2020 Eastern Crop and Pest Management School

Dry Bean Production Issues

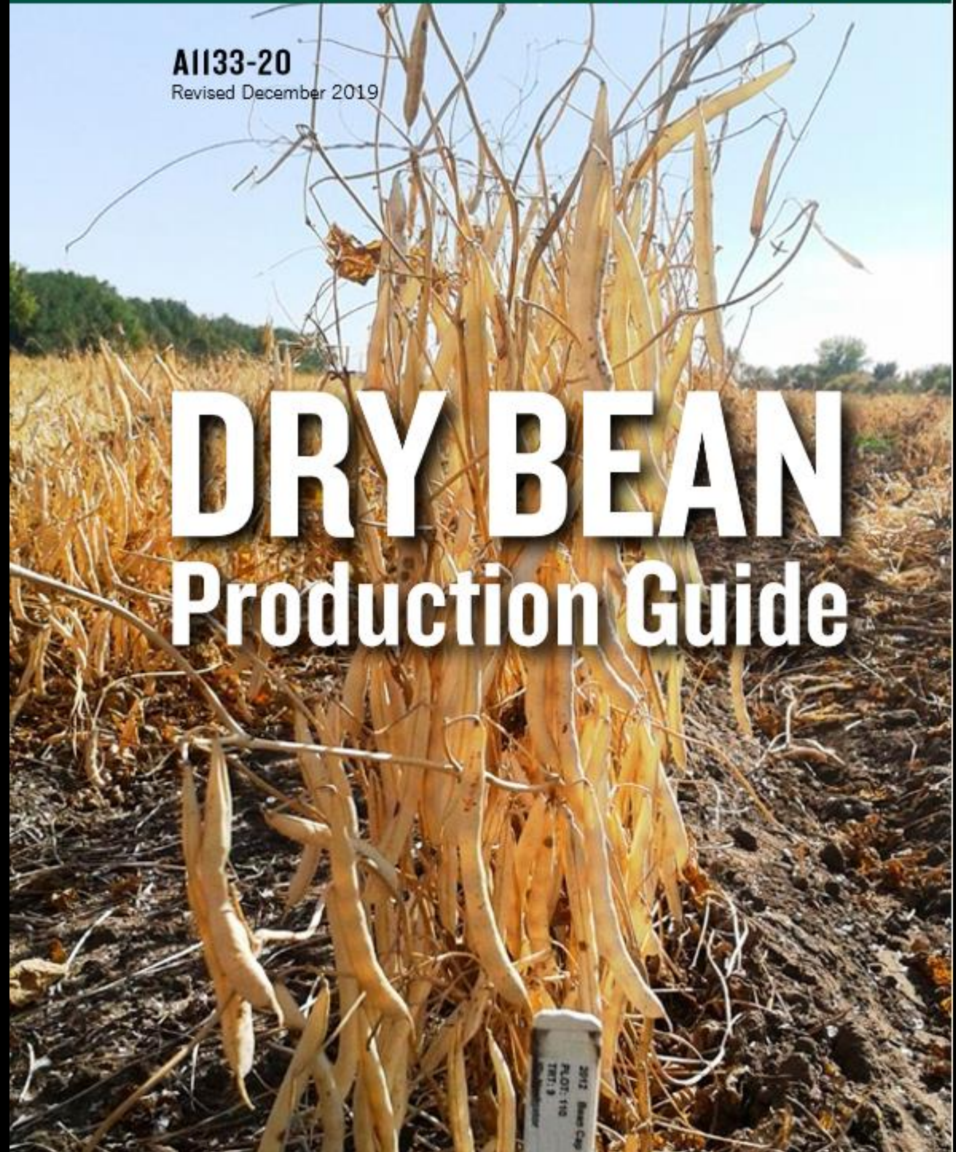
Greg Endres, Extension agronomist
gregory.endres@ndsu.edu; 701-652-2951

