IHARF

INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

2015 Agronomy Update

Chris Holzapfel, MSc, PAg

IHARF Soil & Crop Management Seminar
February 3, 2015
Balgonie Multiplex, Balgonie SK

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

IHARF Funding Sources

- Grain revenues from approximately 1200 ac of cropland comprise up to 50% of gross operating funds
- Additional revenues come from approximately 40-50 research / demo projects (annually) funded through government (provincial & federal), producer groups & private industry

Source	% of Outside Funding (Cash & In-Kind)						
	2010	2011	2012	2013	2014	2015	AVG
Industry	49%	30%	36%	33%	17%	28%	**32%**
Producer	36%	48%	45%	24%	28%	47%	**38%**
Government	15%	22%	19%	43%	55%	25%	**30%**

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION



Row Spacing Effects on Various Crops

Recent Field Trials

- Since acquiring the required equipment in 2009, IHARF & AAFC have conducted row spacing research with several crops
  - Oat: 2009-2011 (SODC)
  - Canola: 2012-16 (SCDC)
  - Soybean: 2014-2017 (SPG/AAFC)
  - Flax: 2014-2016 (ADOPT/SFDC)
  - Spring Wheat: 2013-2016 (AAFC)

- Row spacing ranges from 10-24” (25-61 cm) & was generally combined with other factors such as side-banded N rate, seeding rate, weed control & fungicide applications

