicides due to absence of disease
  - Seed yield increase with **N at tillering**
  - Seed protein increase with **N at** tillering or **post-anthesis**
  - Hard count increase with **N at** tillering or **post-anthesis**
- Study will continue at both locations in 2023

CROP PRODUCTION RESEARCH AND DEMONSTRATION PROJECTS, 2023				
Greg Endres, Extension Cropping Systems Specialist				6-Apr
RESEARCH				
	Trial no.	Title	Cooperators	Sponsor
Crop protection				
1	312	Vios FX foxtail control in wheat	x	
2	311	Huskie FX kochia control in wheat	x	Bayer
Agronomy				
1	342	Corn response to preplant and starter PZn fertilizer	x	ND Corn Utilization Council
2	343	*Pinto bean ground roll X herbicides	J. Ikley	Northarvest
3	307	Rye seeding rates and dates for soybean	x	Soybean Council
4	341	Soybean response to prior P app in corn	x	Soybean Council
5	430&431	*Soybean P rates	Szilvia/L. Malone et al.	Soybean Council
6	381	Durum Intensive Management	L. Bortolon	Wheat Commission
DEMONSTRATIONS AND SURVEYS				
1	x	Weed Arboretum	x	
2	320	Herbicide Site-of-action demonstration	x	
3	x	IPM Crop Field survey	R.Jones/J. Knodel et al.	
4	x	Sunflower survey	?	
*New projects				

Comments or questions?

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