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Fertilizer Rate & Placement in Canola: How much is too much?

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Current Recommendations

Safe Rates of P_2O_5

**based on double disc opener*

- 15 to 20 lb P_2O_5 / ac
- 25 lb P_2O_5 / ac under good moisture
  - Continuous cropping
  - High yielding cultivars

Mining soil for available P

Crop	Yield	P Removal	Seed Limit	Balance
	(bu/ ac)	---------- lb P_2O_5 / ac----------		
Wheat	60	36	50	+14
Canola	**40**	**40**	**20**	**- 20**
Soybeans	35	28	10	- 18
Barley	80	38	50	+12
Flax	32	20	20	0
Peas	50	2038	20	-18
Oats	100	29	50	+ 21

Rates are based on solid seeding with disk or knife openers with a 1 in. spread, 6 or 7 row spacing and good to excellent soil moisture

Cindy, G. and D. Flaten. Review of P fertilizer management research in the Northern Great Plains. Soils & Crops Symposium. March 2019.

Safe rates of SO_4- S

- 10 lb S / ac

Typical Recommendation

- 13- 27 lb S / ac

Can ammonium sulphate be seed-placed?

Objectives

Are current P fertilizer recommendations adequate for high yielding cultivars?

Does all fertilizer P need to be seed placed or is side banding equally effective?

Are current recommendations regarding safe rates of P and S suitable for typical knife or hoe openers in use today?

Scott, Indian Head, & Melfort

- 2016, 2017, 2018
  - 5 Phosphorus Rates
  - 2 Placements
    - Seed-placed (SP)
    - Side-band (SB)

Treatment #	lb/ ac P_2O_5	Placement
1	0	SP
2	18	SP
3	36	SP
4	53	SP
5	71	SP
6	0	SB
7	18	SB
8	36	SB
9	53	SB
10	71	SB
11	0 & 13S	SP
12	18 & 13S	SP
13	36 & 13S	SP
14	53 & 13S	SP
15	71 & 13S	SP

Site Information

Scott

- SBU 10%
- Dark Brown Climatic Zone
  - Loam soil
  - Moderate organic matter (4%)
  - 10” Row Spacing

Indian Head

- SBU 6%
- Thin Black Climatic Zone
  - Clay Loam
  - Low- moderate organic matter (2.7-5.5%)
  - 12” Row Spacing

Melfort

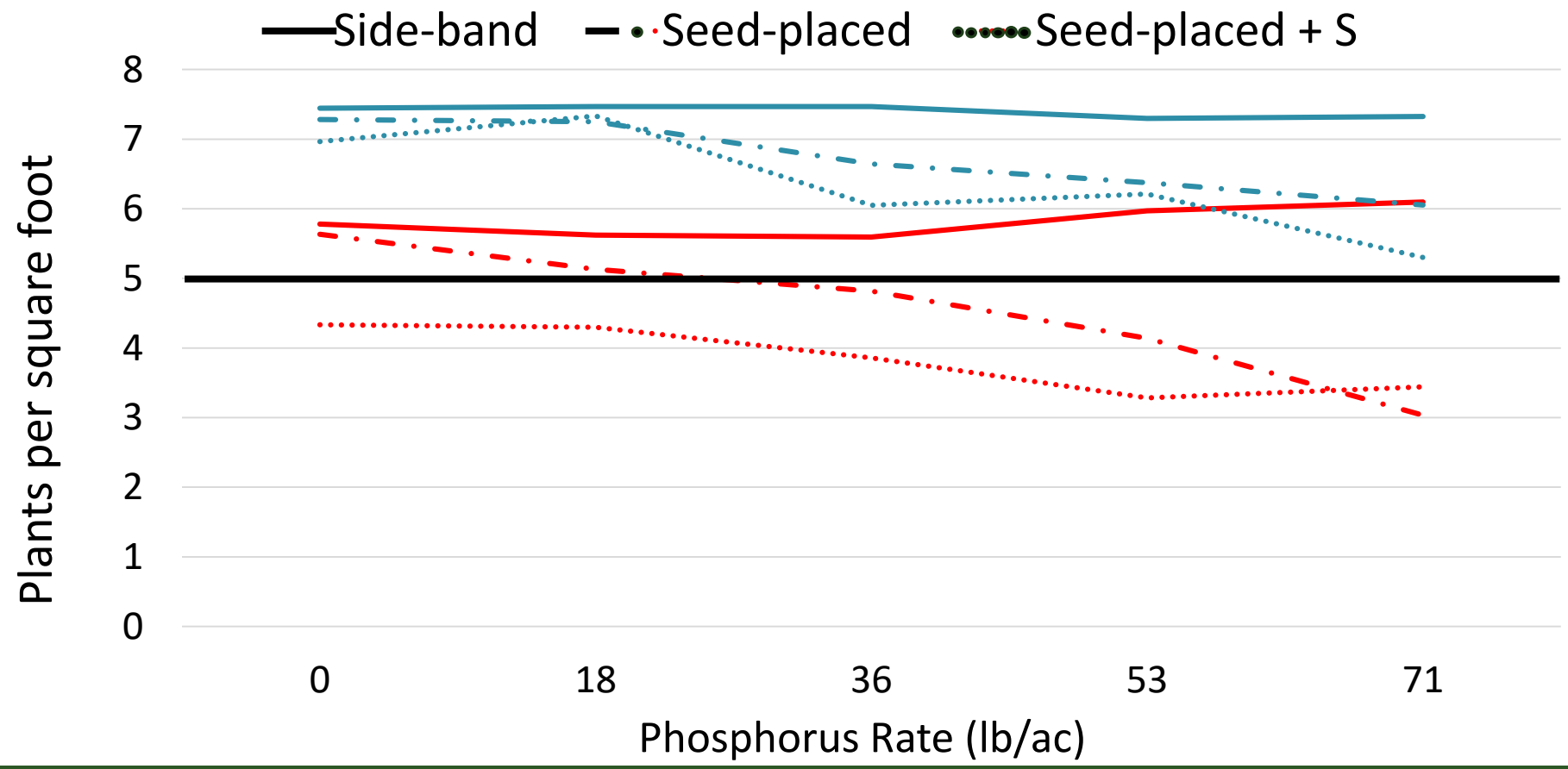
- SBU 8%
- Thick Black Climatic Zone
  - Clay Loam
  - High organic matter (10%)
  - 12” Row Spacing