Equipment

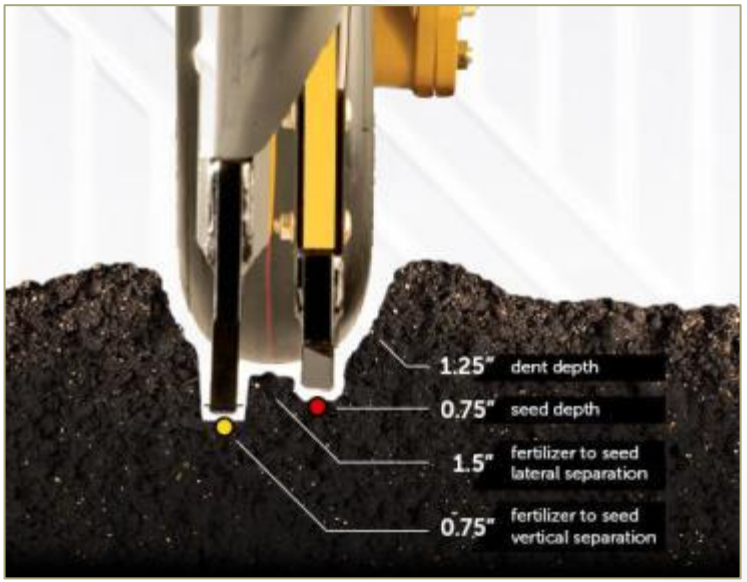


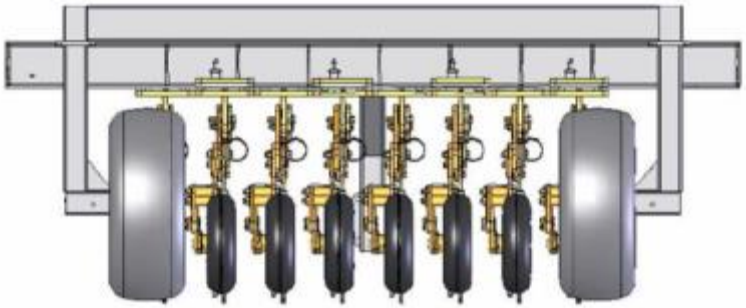
Image Source: www.seedmaster.ca

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

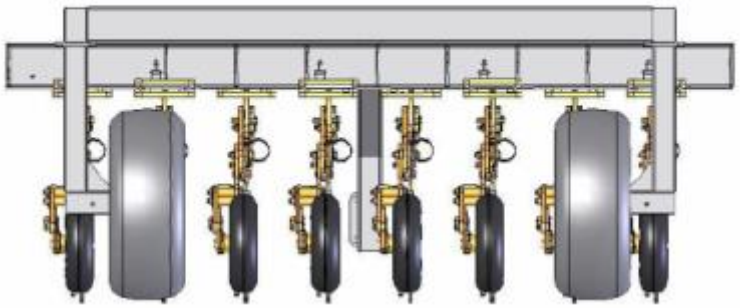
SEED MASTER™

Equipment

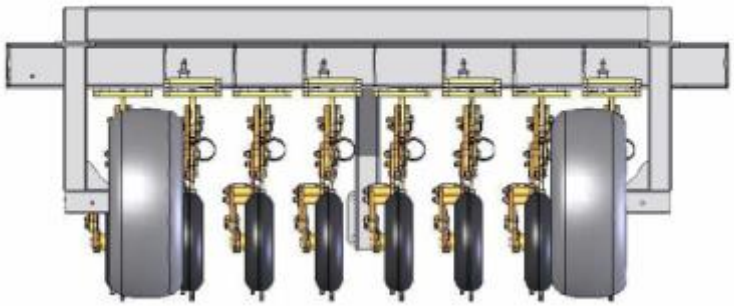
10 inch spacing



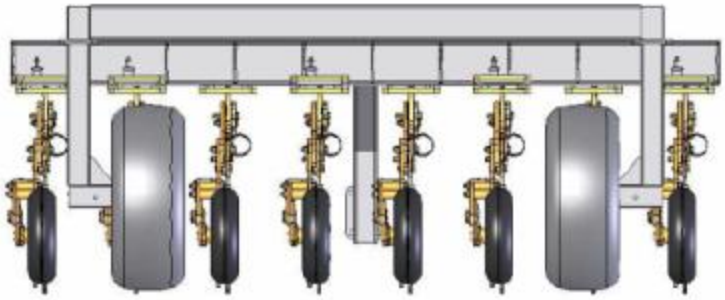
14" cm Spacing



12" cm spacing



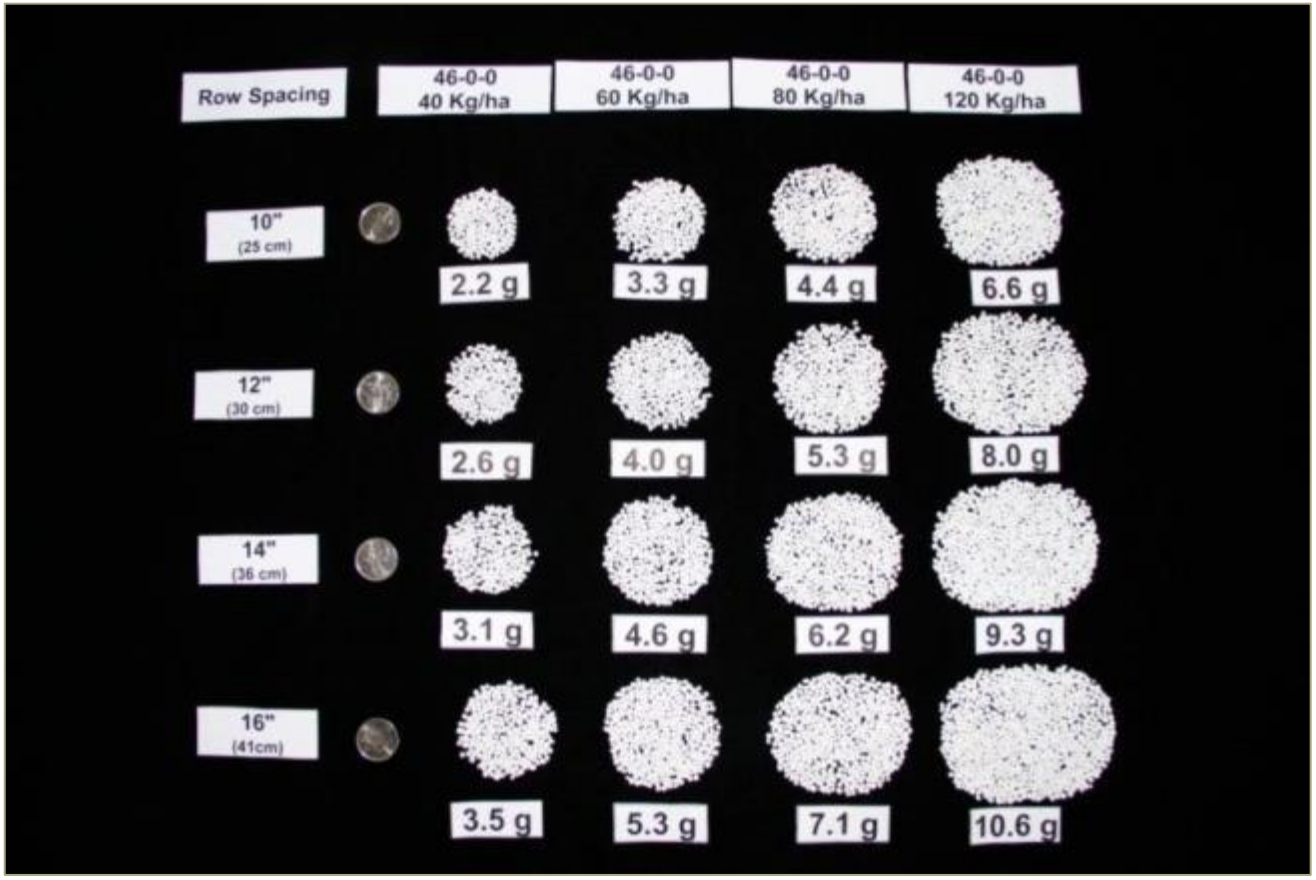
16" cm Spacing



IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SEED MASTER™

Row Spacing Effect on Banded Fertilizer Concentrations



- per 1 meter length of crop row

Oat Response to Row Spacing

Duration: 2009-11 (3 yr)

Treatments (20):

- 10, 12, 14 & 16” row spacing
- 18, 36, 53, 71 & 107 lb N/ac

Data Collected:

- Plant density
- Tiller frequency
- Panicle density
- Above-ground biomass
- Grain yield
- Grain quality

*Lafond et al. 2013. Agron. J. 105: 1-10.

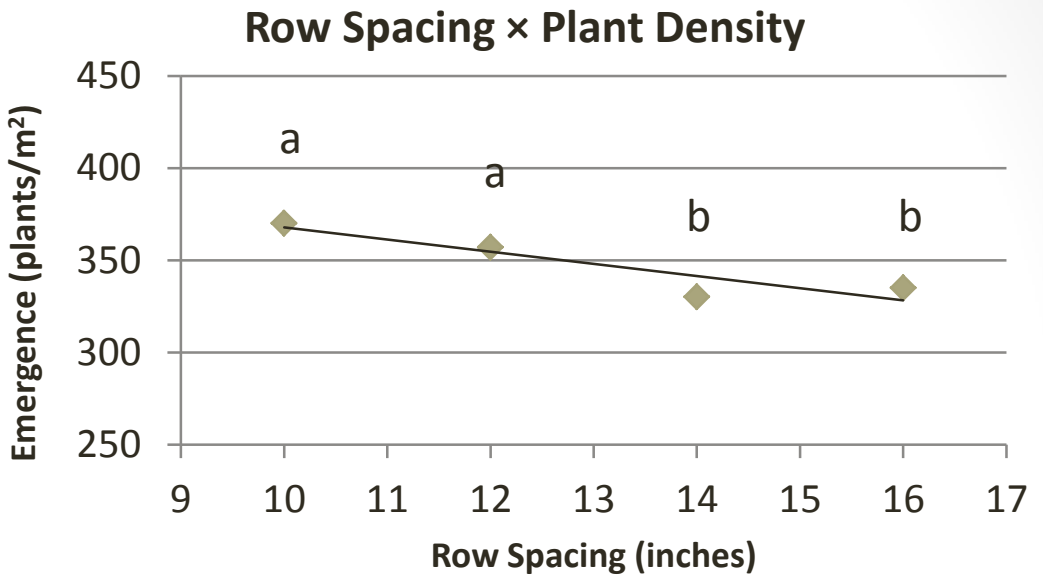
IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