NDSU Carrington Research Extension Center

EXTENDING KNOWLEDGE ❯❯ CHANGING LIVES

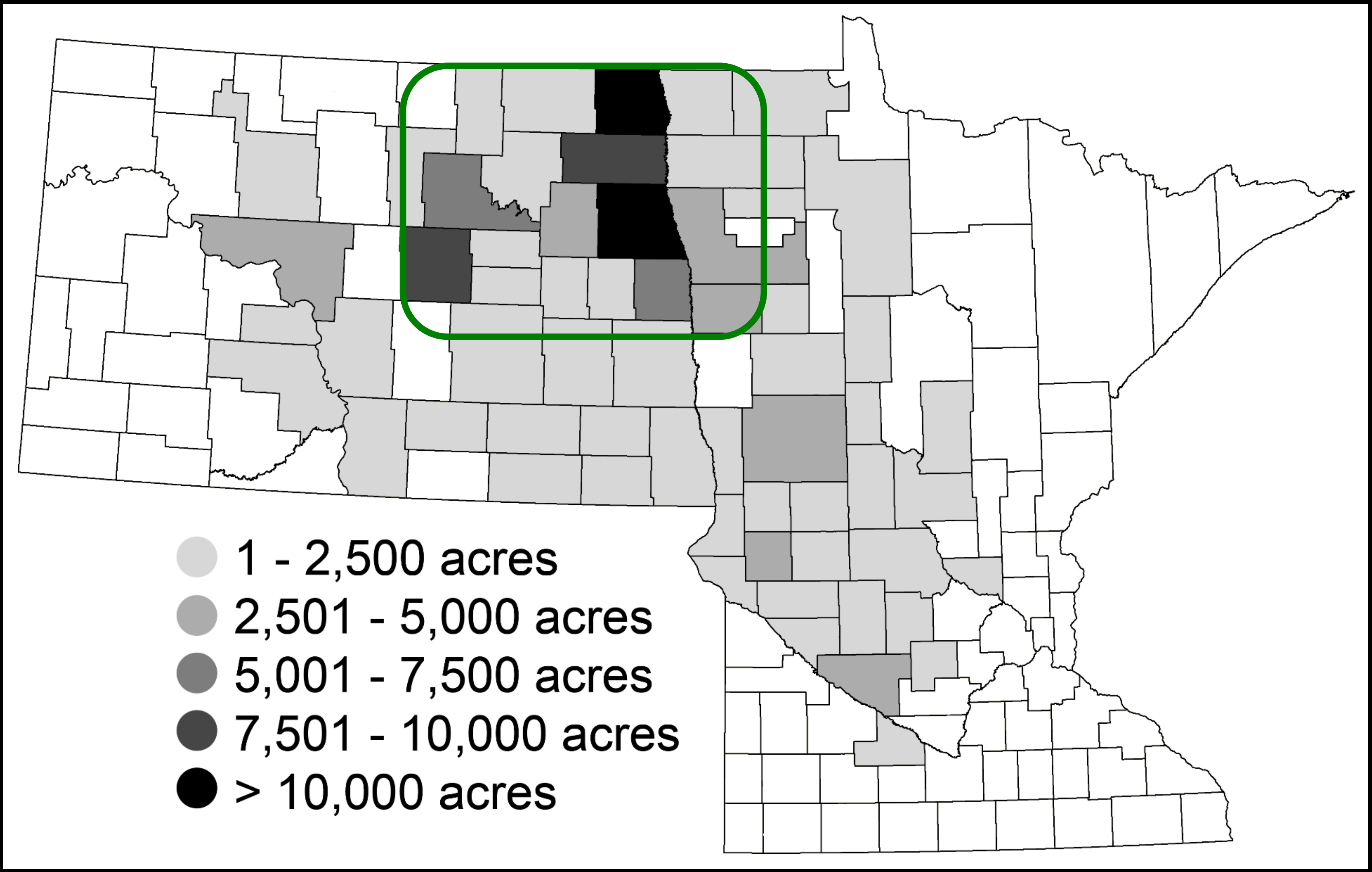
A1133-20
Revised December 2019

DRY BEAN Production Guide



NDSU | EXTENSION

Northarvest Dry Bean Production by County, North Dakota and Minnesota, 2018



Worst production problem reported by Northarvest bean growers, 2014-19

(Dry Bean Grower Survey, NDSU Extension and Northarvest Dry Bean Growers Association)

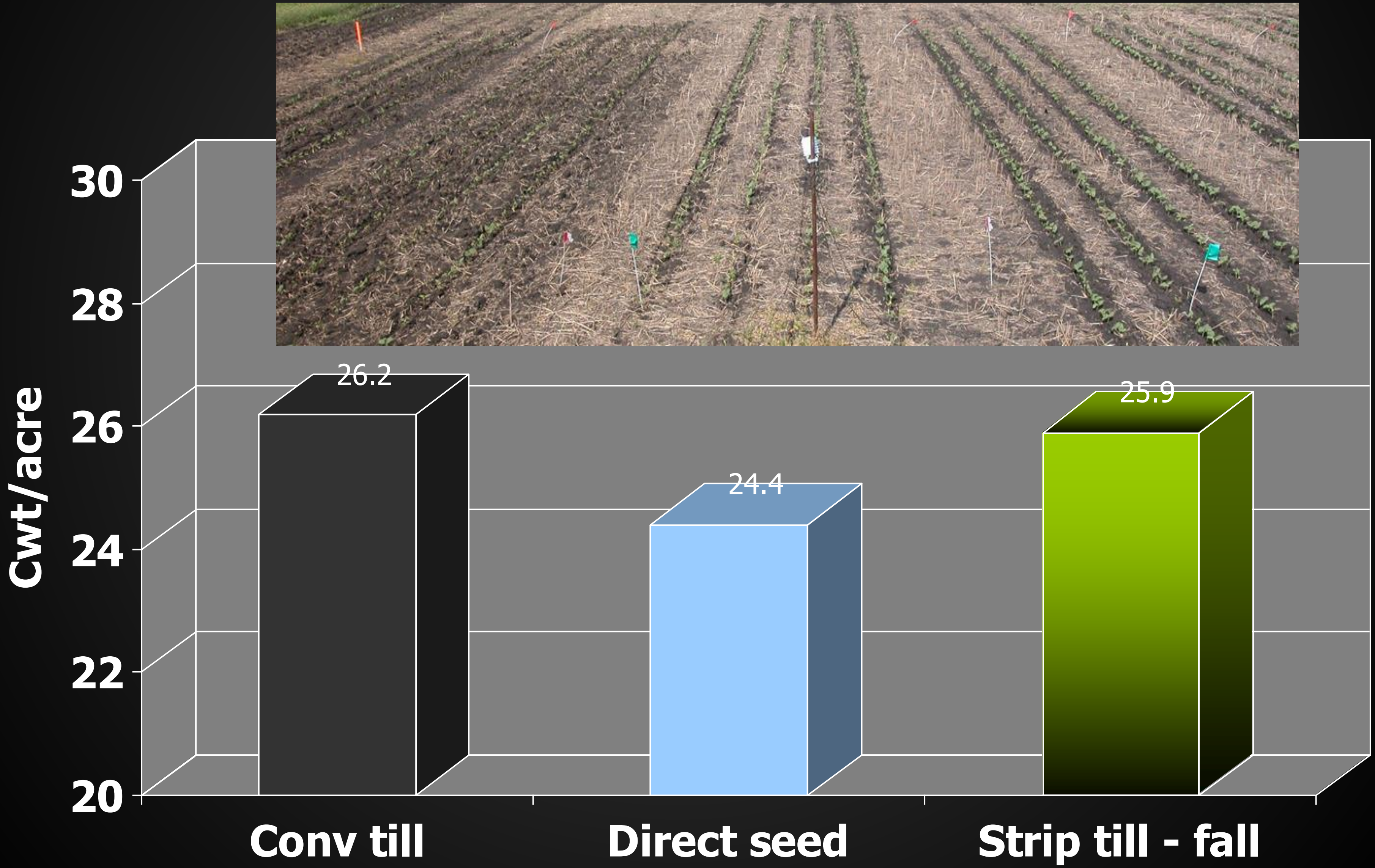
<table>
<tr><th rowspan="2">Rank</th><th colspan="6">Factors</th></tr>
<tr><th>2014</th><th>2015</th><th>2016</th><th>2017</th><th>2018</th><th>2019</th></tr>
<tr><td>1</td><td colspan="2">excess water</td><td>hail</td><td colspan="2">drought</td><td>excess water</td></tr>
<tr><td>2</td><td colspan="2">disease</td><td>weeds</td><td colspan="2">none</td><td>drought</td></tr>
<tr><td>3</td><td>delayed planting</td><td>drought</td><td>water damage (harvest)</td><td>hail</td><td>disease</td><td>harvest</td></tr>
<tr><td>4</td><td colspan="2">weeds</td><td>harvest</td><td>disease</td><td>harvest</td><td>hail</td></tr>
<tr><td>5</td><td>emerge /stand</td><td>hail</td><td>disease</td><td>weeds</td><td>hail</td><td>disease</td></tr>
<tr><td>6</td><td>hail</td><td>emerge/ stand</td><td>wind</td><td>water damage</td><td>weeds</td><td>delayed planting</td></tr>
<tr><td>7</td><td>drought</td><td>wind</td><td>water damage (beans not harvested)</td><td>emerge/stand</td><td>water damage</td><td>snow</td></tr>
</table>