Table 2. Soil Characteristics at Indian Head, Melfort, and Scott, SK in 2016, 2017, and 2018.

	Indian Head (IH)			Melfort (ME)			Scott (SC)		
	2016	2017	2018	2016	2017	2018	2016	2017	2018
Soil Zone	Thin Black			Thick Black			Dark Brown		
Soil Texture	Clay Loam			Clay Loam			Loam		
Salinity	Non - Saline		Saline	Non-Saline			Non-Saline		
Soil pH (0-6”)	7.9	8.0	7.2	6.2	6.1	6.2	5.2	5.6	5.8
Organic Matter (%) (0-6”)	2.7	4.8	5.5	12.3	11.5	9.5	4.1	3.5	4.4
NO_3-N (lb/ac) (0-6”)	10	11	7	39	35	21	17	9	9
NO_3-N (lb/ac) (6-24”)	21	15	9	29	38	19	51	15	2
NO_3-N (lb/ac) (0-24”)	31	26	16	68	73	40	68	24	11
P_2O_5 (ppm) (0-6”)	6	7	9	11	43	12	18	9	18
K_2O (ppm) (0-6”)	540+	701	719	357	796	598	312	380	332
SO_4-S (lb/ac) (0-6”)	9	16	56	10	40	26	8	10	14
SO_4-S (lb/ac) (6-24”)	28	60	360+	14	40	20	8	10	20
SO_4-S (lb/ac) (0-24”)	37	76	416+	24	80	46	16	20	34

Plant Density Scott (Course Textured Soils) vs. Indian Head (Fine Textured Soils)

- Side-band = Seed-placed at current recommendation
- Side-band > Seed-placed at rates > 18 lb/ac
- P & S blended resulted in stand reductions



