

Dry Bean Plant Establishment

- Tillage systems
- Rye cover crop preceding pinto bean
- Row spacing X plant population
- Ground rolling



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E1952 (April 2020)

2019 DRY BEAN Grower Survey

*of Production, Pest Problems
and Pesticide Use*

in Minnesota and North Dakota

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S.G. Markell, J.M. Osorno and J.S. Pasche
North Dakota State University

*In cooperation with the
Northharvest Bean Growers Association*

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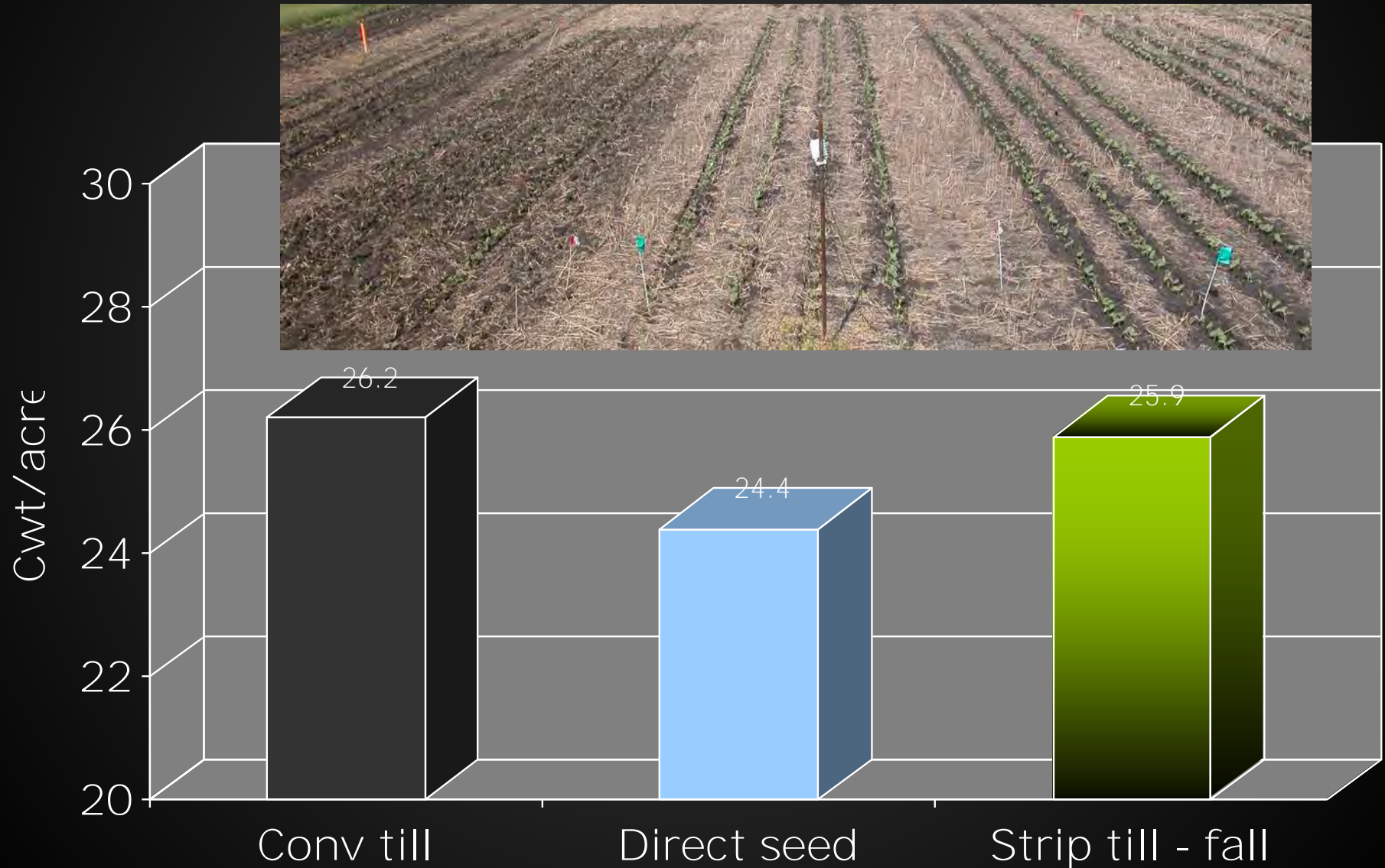
North Dakota State University, Fargo, ND

2019 Dry bean grower survey (Northharvest region): Tillage systems

Tillage system	Acres (%)
Conventional	71
Minimum	16
Strip-till	4
No-till	9



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



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

- 24% respondents used cover crops on dry bean fields
 - ✓ Reasons for cover crop use
 1. Soil conservation (96%)
 2. Weed control (27%)
 3. Soil moisture conservation (20%)

Northharvest	-----Respondents-----	
	No.	%
Cereal grass species only	35	77.8
Broadleaf species only	0	0
Cereal grass + broadleaf species	8	17.8
Not specified	2	4.4
Total	45	100