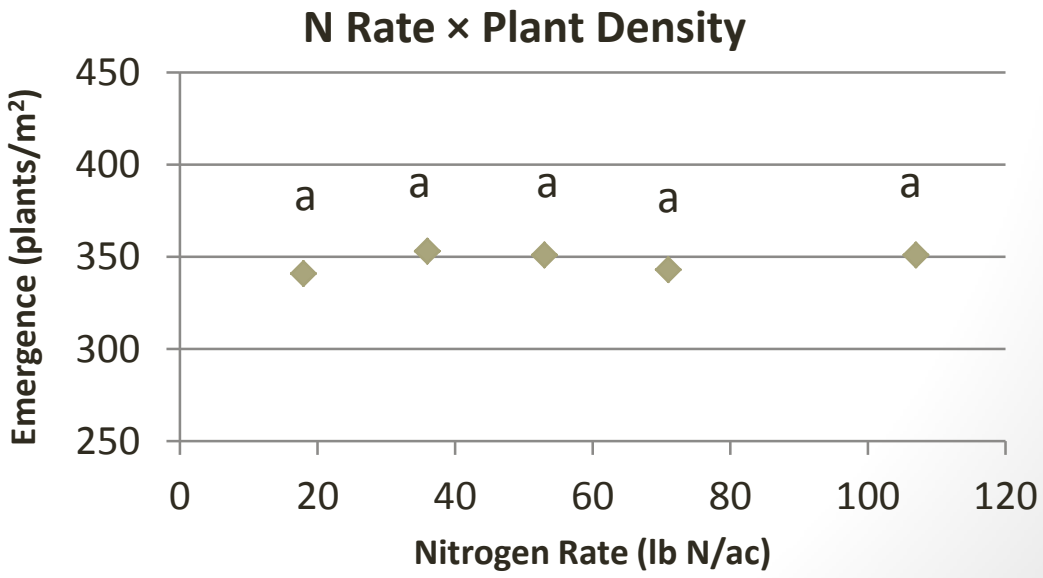
Saskatchewan Oat Development Commission

Oats: Effects on Plant Density

Tests of Fixed Effects:

- **Row spacing (R): 0.001**
- **R linear: <0.001**
- R quad: ns
- N Rate (N)*: ns
- N linear: ns
- N quad: ns
- R × N: ns
- **Year (Y): 0.003**
- Y × R: ns
- Y × N: ns
- Y × R × N: ns