71 lb/ac Side-band

71 lb/ac Seed-placed

71 lb/ac + 13 S Seed-placed

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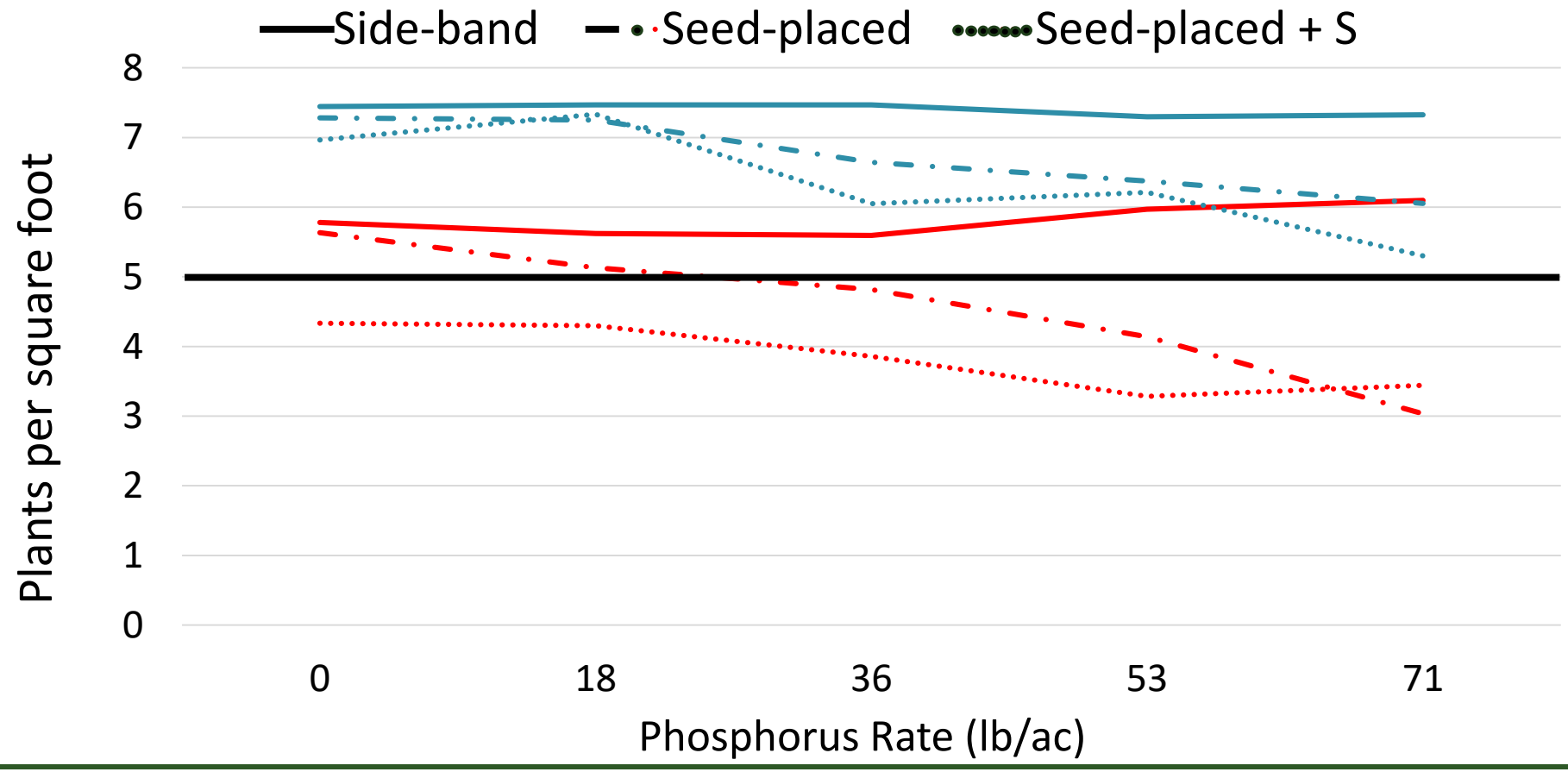
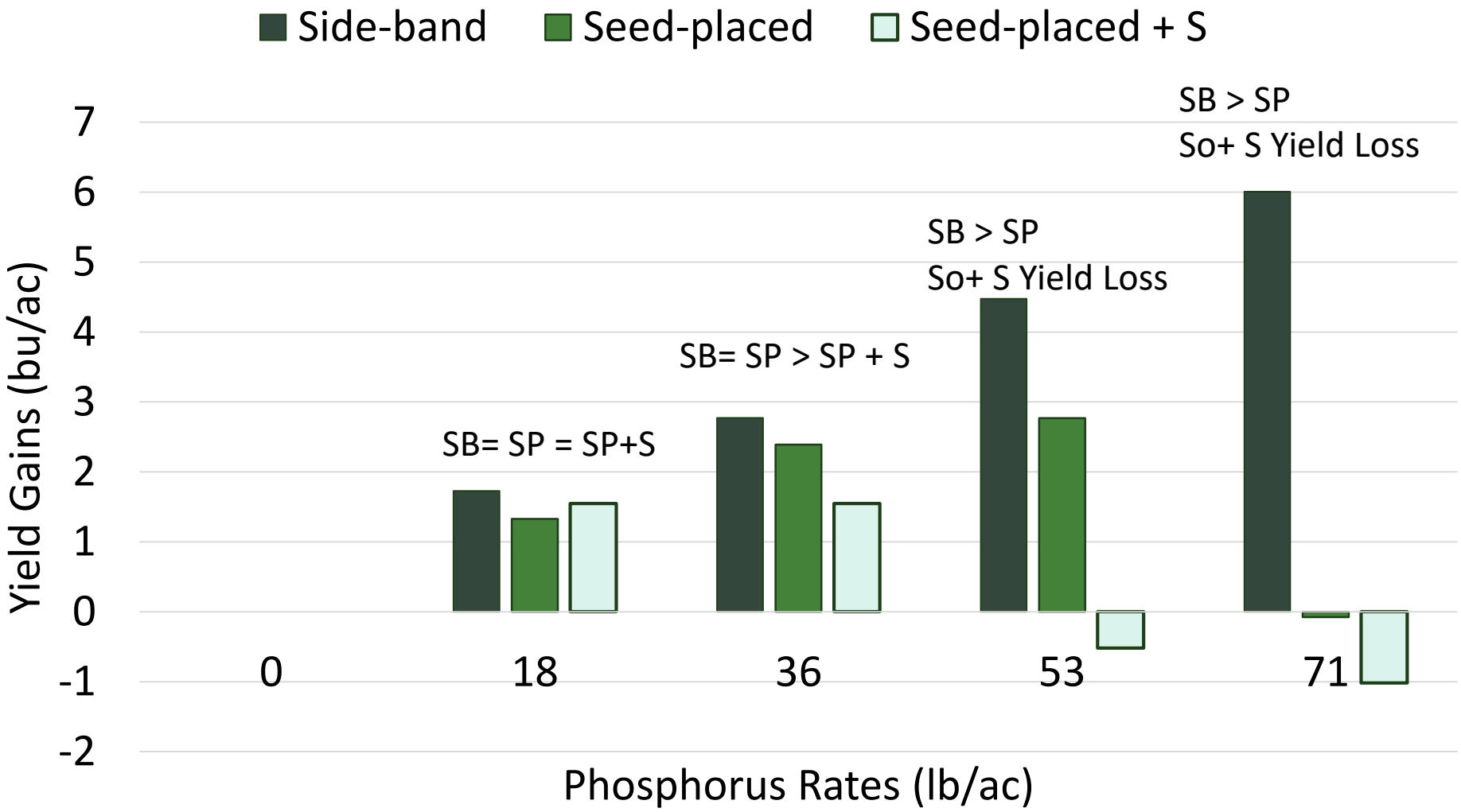
- Side-band ≥ Seed-placed ≥ Seed-placed + S
  - High precipitation reduce damage
  - OM buffer reduce damage BUT can still occur