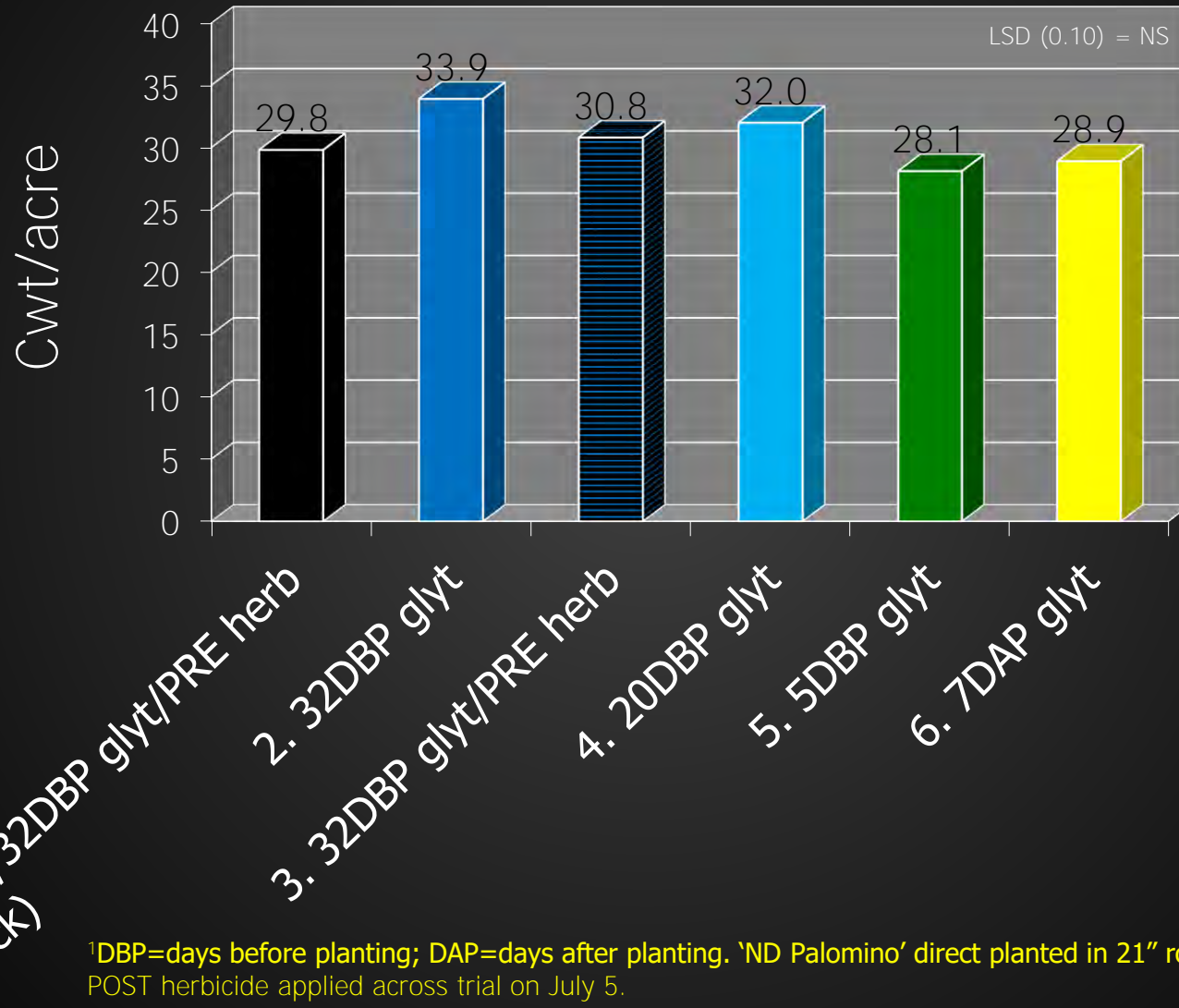
Winter rye cover crop preceding pinto bean, Carrington, 2017-2020