Dry bean **tillage system** reported by Northarvest growers, 2019

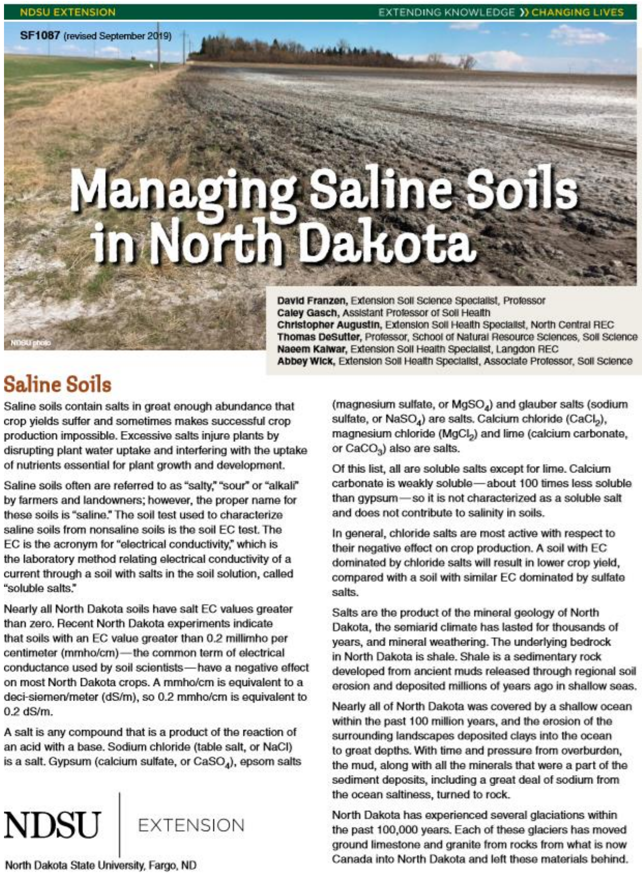
(Dry Bean Grower Survey, NDSU Extension Service and Northarvest Dry Bean Growers Association)

Tillage system	Acres (%)
Conventional	75
Minimum	16
Strip-till	1
No-till	8

Pinto bean yield among tillage systems, Carrington, 2007 and 2009-12 (5 site-yr)



Soybean tolerance to salt-affected soils



NDSU EXTENSION EXTENDING KNOWLEDGE » CHANGING LIVES

SF1087 (revised September 2019)

Managing Saline Soils in North Dakota

NDSU photo

David Franzen, Extension Soil Science Specialist, Professor
Caley Gasch, Assistant Professor of Soil Health
Christopher Augustin, Extension Soil Health Specialist, North Central REC
Thomas DeSutter, Professor, School of Natural Resource Sciences, Soil Science
Naeem Kalwar, Extension Soil Health Specialist, Langdon REC
Abbey Wick, Extension Soil Health Specialist, Associate Professor, Soil Science

Saline Soils

Saline soils contain salts in great enough abundance that crop yields suffer and sometimes makes successful crop production impossible. Excessive salts injure plants by disrupting plant water uptake and interfering with the uptake of nutrients essential for plant growth and development.

Saline soils often are referred to as "salty," "sour" or "alkali" by farmers and landowners; however, the proper name for these soils is "saline." The soil test used to characterize saline soils from nonsaline soils is the soil EC test. The EC is the acronym for "electrical conductivity," which is the laboratory method relating electrical conductivity of a current through a soil with salts in the soil solution, called "soluble salts."

Nearly all North Dakota soils have salt EC values greater than zero. Recent North Dakota experiments indicate that soils with an EC value greater than 0.2 millimho per centimeter (mmho/cm)—the common term of electrical conductance used by soil scientists—have a negative effect on most North Dakota crops. A mmho/cm is equivalent to a deci-siemen/meter (dS/m), so 0.2 mmho/cm is equivalent to 0.2 dS/m.

A salt is any compound that is a product of the reaction of an acid with a base. Sodium chloride (table salt, or NaCl) is a salt. Gypsum (calcium sulfate, or $CaSO_4$), epsom salts (magnesium sulfate, or $MgSO_4$) and glauber salts (sodium sulfate, or $NaSO_4$) are salts. Calcium chloride ($CaCl_2$), magnesium chloride ($MgCl_2$) and lime (calcium carbonate, or $CaCO_3$) also are salts.

Of this list, all are soluble salts except for lime. Calcium carbonate is weakly soluble—about 100 times less soluble than gypsum—so it is not characterized as a soluble salt and does not contribute to salinity in soils.

In general, chloride salts are most active with respect to their negative effect on crop production. A soil with EC dominated by chloride salts will result in lower crop yield, compared with a soil with similar EC dominated by sulfate salts.

Salts are the product of the mineral geology of North Dakota, the semiarid climate has lasted for thousands of years, and mineral weathering. The underlying bedrock in North Dakota is shale. Shale is a sedimentary rock developed from ancient muds released through regional soil erosion and deposited millions of years ago in shallow seas.

Nearly all of North Dakota was covered by a shallow ocean within the past 100 million years, and the erosion of the surrounding landscapes deposited clays into the ocean to great depths. With time and pressure from overburden, the mud, along with all the minerals that were a part of the sediment deposits, including a great deal of sodium from the ocean saltiness, turned to rock.

North Dakota has experienced several glaciations within the past 100,000 years. Each of these glaciers has moved ground limestone and granite from rocks from what is now Canada into North Dakota and left these materials behind.

NDSU EXTENSION

North Dakota State University, Fargo, ND

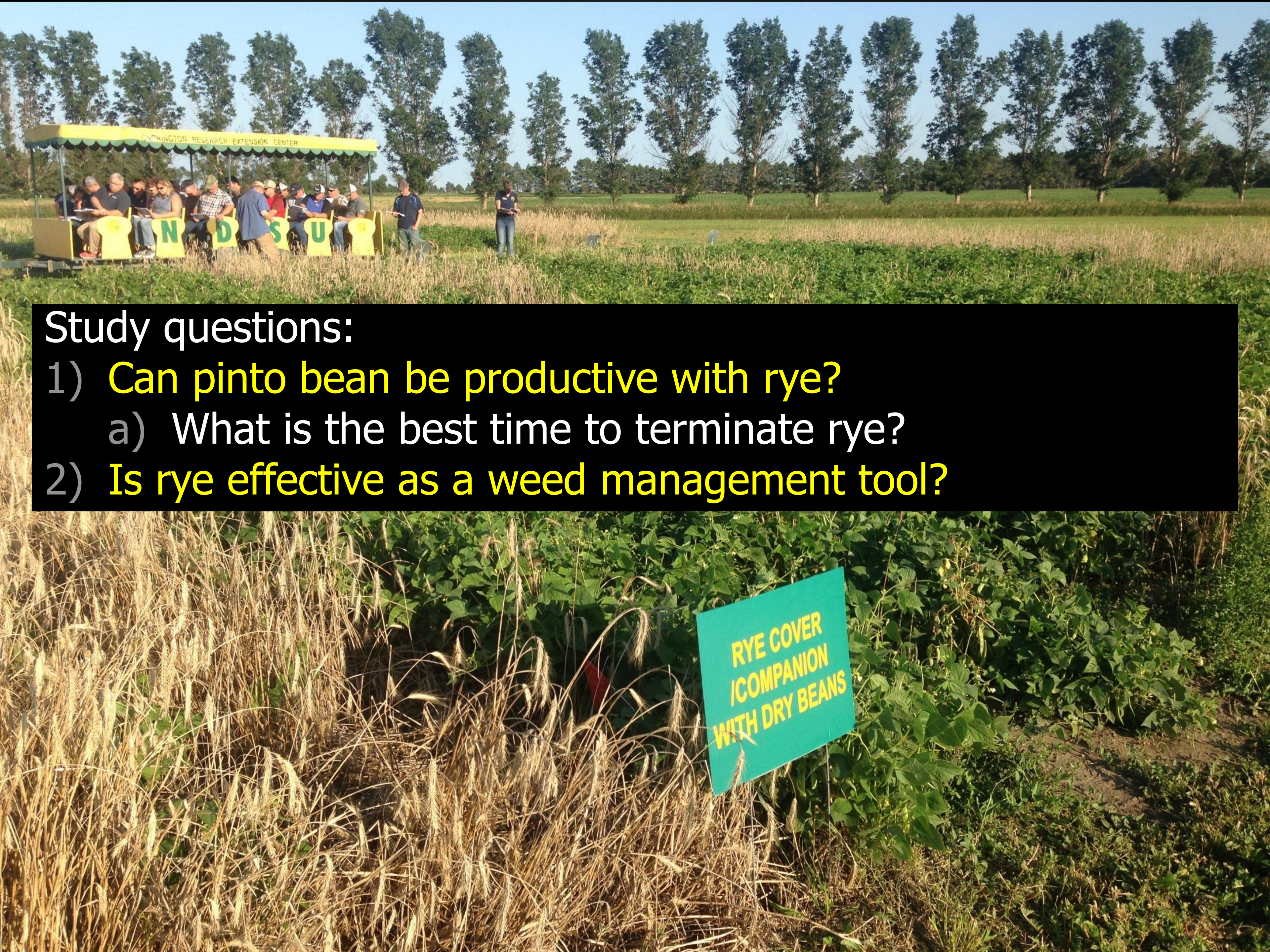
Table 1. Approximate threshold salinity values for field crops and percent reduction in yield due to salinity.