High degree of risk associated with seed-placed fertilizer when soil and climatic conditions are conducive for high levels of fertilizer



High level of crop safety associated with side-band placement of fertilizer when it is banded away from the seed

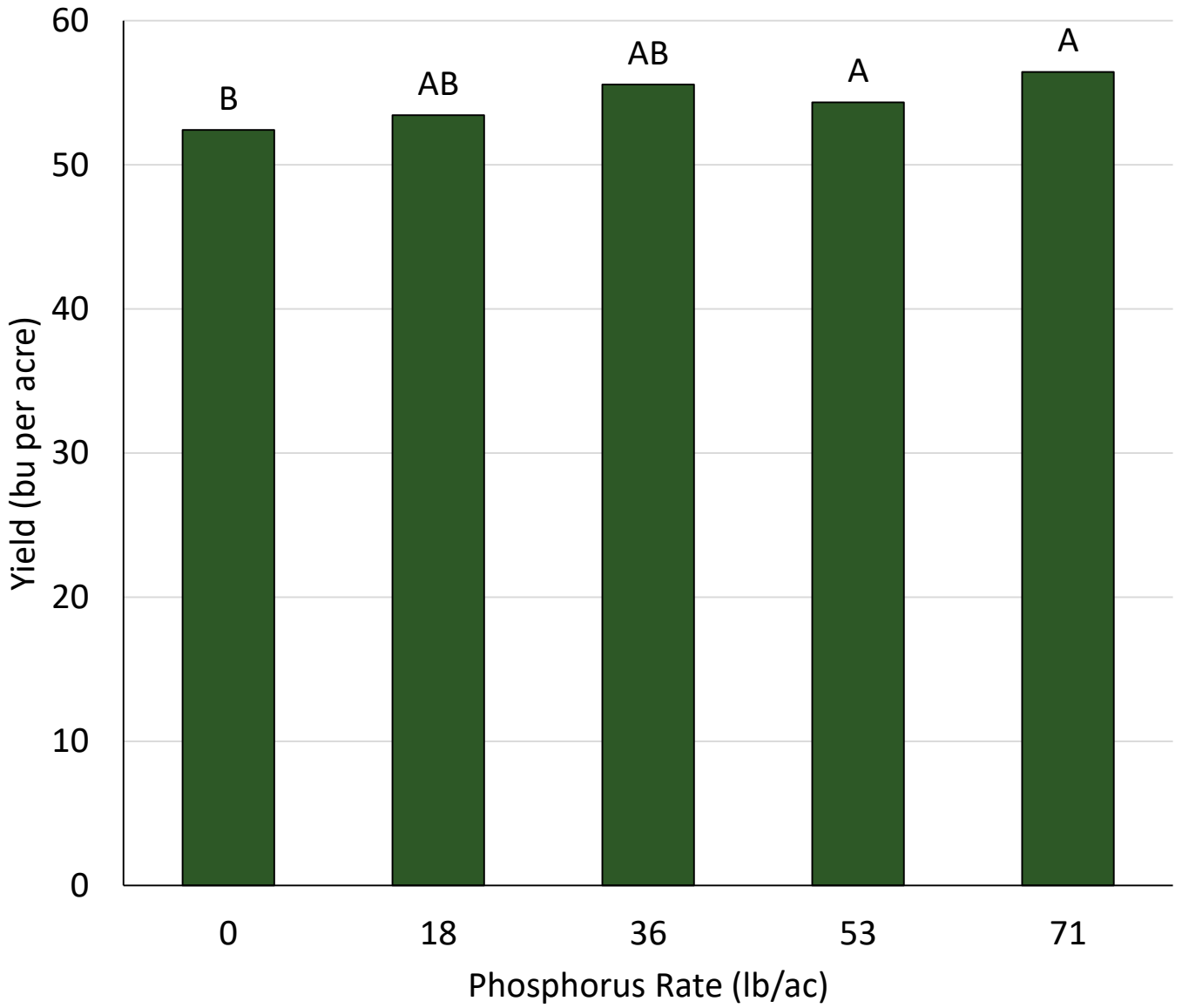
Yield Scott (2016-2018) Significant Interaction of Rate * Placement