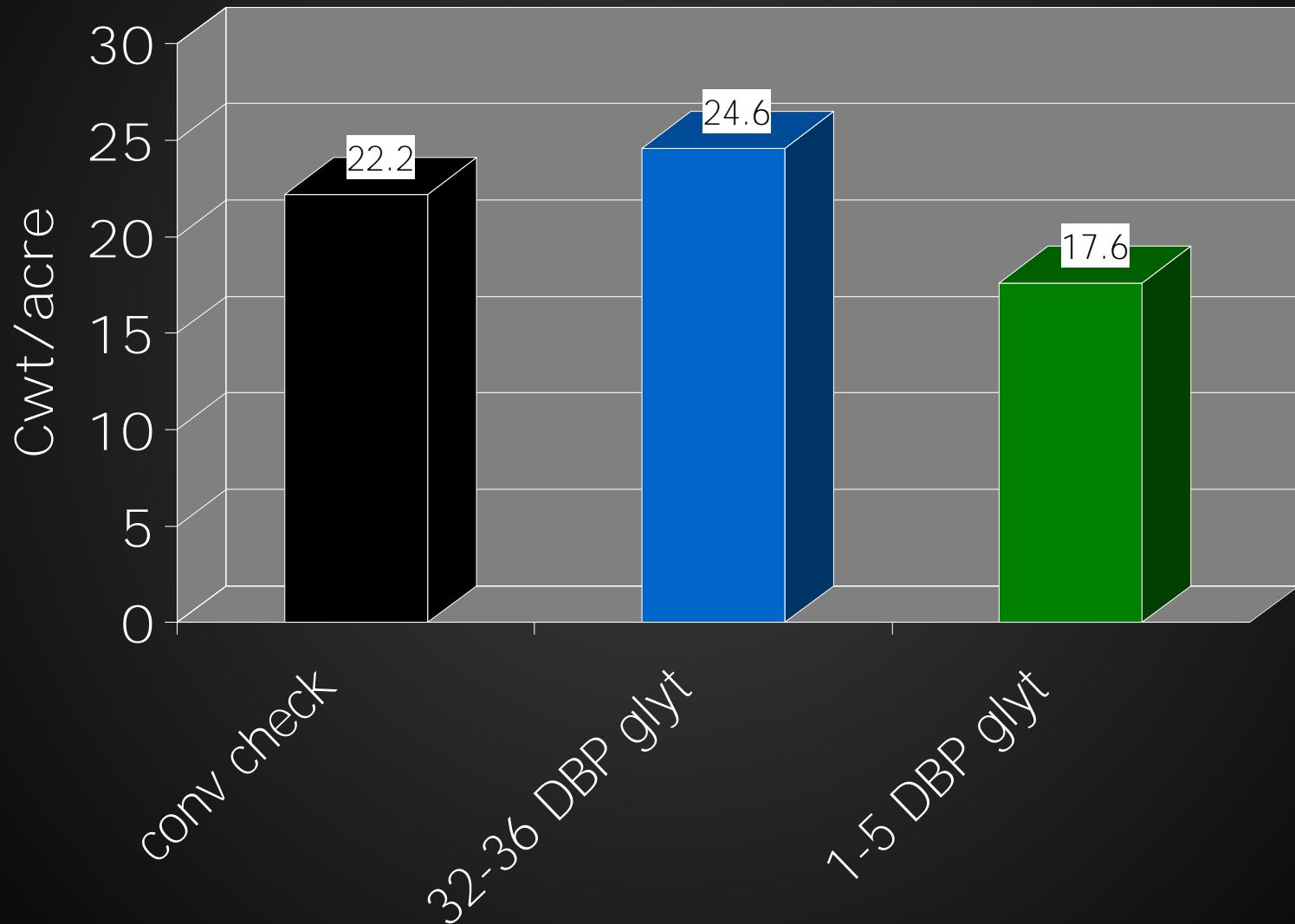
Bean yield?
Rye termination timing?
Weed suppression?



Pinto bean *yield* among rye termination and weed control treatments, Carrington, 2019



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



Agronomic notes, 2017-19

- Pinto bean can yield well with rye as a preplant cover crop
 - Terminate rye before bean planting
 - closely monitor early season soil moisture
 - **3-4 weeks before bean planting during 'dry' spring**
 - Established less than targeted crop stand
 - trial average 48,700-62,300 plants/acre

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Revised December 2019

DRY BEAN

Production Guide

pp. 14-17

Table 7. Recommended plant populations for specialty market classes.

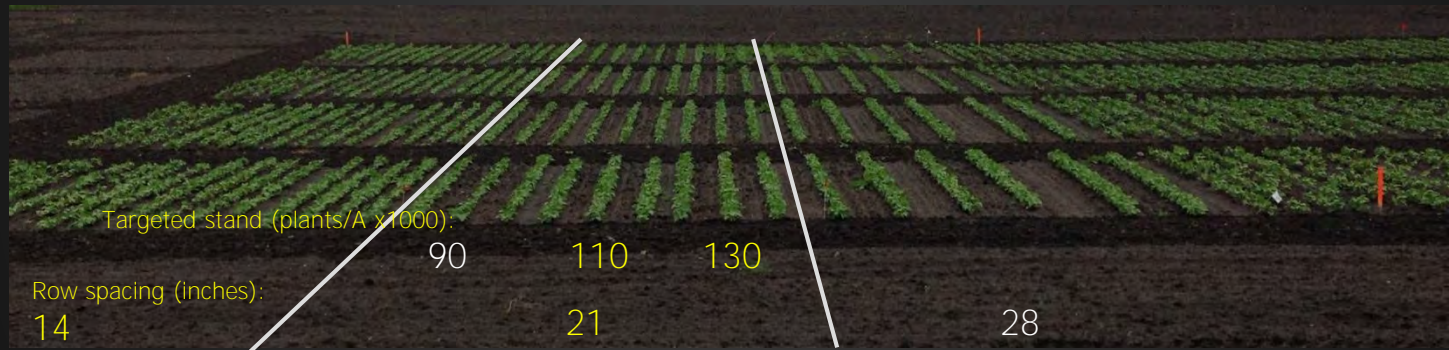
Market class	Plant population (plants per acre)
Black	90,000-120,000
Cranberry	65,000-80,000
Great Northern	70,000-80,000
Kidney	70,000-90,000
Navy	90,000 (wide rows); greater than 115,000 (narrow rows)
Pink	70,000
Pinto	70,000-80,000
Small Red	70,000-90,000