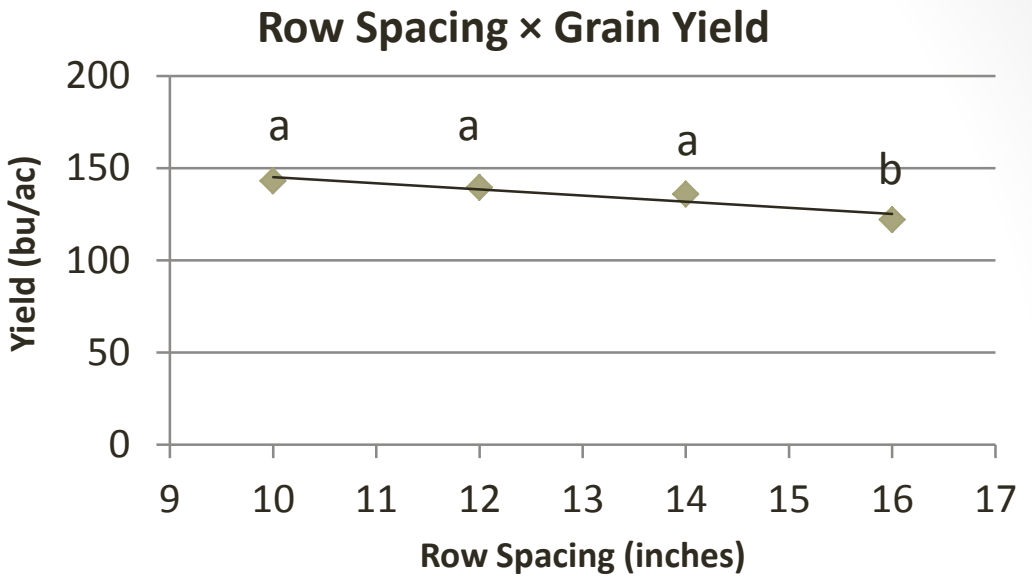
Saskatchewan Oat Development Commission

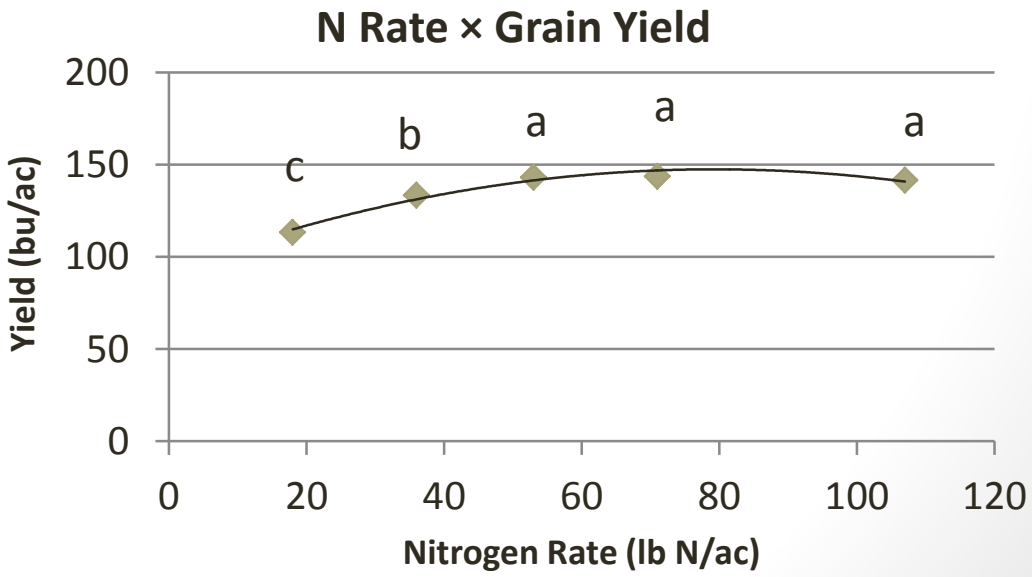
IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Oats: Effects on Grain Yield

Tests of Fixed Effects:

- **Row spacing (R): <0.001**
- **R linear: <0.001**
- R quad: ns
- **N Rate (N): <0.001**
- **N linear: <0.001**
- **N quad: <0.001**
- **R × N: 0.006**
- **Year (Y): <0.001**
- **Y × R: 0.012**
- **Y × N: <0.001**
- Y × R × N: ns

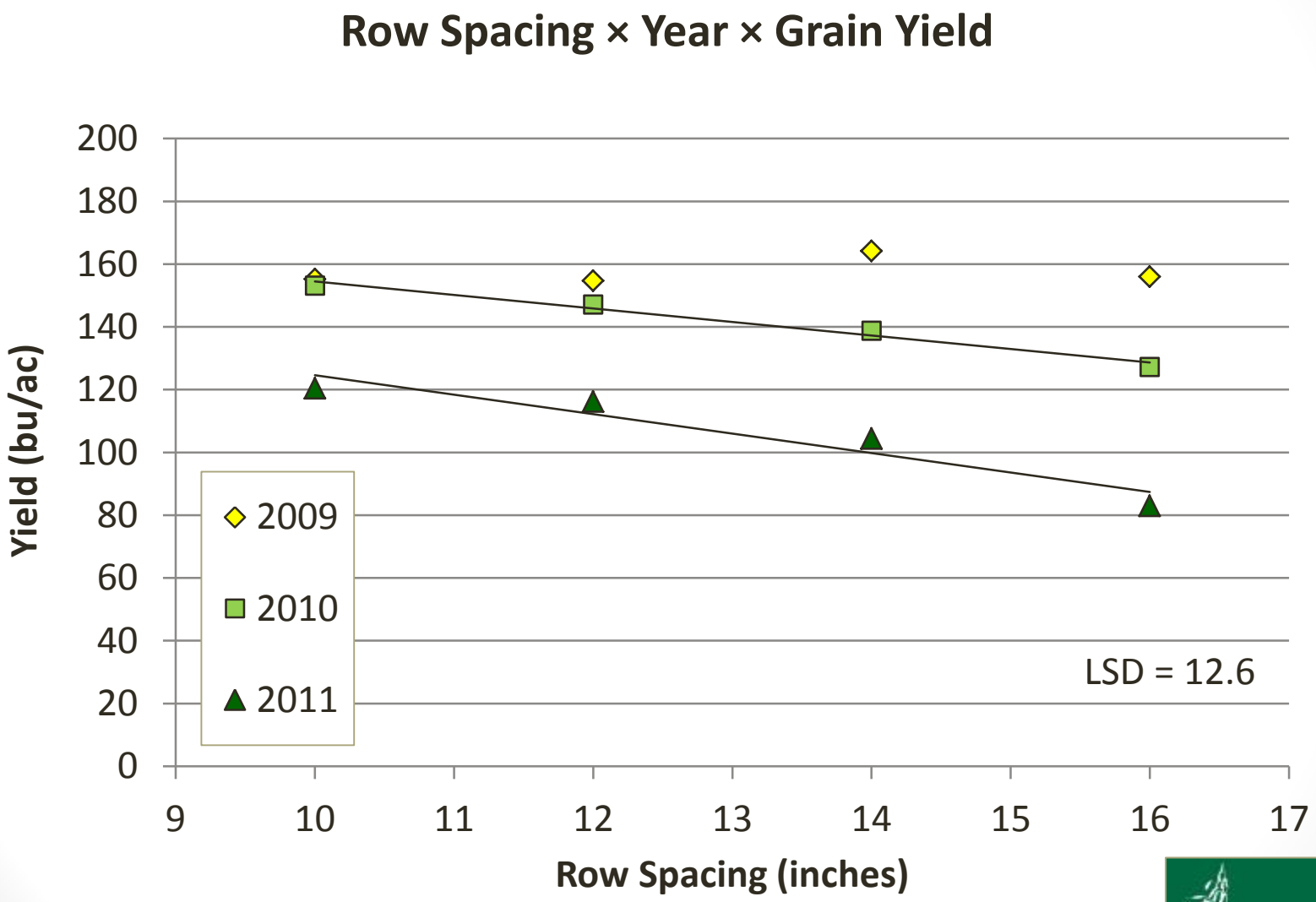




Saskatchewan Oat Development Commission

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Oats: Effects on Grain Yield



IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Saskatchewan Oat Development Commission