Crop	Threshold salinity 1:1 EC, mmhos/cm	% Yield reduction due to salts 10	25	50	100
		mmhos/cm necessary to reduce relative yield			
Alfalfa	1	1.6	2.5	4.2	7.9
Barley	2	3	4.5	6	12
Canola	1.5	2	3	4	7.5
Chickpea	0.75	1	1.6	2.3	4
Corn	1	2	3	4	5.5
Dry bean	0.5	0.8	1.3	1.7	3
Faba bean	0.75	1	1.75	2.5	4.5
Field pea	0.3	1	1.8	3.75	7
Flax	0.5	0.6	1	1.5	3
Lentil	0.6	0.75	1.25	1.5	3
Oats	2.3	3	4	6	8
Rye	3.8	5.4	6.3	7.2	10
Safflower	3.5	4.5	6.5	8	14
Soybean	0.6	1	1.75	2.3	4
Sugarbeet	3	4	6	8	12
Sunflower	0.75	1	2.2	5	10
Wheat	1	2	3.5	5.5	11

2019 Dry bean grower survey (Northarvest region): Cover crop use

- 23% respondents used cover crops on dry bean fields
  - ✓Reasons for cover crop use
    1. Soil conservation (97%)
    2. Weed control (26%)
    3. Moisture conservation (18%)

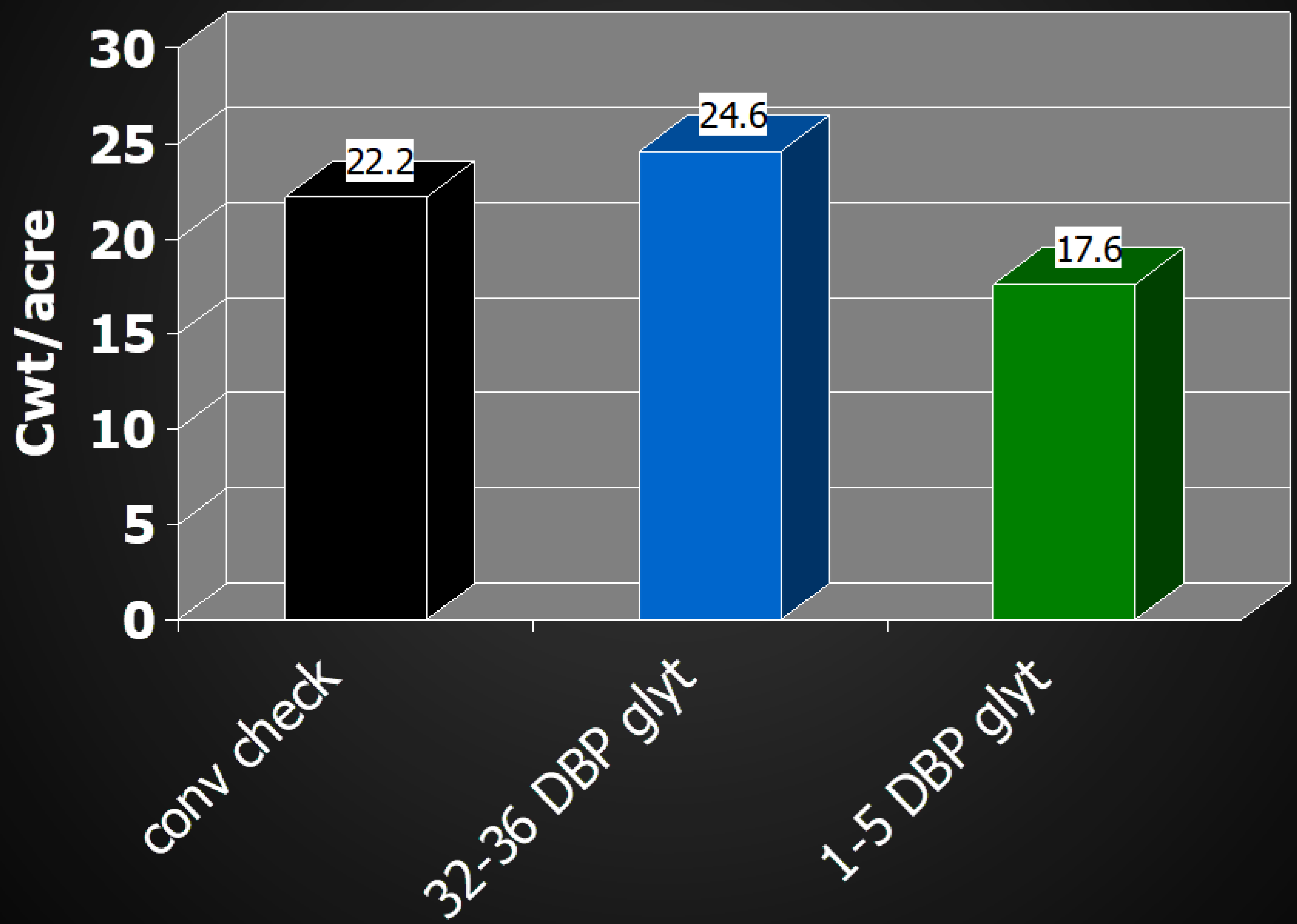
	No.	%
Cereal grass species only	32	82.1
Broadleaf species only	0	0.0
Cereal grass + broadleaf species	7	17.9
Total	**39**	**100.0**
Cereals include spring wheat, winter wheat, rye, barley, oats		
Broadleaf species include peas, turnip, radish, flax and sunflowers		