Black, Navy and Pinto Bean: Row Spacing and Plant Population

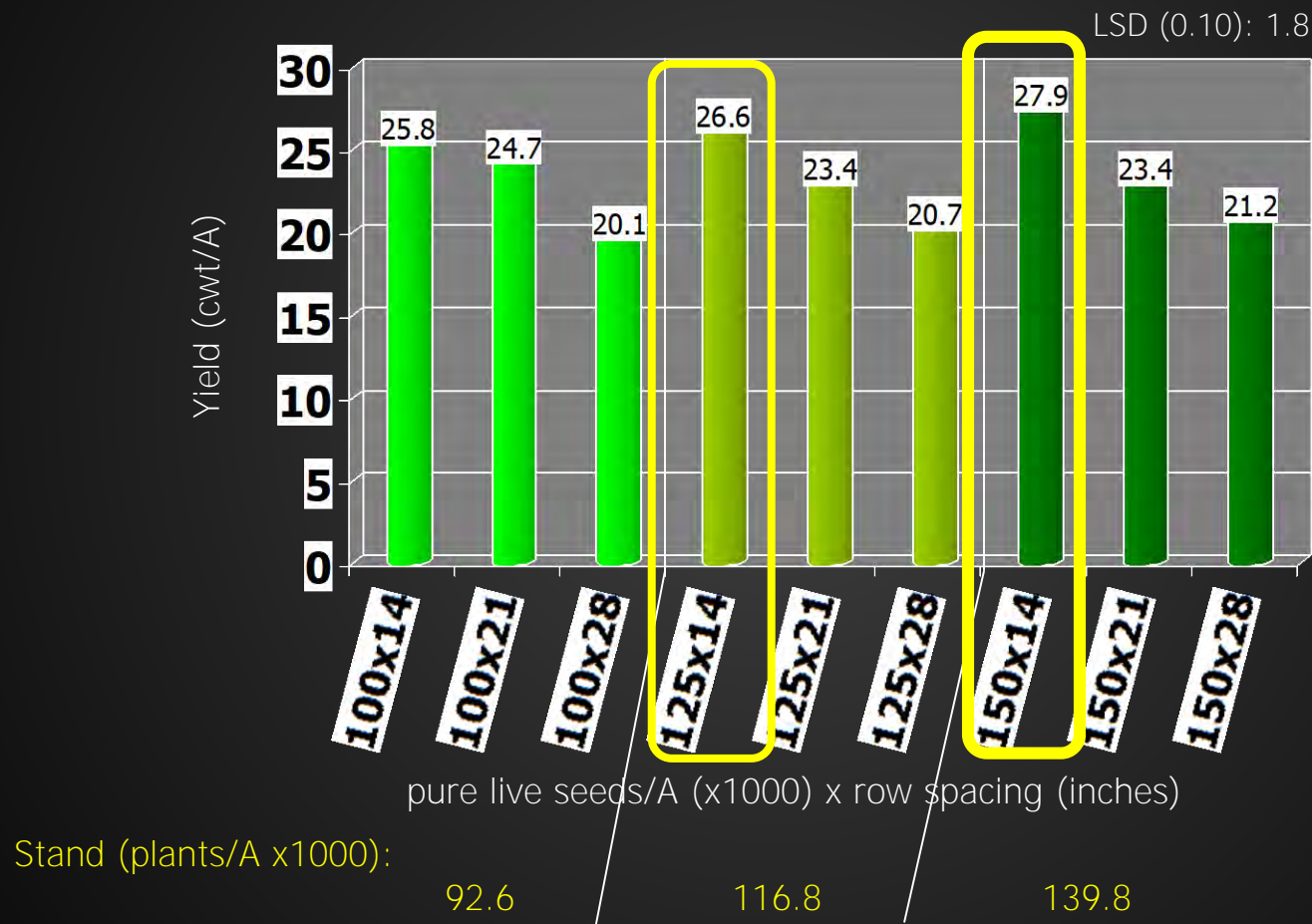
Can seed yield be economically increased by planting in narrow rows with greater plant populations than traditional NDSU recs?



Black and navy bean response to row spacing by plant population, Carrington, 2014-18



Navy bean seed yield with three row spacings and three plant populations, Carrington, 2014 and 2016-17 (3 site-years)



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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.

Black and Navy Bean

Response to Row Spacing and Plant Population in Eastern North Dakota

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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.