Oats: Effects on Grain Quality

Effect	Protein	Groat Yield	1000 seed wt	Test Weight	% Plump	% Thin
Spacing (R)	ns	ns	ns	ns	ns	ns
R linear	ns	ns	ns	ns	ns	ns
R quad	ns	ns	**0.014**	ns	ns	ns
N rate (N)	**<0.001**	ns	**<0.001**	**<0.001**	**<0.001**	**<0.001**
N linear	**<0.001**	ns	**<0.001**	**<0.001**	**<0.001**	**<0.001**
N quad	**<0.001**	ns	ns	ns	**0.036**	**<0.001**
R × N	ns	ns	ns	ns	ns	**<0.001**
Year (Y)	ns	**0.001**	**<0.001**	**0.001**	**0.002**	ns
Y × R	ns	ns	0.006	ns	ns	ns
Y × N	**<0.001**	ns	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Y × R × N	ns	ns	ns	ns	ns	ns

Wheat Response to Row Spacing

Duration: 2013-16 (4 yr)

Treatments (20):

- 10, 12, 14 & 16 row spacing
- 18, 36, 71, 107 & 142 lb N/ac

Data Collected:

- Plant density
- Head density
- Straw N
- Grain Yield
- 1000 seed weight
- Test weight
- Protein

Source: Bill May, AAFC

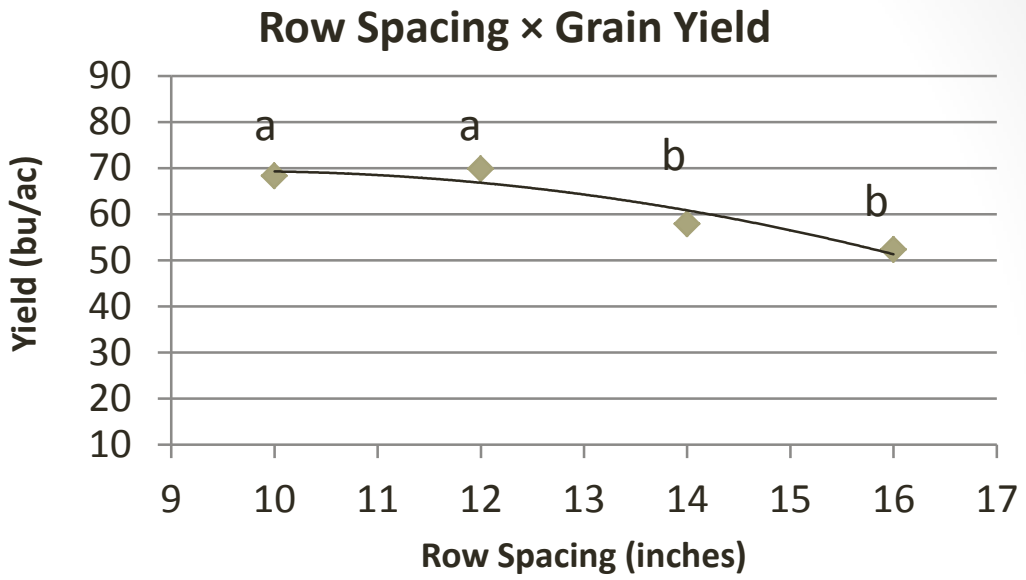
Wheat: Effects on Grain Yield

INDIAN HEAD - 2013

Row spacing (R): *P* = 0.010

N Rate (N): *P* <0.001

R × N: *P* = 0.939

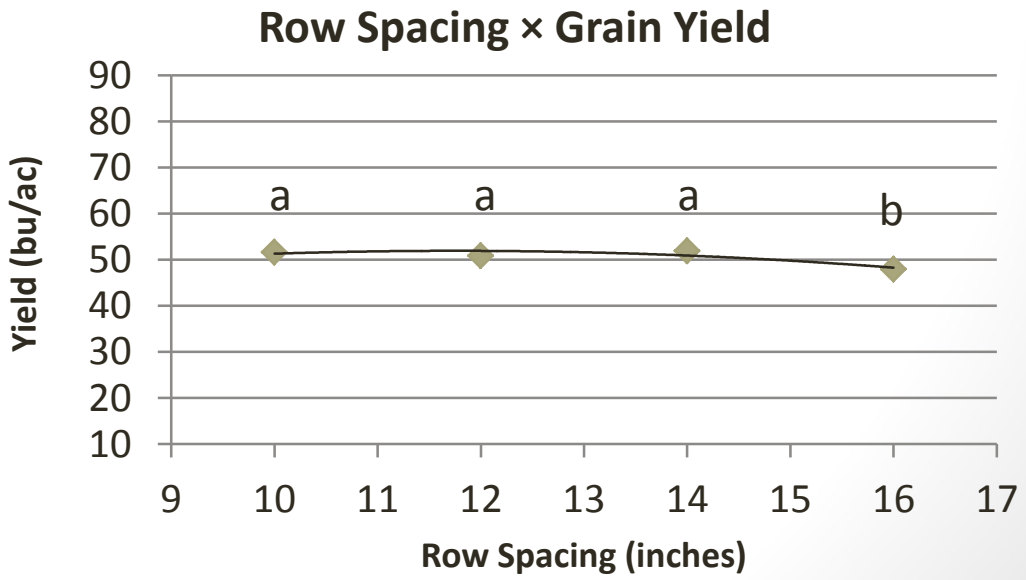


INDIAN HEAD - 2014

Row spacing (R): *P* = 0.033

N Rate (N): *P* <0.001

R × N: *P* = 0.437



Agriculture and Agri Food Canada | Agriculture et Agroalimentaire Canada

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SEED MASTER™

Source: Owen Kinch

SeedMaster Research Farm

HRSW 10" vs. 15" Row Spacing Trial

	year	Spacing	Grade Offer	Test Weight (lb/bu)	Protein (%)	Moisture (%)	Yield (bu/acre)
10"	2013	10"	#2 Red	62.50	13.70	15.60	58.92
	2014	10"	#2 Red	61.70	13.60	13.10	55.70
	2015	10"	#2 Red	62.90	14.70	13.90	58.93
			3 Year Average	62.37	14.00	14.20	57.85
15"	2013	15"	#2 Red	62.60	14.20	15.50	58.63
	2014	15"	#2 Red	61.80	13.60	13.10	54.10
	2015	15"	#2 Red	62.80	15.00	13.90	58.78
			3 Year Average	62.40	14.27	14.17	57.17