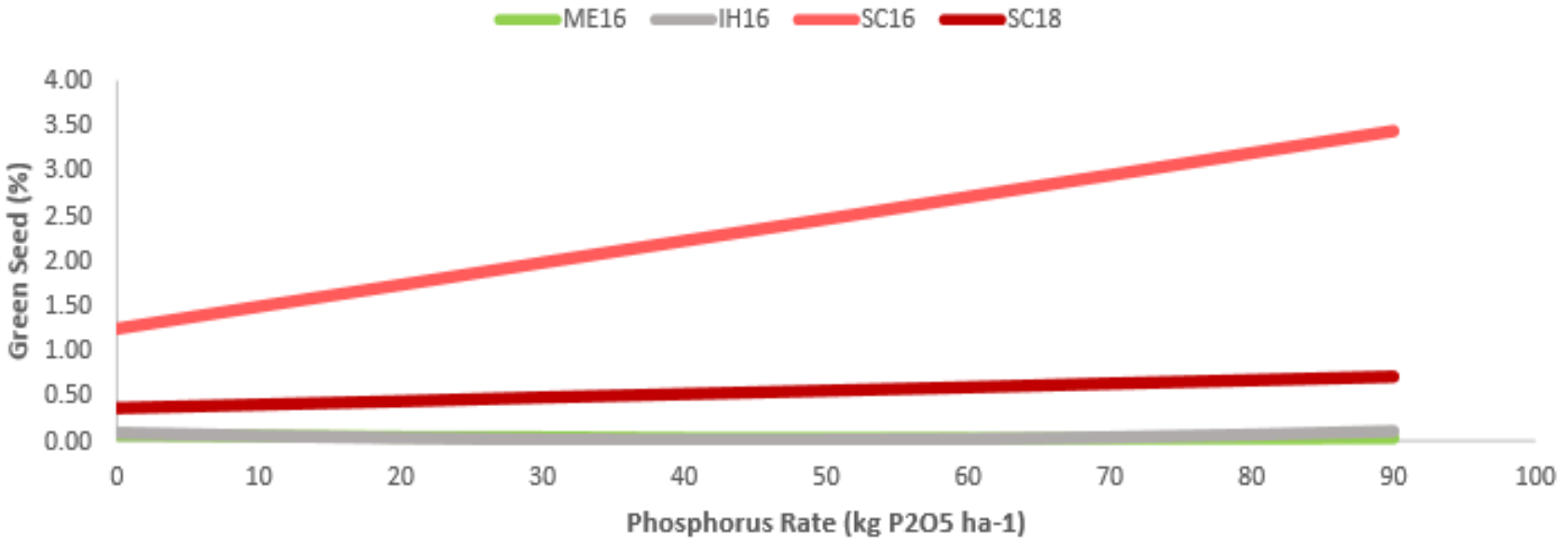
Side-banded at 71 lb/ac resulted in the highest yield

Yield Melfort & Indian Head (2016-2018) Significant Effect of Rate (4/6 Site-Years)

- Melfort 2016 – 16 bu/ ac gain vs check
- Indian Head 2018 - 2 bu/ ac gain vs check
- On average, 4 bu/ac gain vs check



Green Seed at Melfort (2016), Indian Head (2016), Scott (2016 & 2018)



- Side-banded P did not impact green seed
- Seed-placed P sometimes impacted green seed
- Seed-placed P & S influenced green seed * *Scott*

Results Summary

Scott (Course, sandy loam textured soils)

- Side-band = Seed-placed at current recommendation
- Side-band > Seed-placed at rates > 18 lb/ac
- P & S blended resulted in stand reductions

- Rate * Placement Influenced Yield
  - Addition of S in seed-place results in yield losses
  - Side-banded & Seed-placed similar at current recommendations
  - Higher P rates increased yield when SB > SP

Indian Head/ Melfort (Fine, clay textured soils)

- Side-band ≥ Seed-placed ≥ Seed-placed + S
  - High precipitation reduce damage
  - OM buffer reduce damage BUT can still occur

- P rate was only significant factor for yield
  - Increasing rates tended to increase yield

Side-banded at 71 lb/ac resulted in the highest yield

Implications

Are current P fertilizer recommendations adequate for high yielding cultivars?

- Current recommendation 20 lb/ac vs. 71 lb/ac
- 4 bu/ac gain

Does all fertilizer P need to be seed placed or is side banding equally effective?

- Side banded ≥ Seed placed > Seed placed P & S (13 lb/ac)

Factors to Consider: **SOIL TEXTURE**
SOIL MOISTURE

Are current recommendations regarding safe rates of P and S suitable for typical knife or hoe openers in use today?