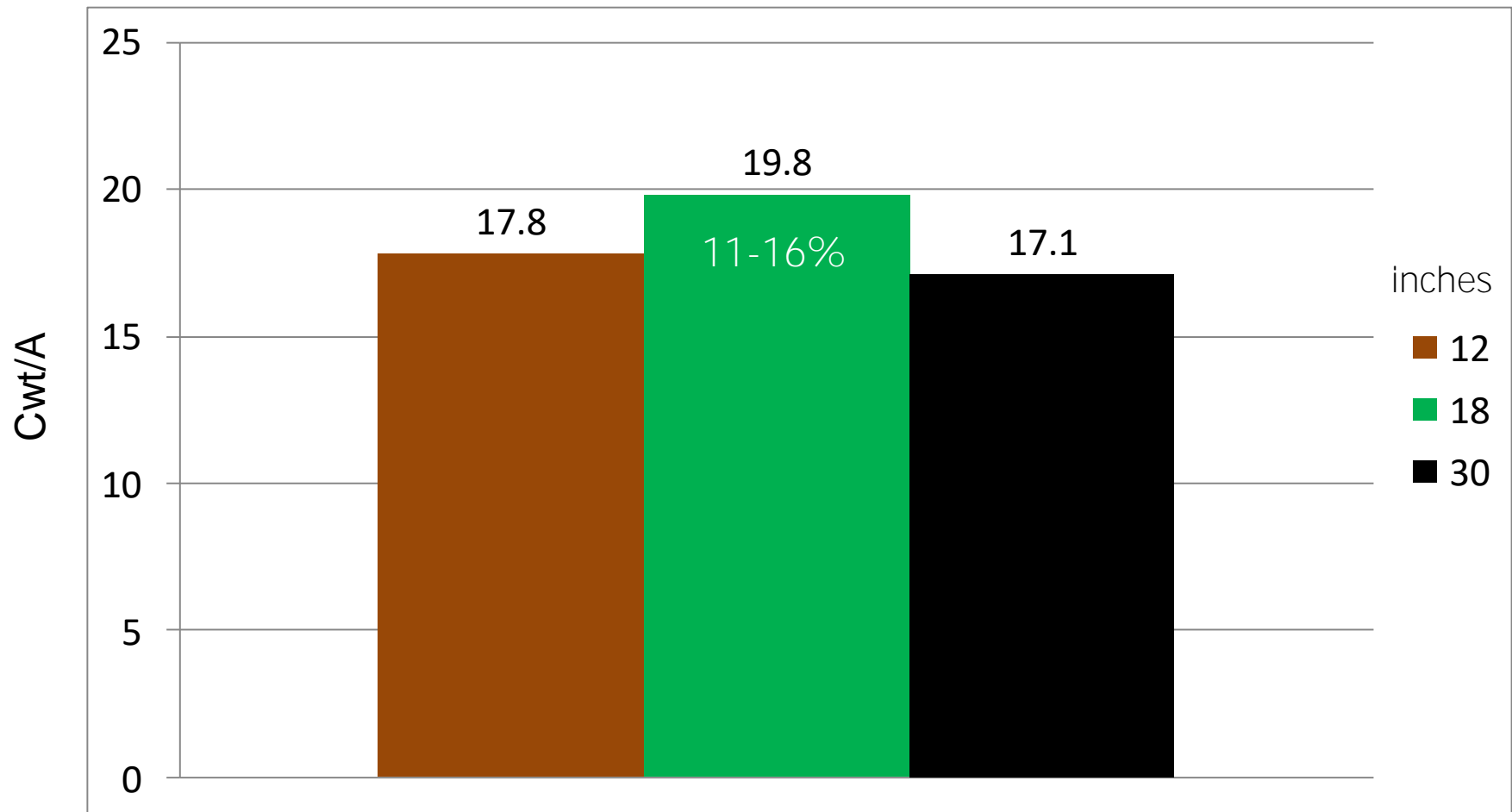
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North Dakota State University, Fargo, North Dakota
May 2019



Hans Kandel, NDSU

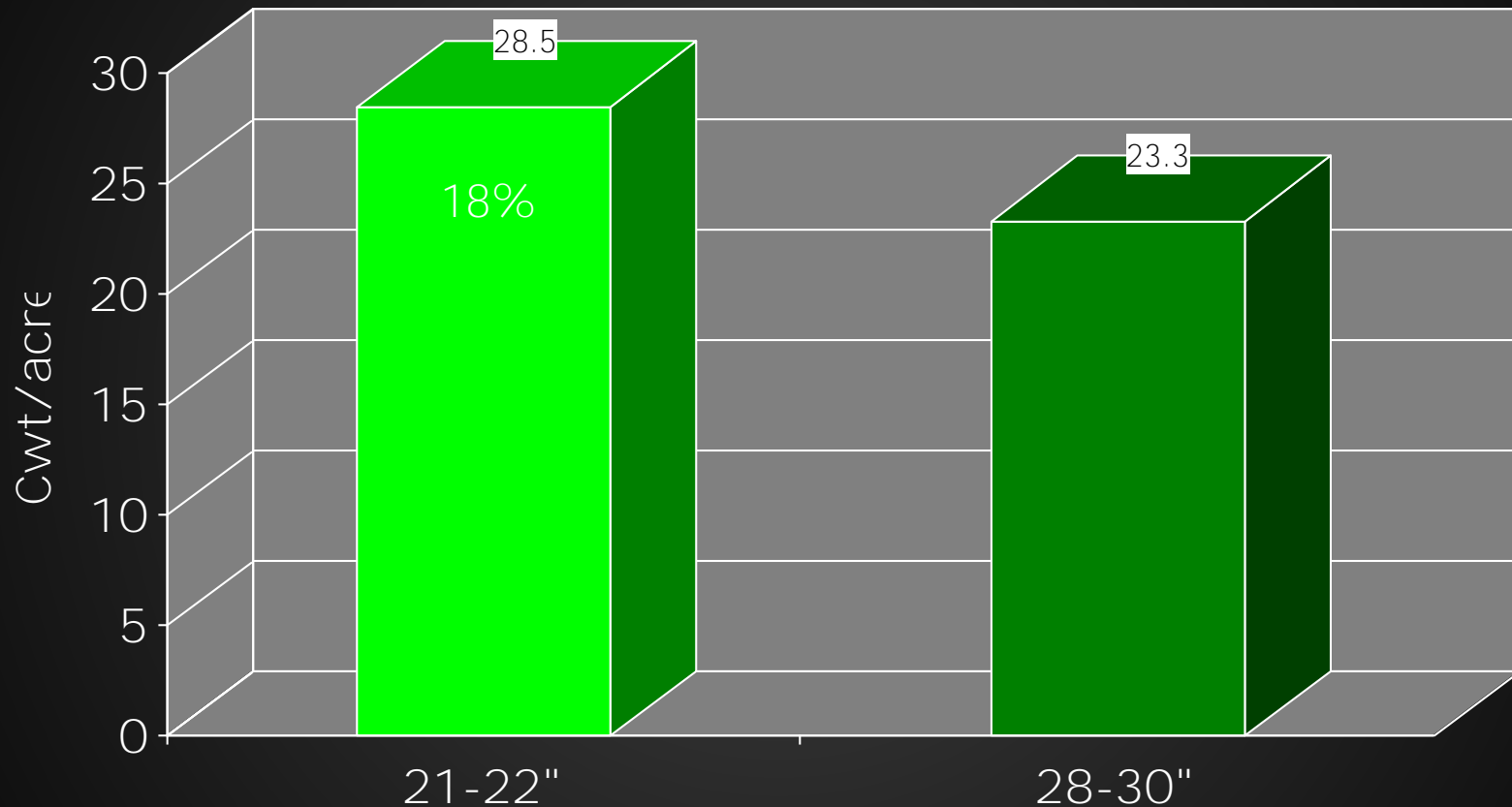
Pinto bean seed yield response to row spacing, eastern ND, 2008-09 (4 site-years)*