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

www.seedmaster.ca

Flax Response to Row Spacing

Duration: 2014-16 (3 yr)

Treatments (10):

- 10, 12, 14, 16 & 24” row spacing
- With and without foliar fungicide

Data Collected:

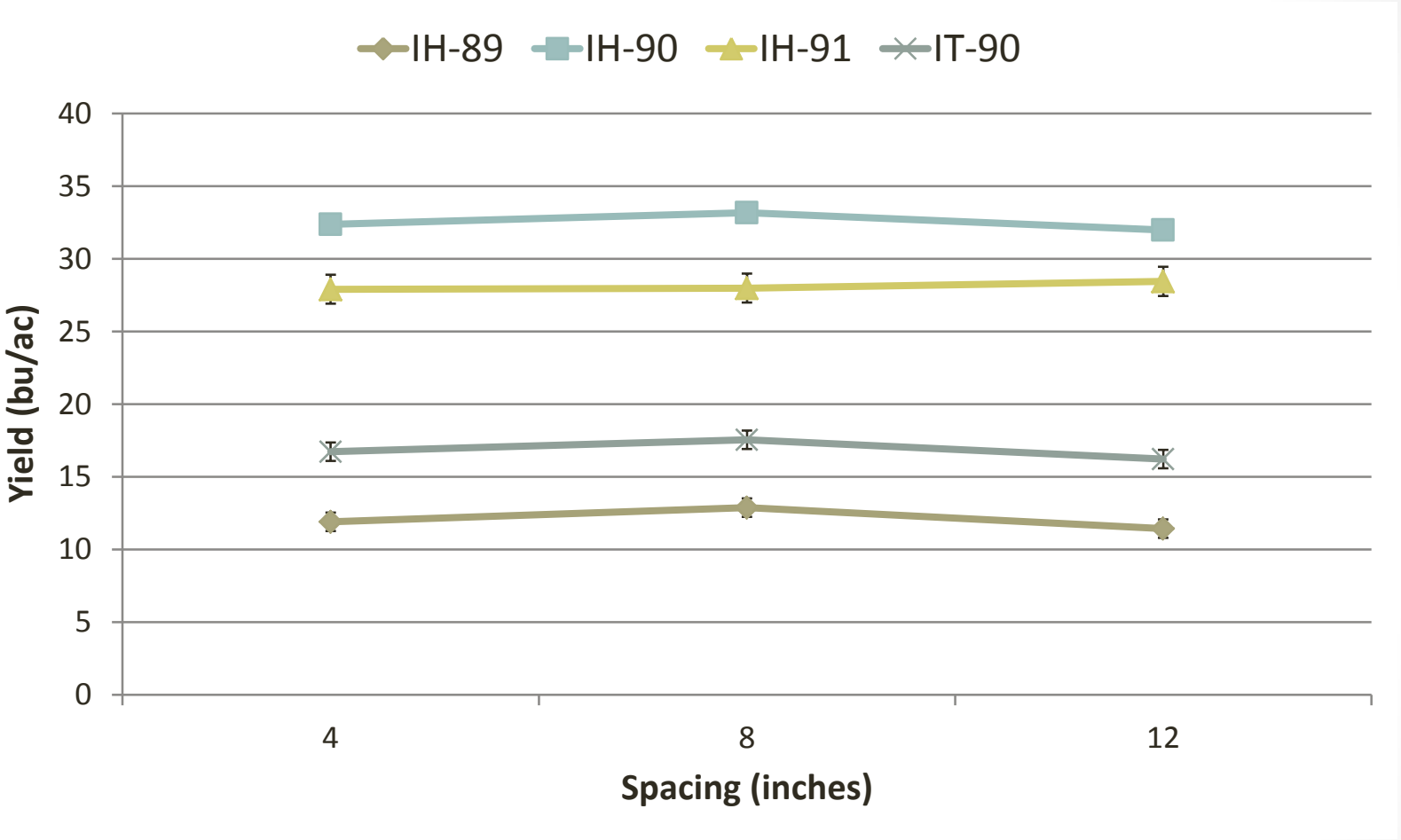
- Plant density
- Maturity
- Lodging
- Seed yield