Study questions:

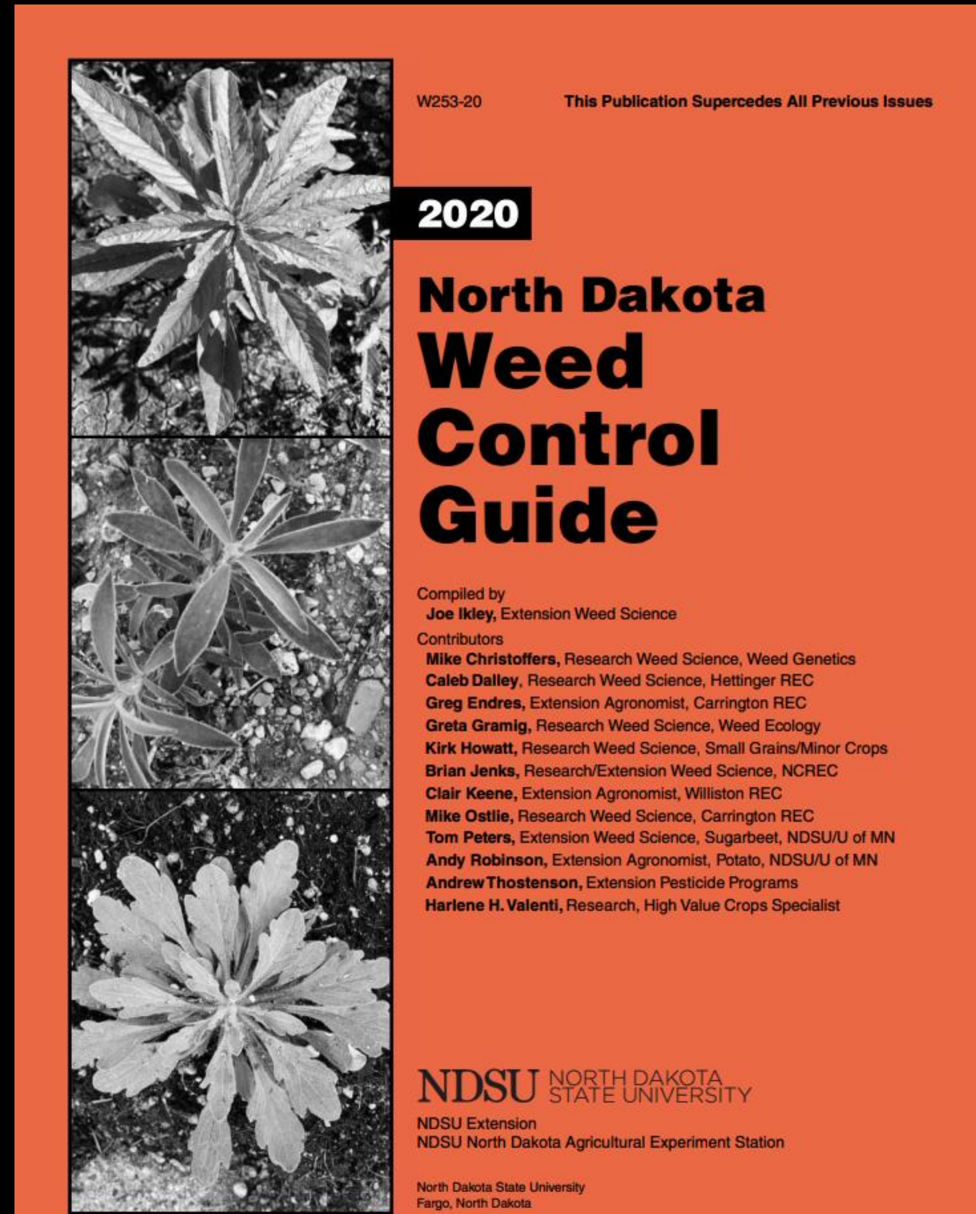
1) Can pinto bean be productive with rye?
    a) What is the best time to terminate rye?
2) Is rye effective as a weed management tool?

Pinto bean yield with conventional check, and early and late spring termination of rye, Carrington, 2017-19 (3 site-years)