- Yes: Current recommendations suit all situations
- No: Proper conditions support higher P rate applications

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Side Banding vs. Mid Row Fertilizer Placement

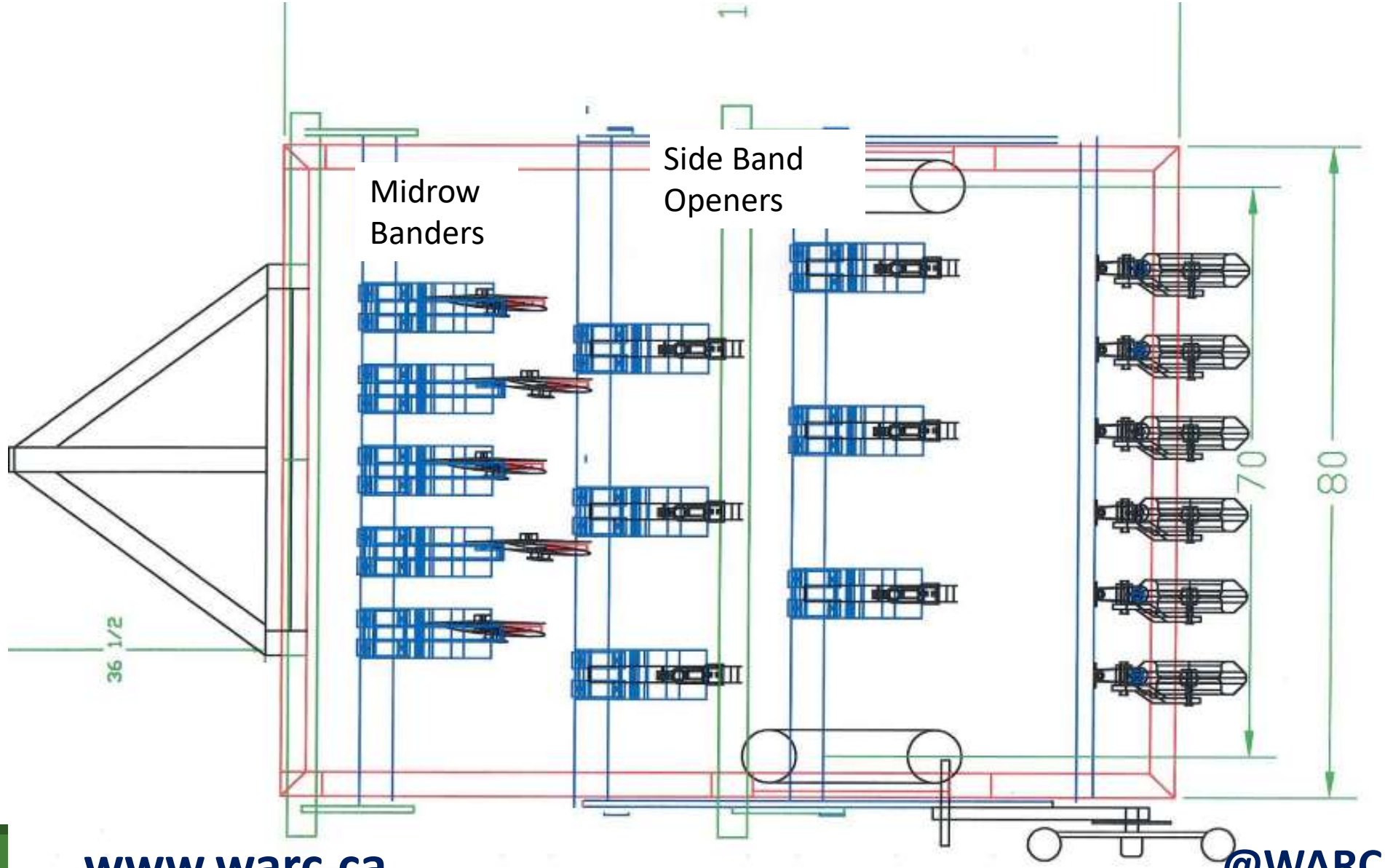
- 3 Rates of Phosphorus Seed Placed
- Nitrogen: 120 lb/ac
  - Urea (46-0-0)
- Sulphur: 45 lb/ac
  - Ammonium Sulphate (20.5-0-0-24)
- Blend 49-0-0-51 @ 367 lb/ac
- Scott, 2019 (1 site-year)
  - Producer Funded
    - Blaine Davey
    - Dan Holman
    - Kun 5 Farms

Trt #	11-52-0 lb/ac Rate	Phosphorus Rate Seed Placed	N & S Fertilizer Placement
1	0	0	0
2	0	0 P_2O_5	Sideband
3	19	10 P_2O_5	Sideband
4	96	50 P_2O_5	Sideband
5	0	0 P_2O_5	Midrow
6	19	10 P_2O_5	Midrow
7	96	50 P_2O_5	Midrow