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SaskFlax

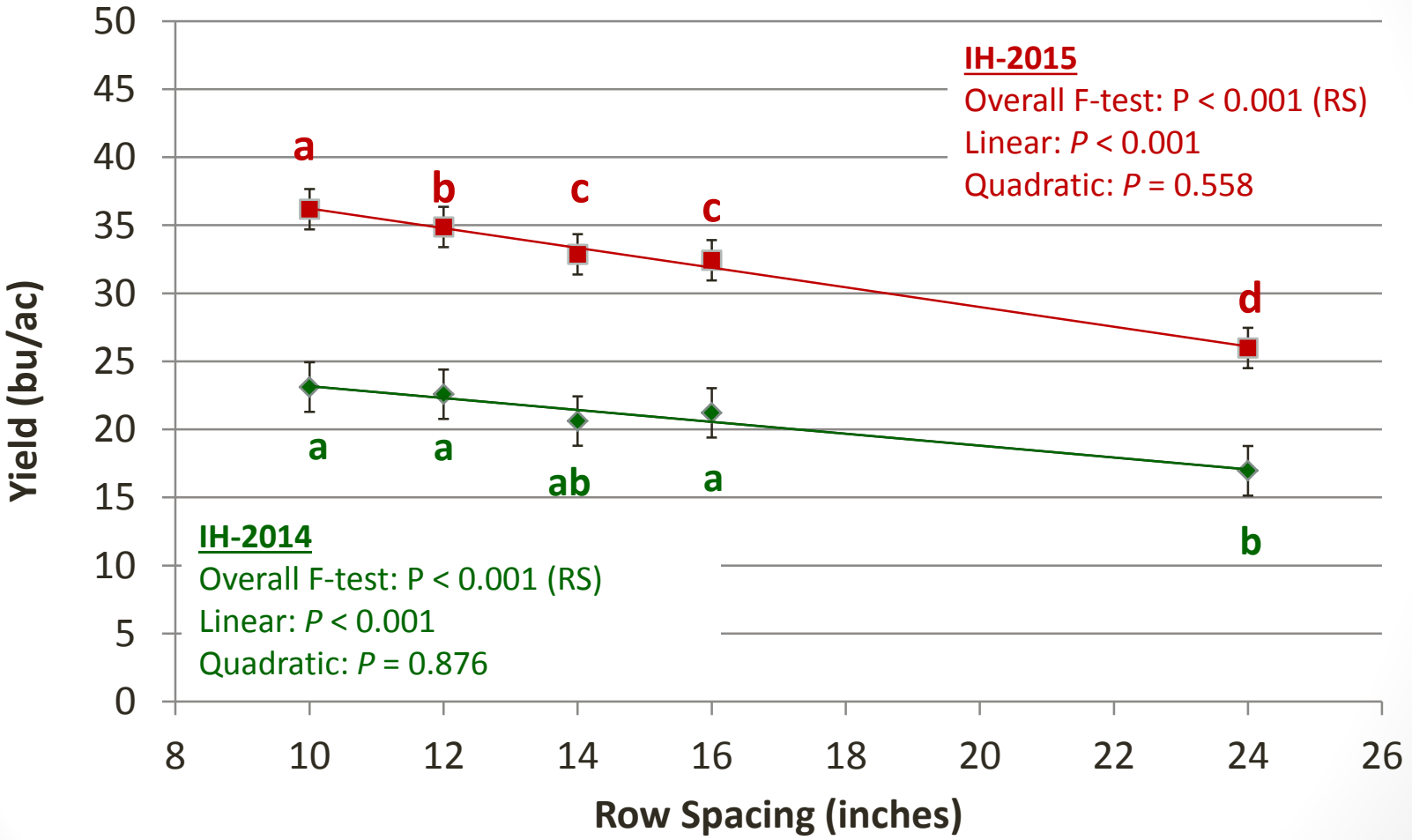
Canada

Optimum Row Spacing for Flax



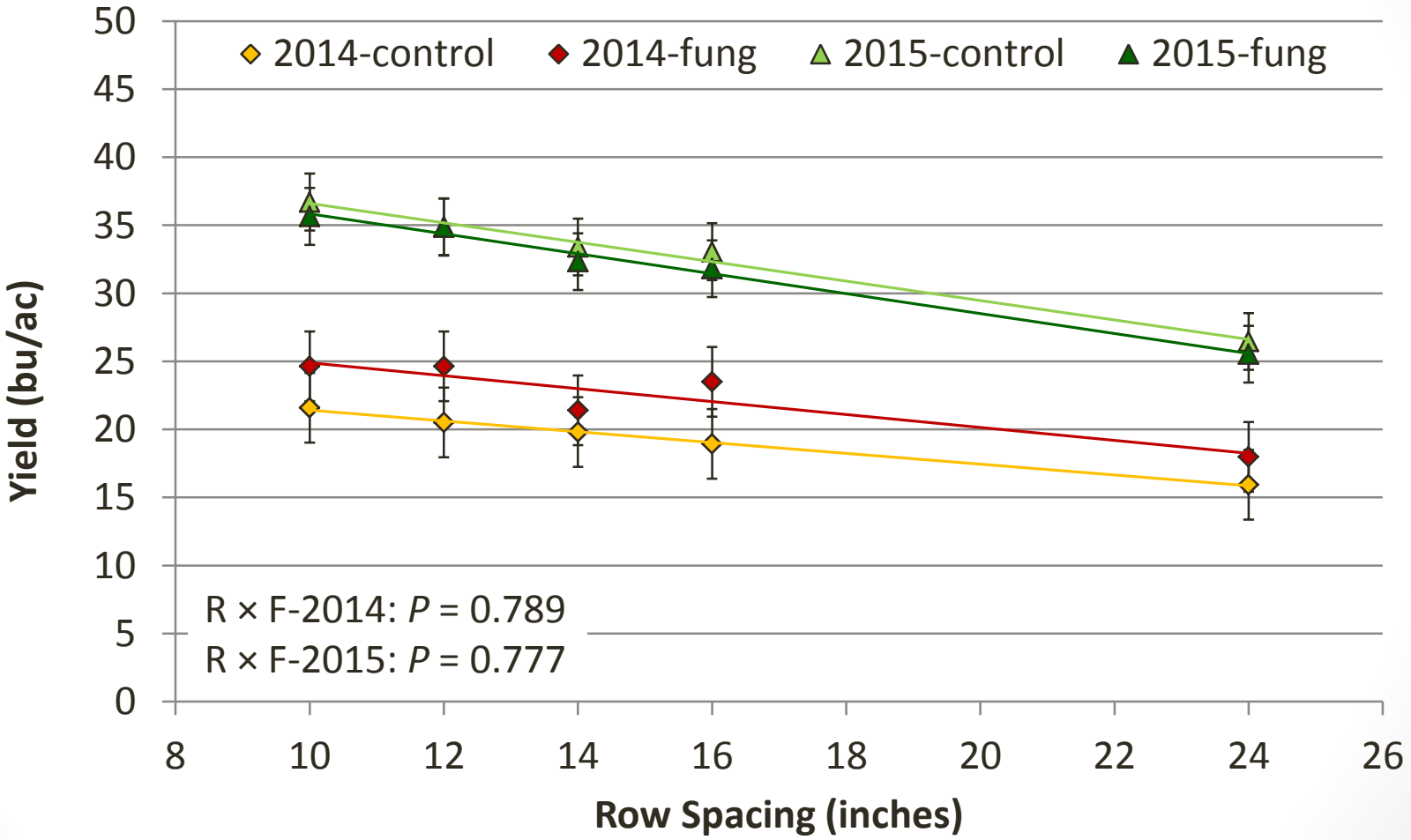
- Lafond (1992) showed declining plant density, increased height and no effect on yield as row spacing increased from 4 to 12" (Can. J. Plant Sci. 93: 375-382)