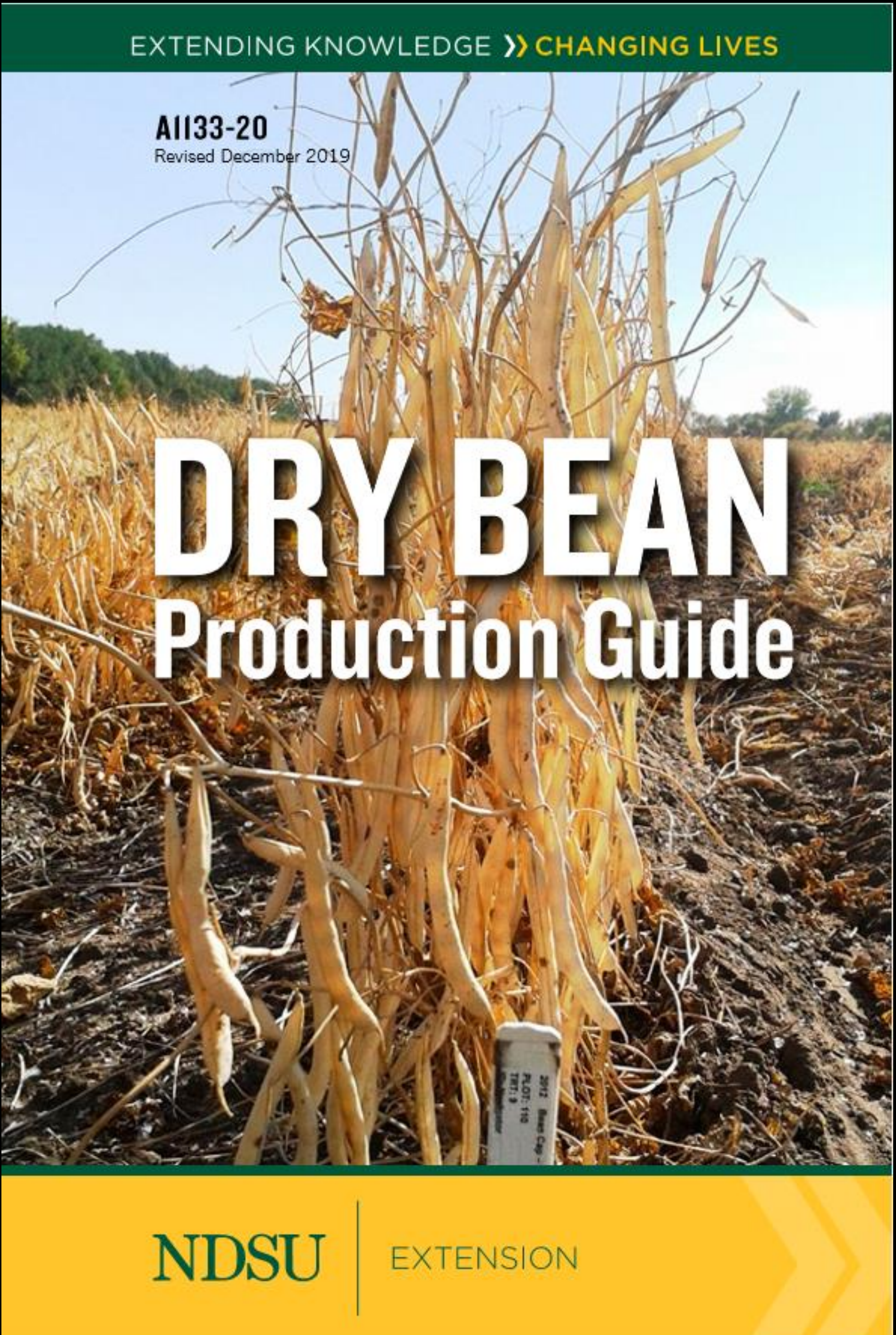


Weed management notes, 2017-19

- Balance live rye period for benefits (including weed suppression) vs negative impact on dry bean (moisture stress)
- Rye density
  - ✓ ‘high’ = increased and extended (after rye termination) weed suppression
- Rye <u>supplement</u> to soil-applied herbicide
  - ✓potentially a substitute
  - ✓timely POST herbicide app
  - ✓watch for tolerant weed species (e.g. legumes [black medic], lanceleaf sage)



Dry edible bean:
pp. 42-43, 48

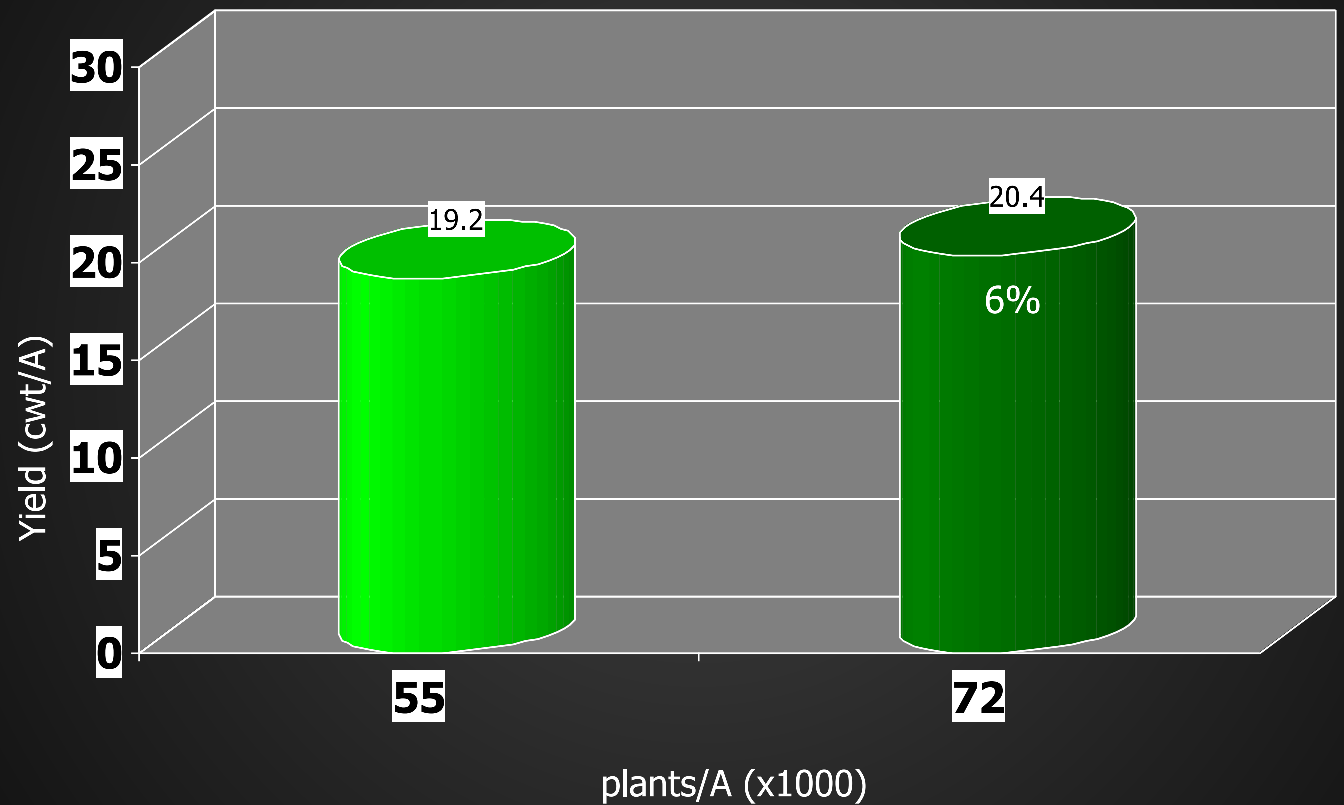


pp. 14-17

Table 7. Recommended plant populations for specialty market classes.

Market class	Plant population (plants per acre)
Black	90,000-120,000
Cranberry	65,000-80,000
Great Northern	70,000-80,000
Kidney	70,000-90,000
Navy	90,000 (wide rows); greater than 115,000 (narrow rows)
Pink	70,000
Pinto	70,000-80,000
Small Red	70,000-90,000