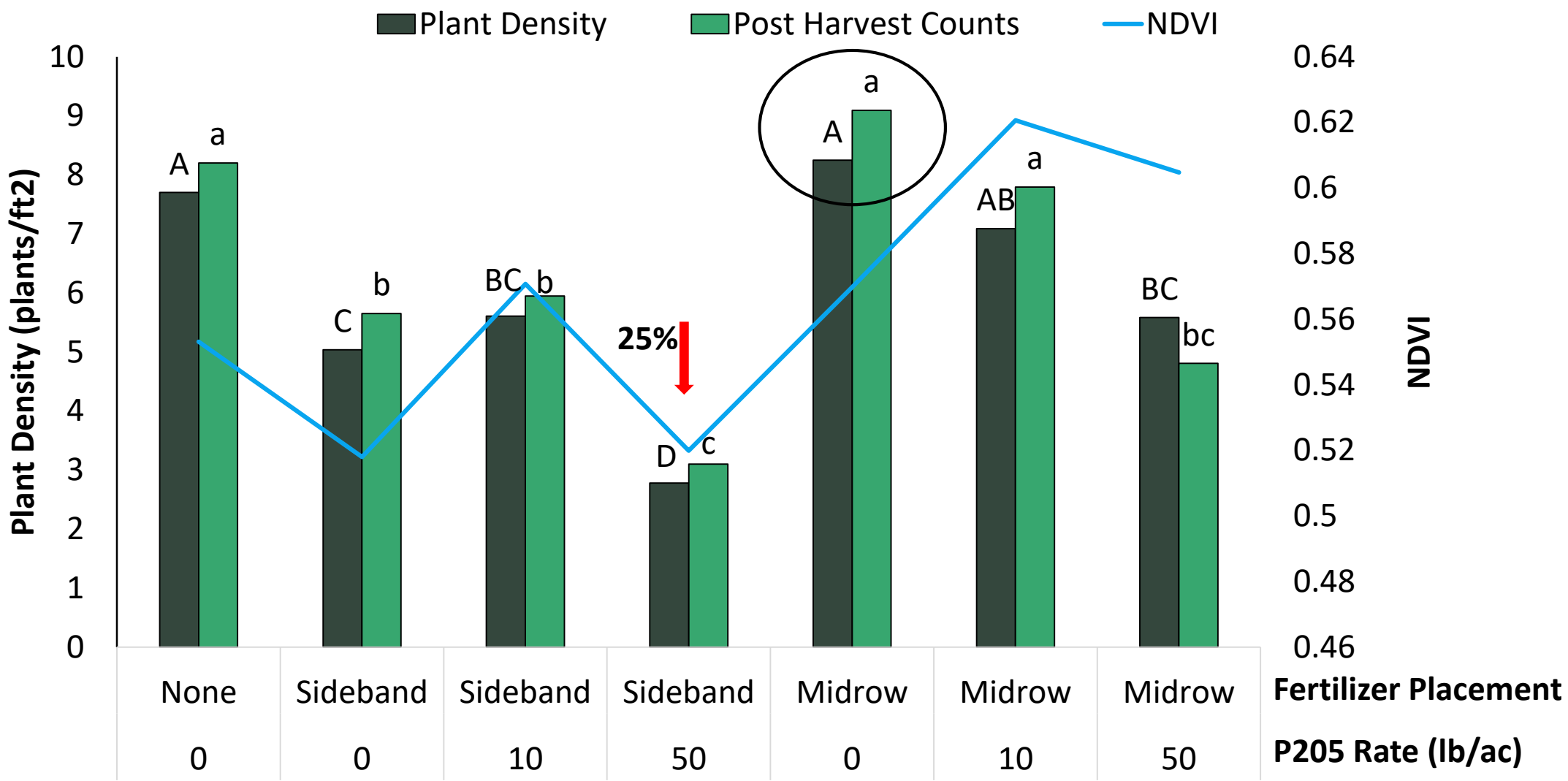
Knife Openers Used in Study

Opener Type: Side Band Granular
Shank Type: Bourgault Paralink
Point Size: ¾” with 1 1/2”wing

Top View of Seeder Used in Study



Effect of Placement & Rate on Plant Densities & NDVI



Dual Banding N and P Fertilizer

What are the consequences of dual banding at these high rates?

Seedling Damage

1. Ammonia Toxicity

- Nitrification process: ammonia (highly toxic) to ammonium (toxic) to nitrate (plant available form) the natural acidification
- High concentration is toxic and damages the seeding
  - Greater than 75 lb/ ac of N
- Delay P uptake for several weeks due to band toxicity

2. Salt Burn

- High salt index
- Toxicity is related to salt effect from N portion of MAP fertilizer
  - Desiccates the canola seedlings