*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)*



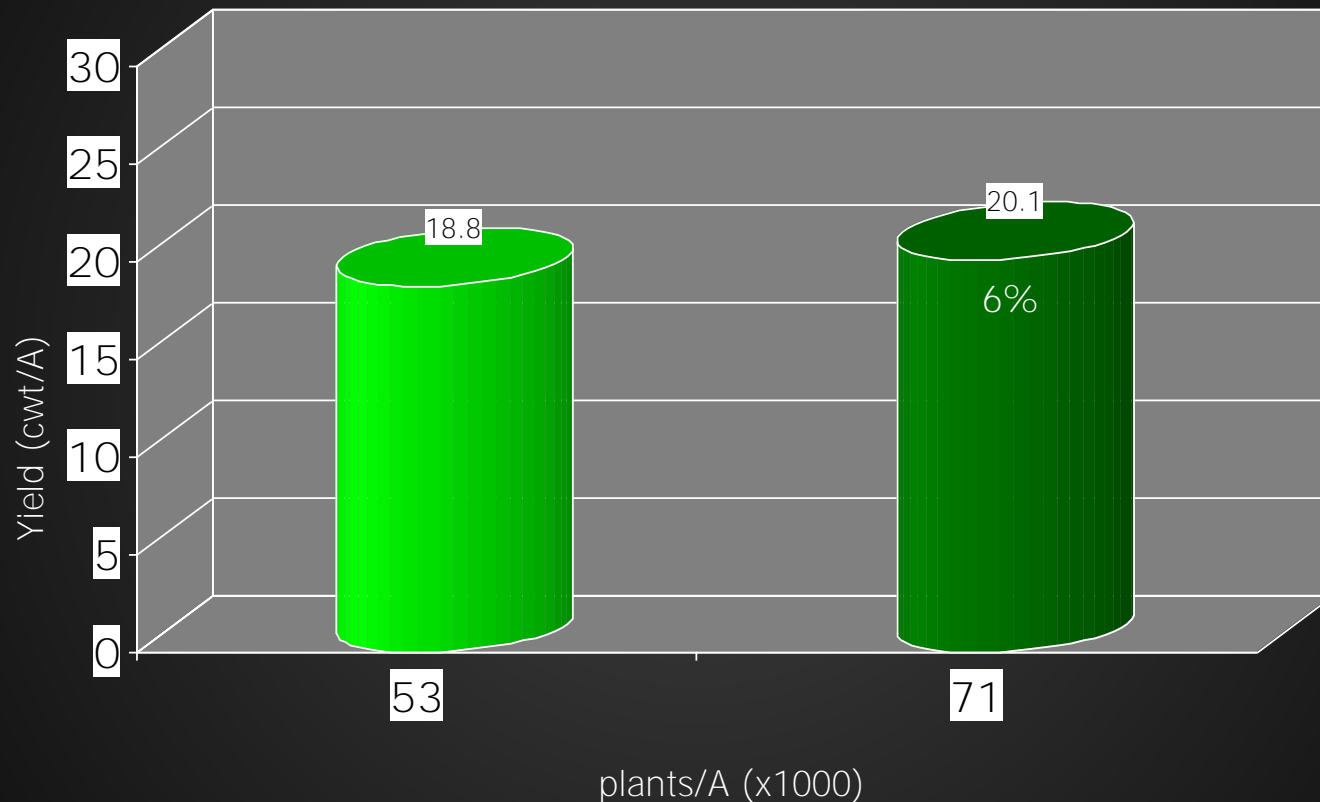
*'Lariat': 2011-13; 'ND Palomino': 2018-19. Averaged across tillage systems and fertilizer treatments (2011-13) and plant populations (2018-19). LSD (0.10): significant each year.

Pinto bean seed yield among row spacings and white mold severity levels, Carrington and Oakes, 2012-17 (13 site-years)

- Yield advantage conferred by narrow (14-inch) rows versus wide (28-inch) with end-of-season white mold severity (percent of the canopy diseased):
 - 410 lb/acre with severity at 26-50%
 - 339 lbs/acre with severity at 51-75%
- Yield was only maximized in wide rows when white mold severity was greater than 80%.