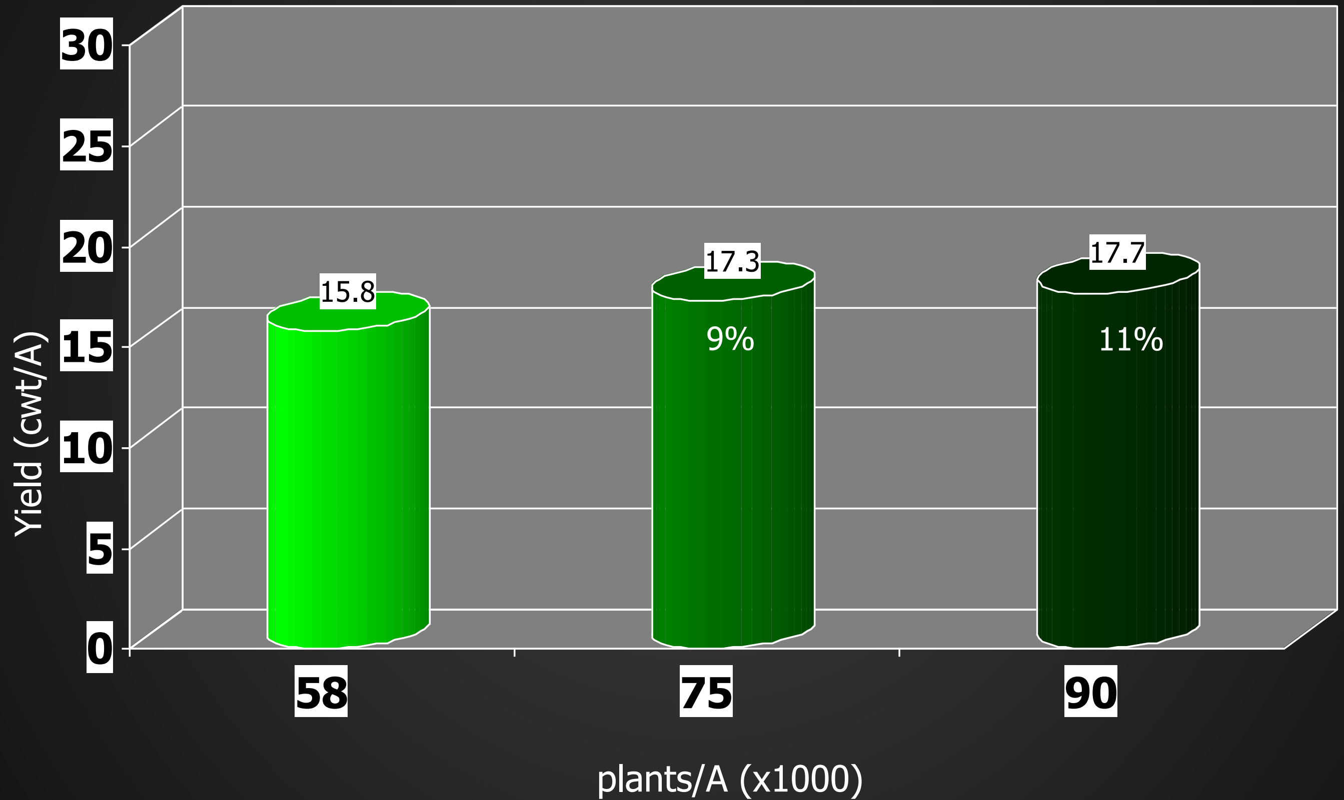
Pinto bean seed yield between **plant populations,** Carrington, 2013 and 2018-19; and Minot, 2019 (4 site-years)*



*2013: 'Lariat'; 2018-19: 'ND Palomino'. Carrington: Averaged across planting dates (2013) and row spacings (2018-19); LSD: 2013 (0.05) = NS; 2018-19 (0.10) = *. Minot: Averaged across row spacings and planting techniques; LSD (0.05): NS.

G. Endres, E. Eriksmoen et al.

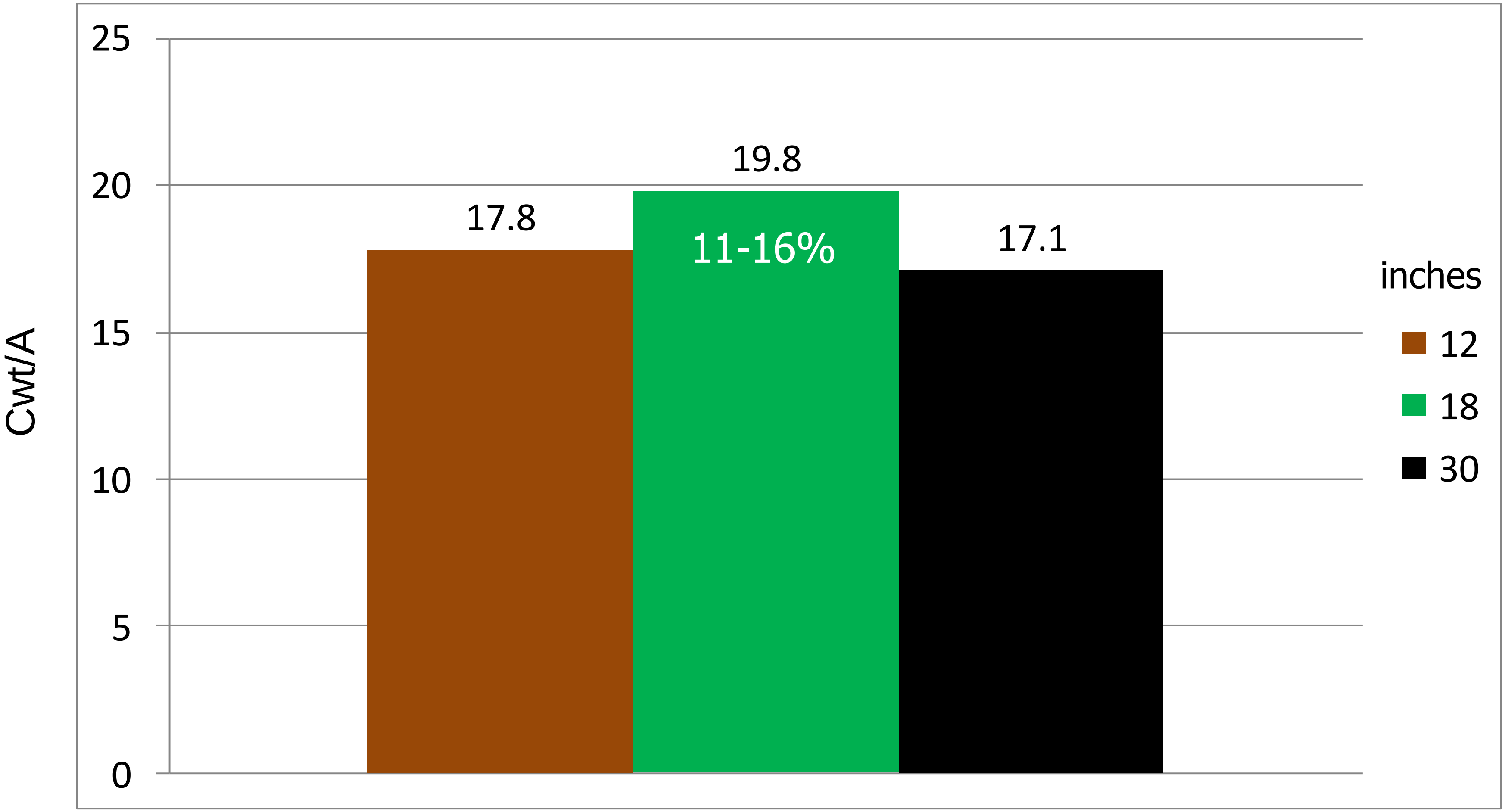
Pinto bean seed yield among **plant populations**, Carrington, 2013 and 2018 (2 site-years)*



*2013: ‘Lariat’; 2018: ‘ND Palomino’. Averaged across planting dates (2013) and row spacings (2018).
LSD: 2013 (0.05) = NS; 2018 (0.10) = *.