0 lbs P_2O_5
N and S side-banded

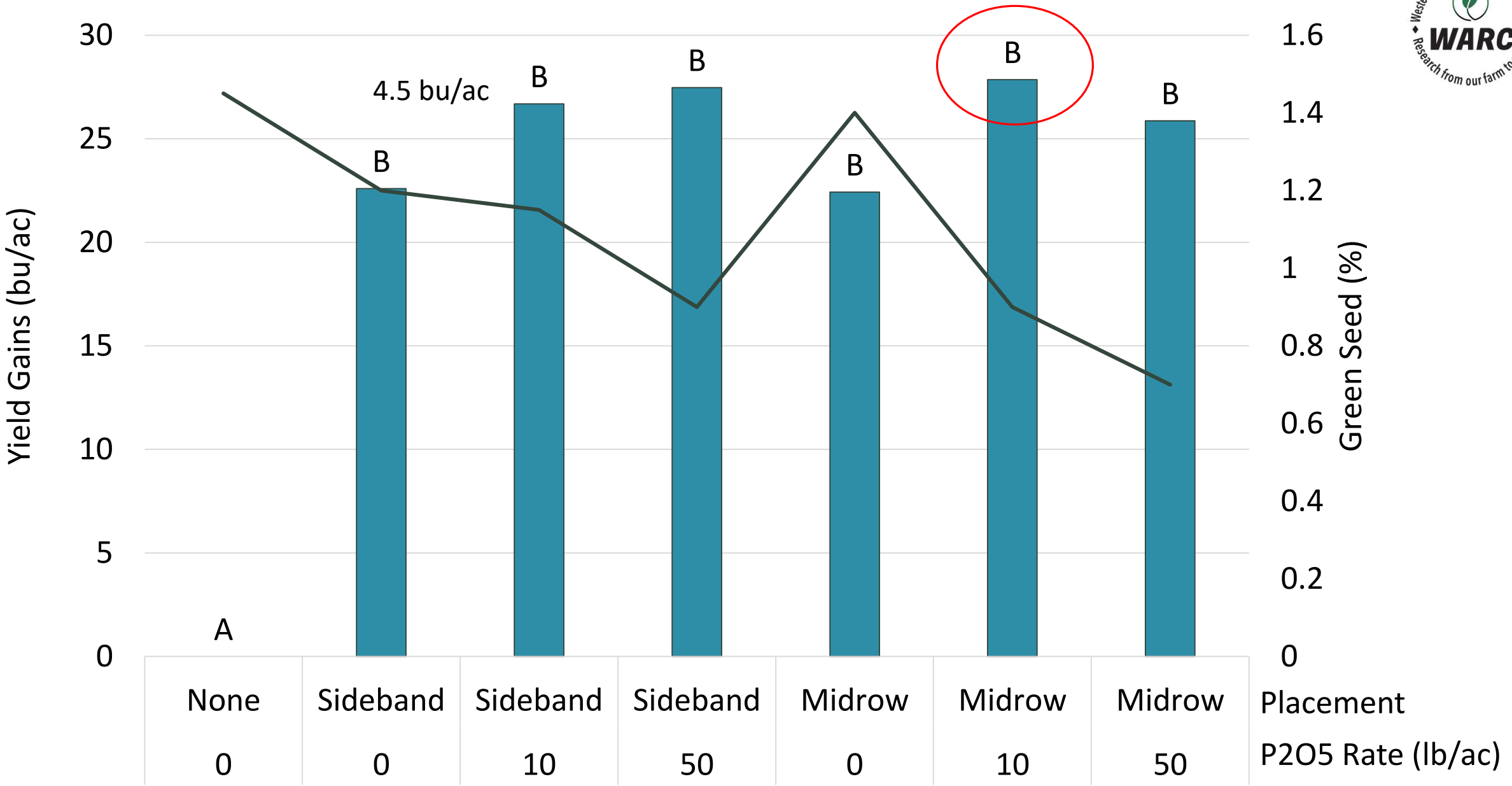
0 lbs P2O5
N and S Midrow Banded

10 lbs P2O5
N and S side-banded

10 lbs P2O5
N and S Midrow Banded

50 lbs P2O5
N and S side-banded

50 lbs P2O5
N and S Midrow Banded


Yield Gains (bu/ac)
Green Seed (%)
30
25
20
15
10
5
0
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
4.5 bu/ac
A
B
B
B
B
B
B
None
Sideband
Sideband
Sideband
Midrow
Midrow
Midrow
Placement
0
0
10
50
0
10
50
P2O5 Rate (lb/ac)

What does this mean for you?

- Side band **Phosphorus** (40 lb P_2O_5/ ac) replenish reserves & positive yield response
- Side- band **Phosphorus** at higher rates (70 lb P_2O_5 / ac) can result in highest yields
  - Risk of seedling burn if conditions are not ideal
- Seed placed **Phosphorus** (10- 20 lb P_2O_5/ ac) and midrow banding high rates of N (120 lb/ac) & S (45 lb/ac)
- Side banding high rates of **N (120 lb/ac) & S (45 lb/ac)** will cause stand reductions
  - Greater reduction with high rates of seed placed P
  - Risk of seedling damage if soil texture & moisture are not ideal

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[1]Northeast Agriculture Research Foundation, [2]Indian Head Agricultural Research Foundation

Big Thank You to the WARC Staff:

- Kayla Slind
- Herb Schell
- Sukhdeep Kaur
- Gurtaj Singh
- Keanna Svendsen-Striga
- Haile Wangler
- Jocelyn Leidl

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IHARF Indian Head Agricultural Research Foundation

NARF Northeast Agriculture Research Foundation

SaskCanola

Questions?

Crop Opportunity

March 4th

Dekker Centre, North Battleford

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