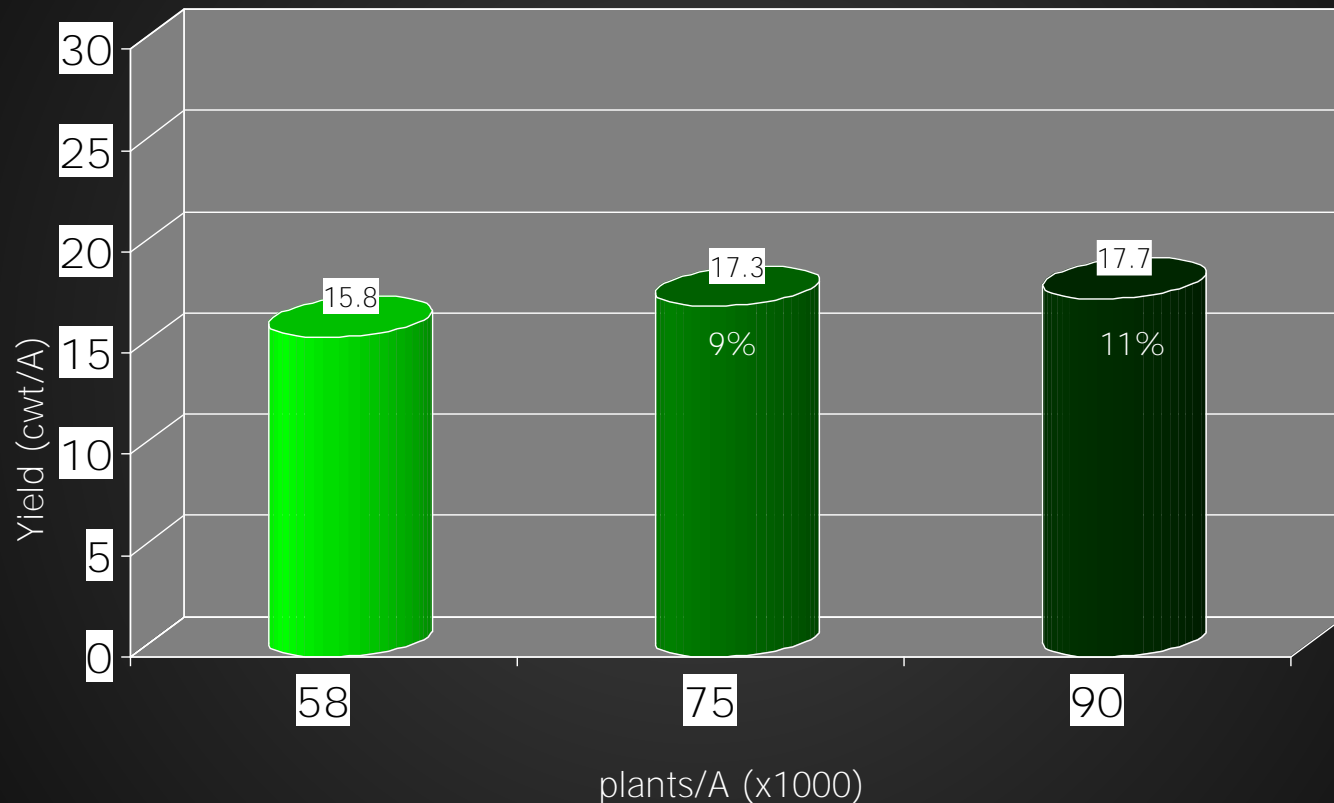
Research continued 2018-20 with four row spacings and 1-2 varieties

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



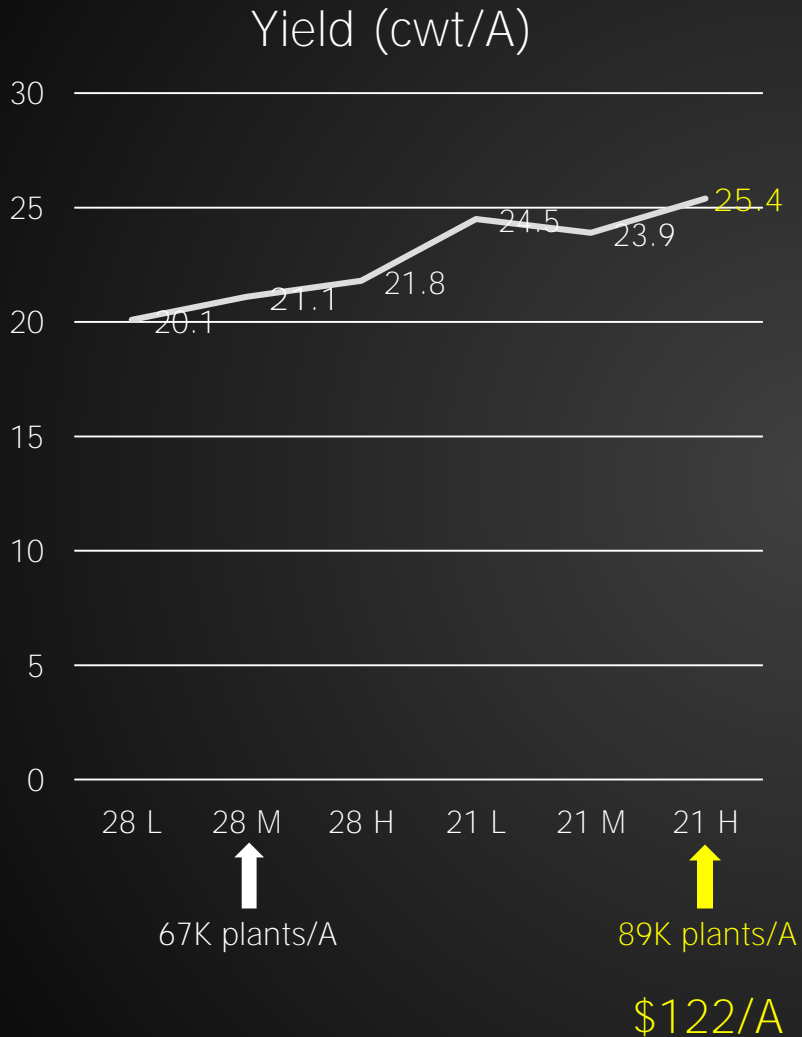
*2013: 'Lariat'; 2018-19: 'ND Palomino'. Carrington: Averaged across planting dates (2013) and row spacings (2018-19); LSD: 2013 (0.05) = NS; 2018-19 (0.10) = *. Minot: Averaged across row spacings and planting techniques; LSD (0.05): NS.