G. Endres et al.

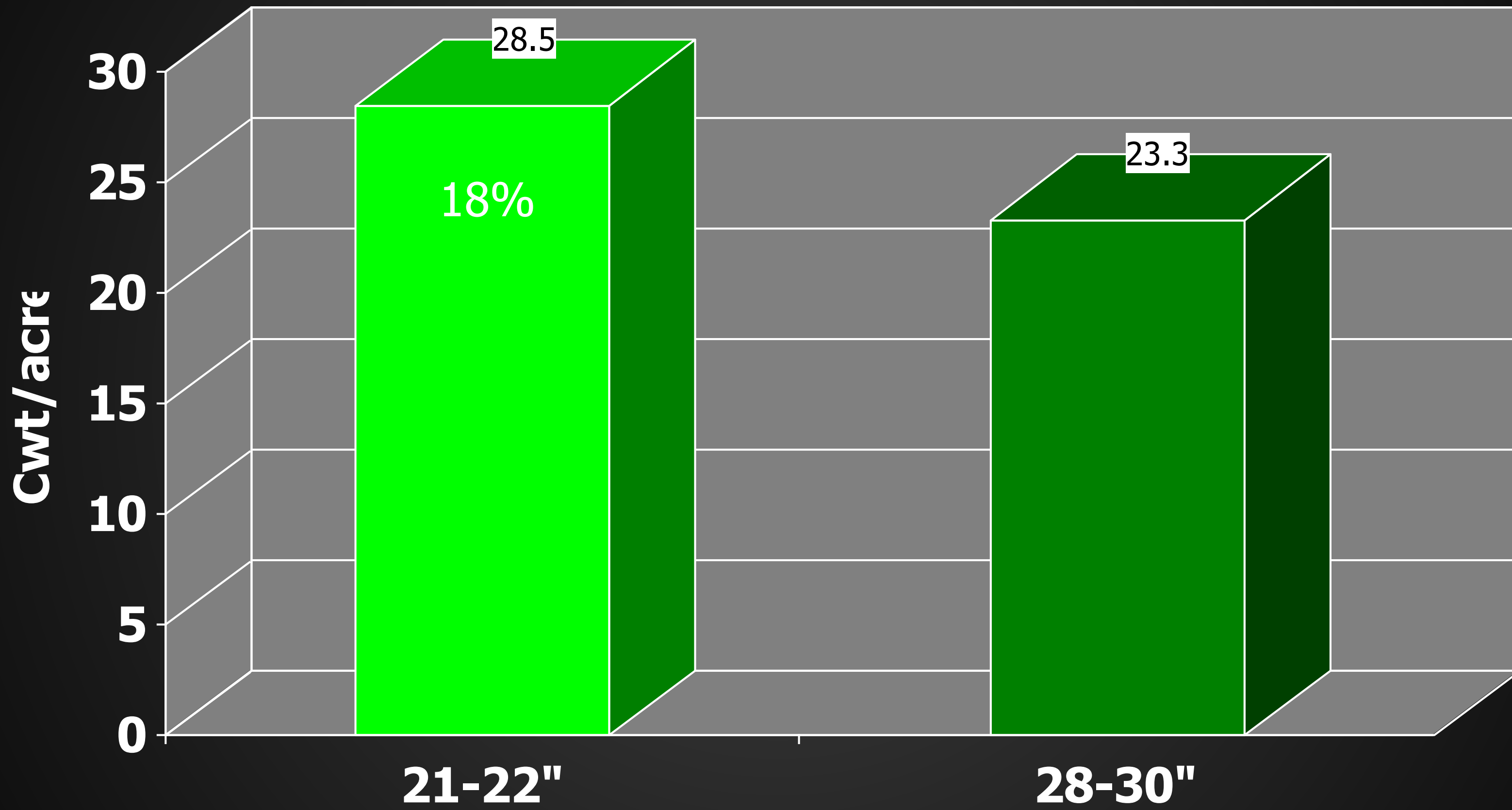
Pinto bean yield response to row spacing, eastern ND, 2008-09 (4 site-years)*



*Carrington, Hatton and Prosper. Means averaged across varieties, N levels and harvest methods.

Kandel, Osorno et al.

Pinto bean seed yield between row spacings, Carrington, 2011-13 and 2018-19 (5 site-years)*



*'Lariat': 2011-13; 'ND Palomino': 2018-19. Averaged across tillage systems and fertilizer treatments (2011-13) and plant populations (2018-19). LSD (0.10): significant each year.

G. Endres et al.

A1921

Black and Navy Bean

Response to Row Spacing and Plant Population in Eastern North Dakota

Gregory Endres, Extension Cropping Systems Specialist, Carrington Research Extension Center
Hans Kandel, Extension Agronomist, Plant Sciences Department, Fargo

Others who contributed to research for this publication:
Mike Ostlie, Research Agronomist, Carrington Research Extension Center
Blaine Schatz, Director and Research Agronomist, Carrington Research Extension Center
Ryan Buetow, Extension Cropping Systems Specialist, Dickinson Research Extension Center

Narrower row spacings and higher plant populations are trending in dry bean production. Data from a 2018 dry bean grower survey (Knodel et al. 2019) indicate 39% of black and 44% of navy bean were planted in North Dakota at rates of 110,000 seeds per acre or greater, with the likely goal of establishing at least 100,000 plants per acre. In addition, the survey results record about 70% of black and navy bean in 2018 were planted in row widths ranging from 11 to 25 inches.

Based on historic North Dakota work, NDSU recommends an established stand of 90,000 plants per acre for black and navy bean. Research conducted in 1999 to 2000 indicated no seed yield response among black and navy bean planting rates of 90,000, 105,000 and 120,000 pure live seeds (PLS) per acre and a yield increase in one of two years with 7- versus 30-inch row spacings (Schatz et al. 2000).

This publication summarizes NDSU research trials conducted 2014 to 2018 in eastern North Dakota to evaluate potential yield increase of black and navy bean with higher plant populations and narrower rows compared to the traditionally recommended plant density in wide rows.

NDSU EXTENSION

North Dakota State University, Fargo, North Dakota
May 2019

Hans Kandel, NDSU

Summary

Black bean seed yield was similar among the three row spacings. The high plant population (slightly more than 140,000 plants per acre) increased yield 3% compared to the low population (slightly less than 100,000 plants per acre).

Narrow (14-inch) rows with navy bean plant populations of greater than 115,000 plants per acre increased yield 24% to 28% compared to wide rows with slightly more than 90,000 plants per acre.

Summary

- Dry bean yield can be maintained with reduced till system while realizing the soil benefits
- Seed yield can be maintained with winter rye as a cover crop before dry bean with proper management while realizing the cover crop benefits
- Seed yield increase with rows and population
  - row spacing: navy = 12-15 (14)”; pinto = 18-22”
  - population: navy (and black) = $\geq$ 115,000 plt/A; pinto = $\geq$ 70,000 plt/A