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) = *.

Pinto bean seed yield to row spacing and plant population, Carrington, 2018-2019 (2 site-yr)



Ground Rolling

2019 Dry bean grower survey

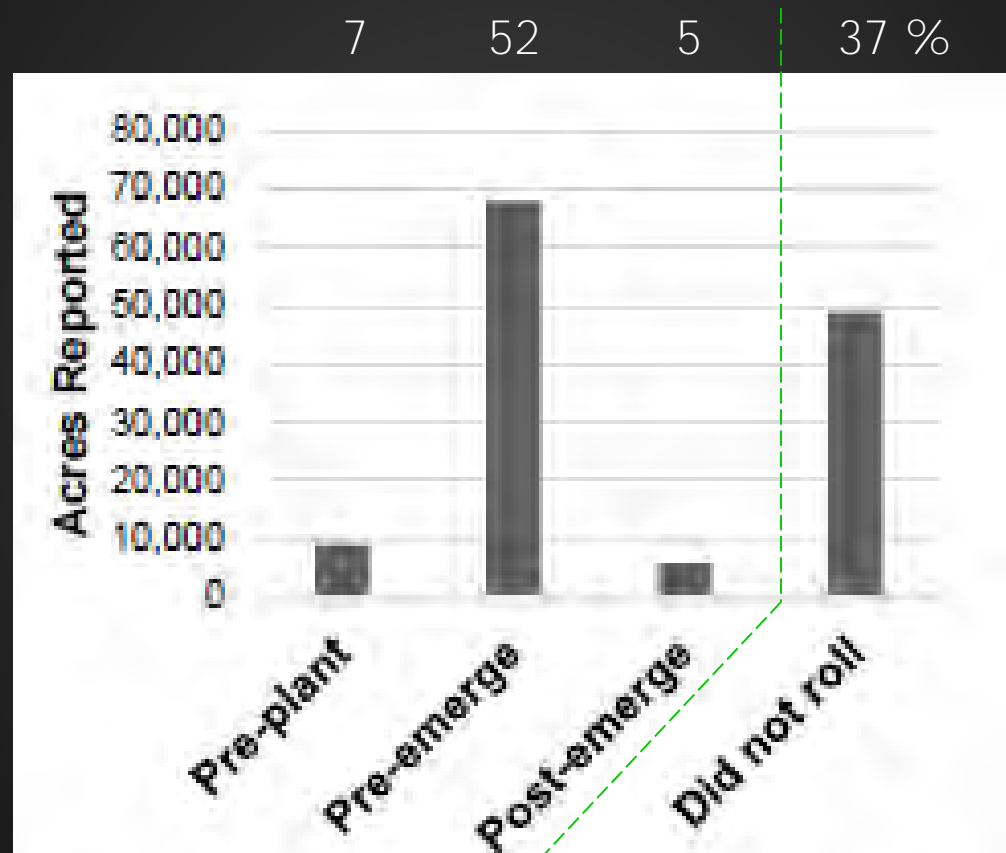


Figure 9. Northarvest ground rolling on dry bean fields in 2019.

Table 2: Plant and Soil Response as Measured in the Dry Bean Field Rolling Trial, Arborg, MB 1999

Treatment ^a	Yield (lbs/acre)	Plants /m ² (#)	Damaged Plants/m ² (#)	0-5 cm Bulk Density (g/cm ³)	5-10cm Bulk Density (g/cm ³)	10-15cm Bulk Density (g/cm ³)
No Rolling	3040	63	0	0.82	1.06	1.06
Rolling prior to emergence	3000	63	0	0.91	1.17	1.18
Rolling 7 days after emerg.	3100	63	2.4	0.93	1.11	1.16
Mean	3047	63	1	0.88	1.11	1.13
C.V. (%) ^b	11.53	12.9	134.16	8.61	4.57	4.79
LSD (0.05) ^c	ns	ns	1.5	ns	ns	ns

^a The rolling was conducted using a 12.2 metre wide Begelman Industries field roller. The empty weight was 6,125 kg giving a pressure of 5.0kg/cm of roller.

^b Coefficient of Variation - the variation in the data for which the source is unknown. Expressed as a percentage of the overall mean.

^c Least Significant Difference. Any two means in the column that differ by more than this value are considered significantly different with a confidence level of 95 percent. "ns" indicates that the differences are not statistically significant.

THE PULSE BEAT

Summary

- Dry bean yield can be maintained with reduced till systems while realizing the soil and economic 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 X narrow rows: navy (and black) = \geq 115,000 plt/A; pinto = \geq 70,000 plt/A
- PRE ground rolling is optimum timing; suggest VE-VC stages if POST