Flax: Effects on Seed Yield (IH-2014 & 2015)



IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION
SaskFlax
Canada

Row Spacing × Fungicide Effects on Flax Yield



IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SaskFlax

Canada

Flax at Varying Row Spacing (IH-2015)

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SaskFlax

Canada

Soybean Response to Row Spacing

Duration: 2014-17 (4 yr)

Treatments (15):

- 10, 12, 14, 16 & 24” row spacing
- 40, 50 & 60 seeds/m^2 (162-243k seeds/ac)

Data Collected:

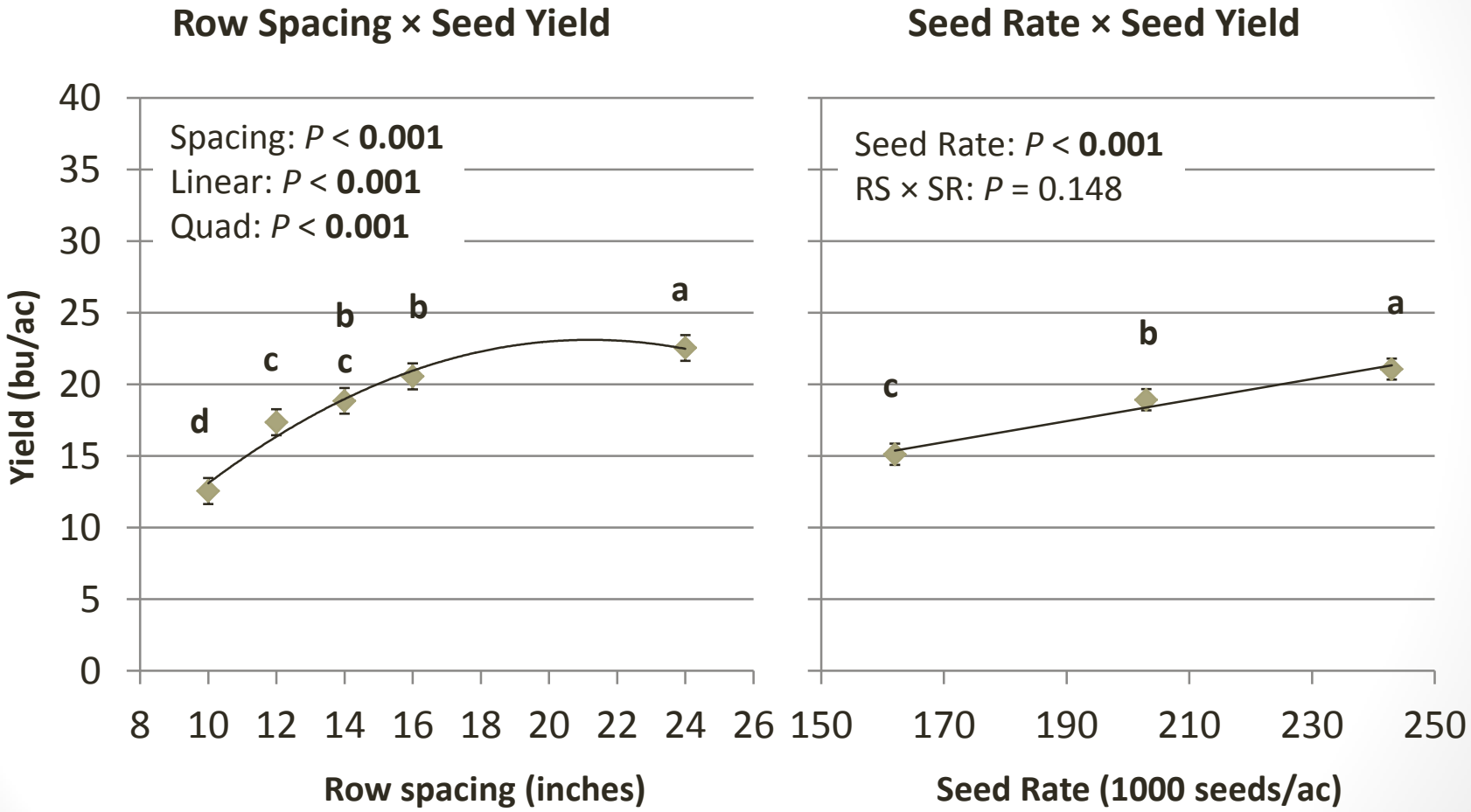
- Plant density
- Maturity
- Pod clearance
- Seed yield
- 1000 seed weight

SASKATCHEWAN pulse Growers

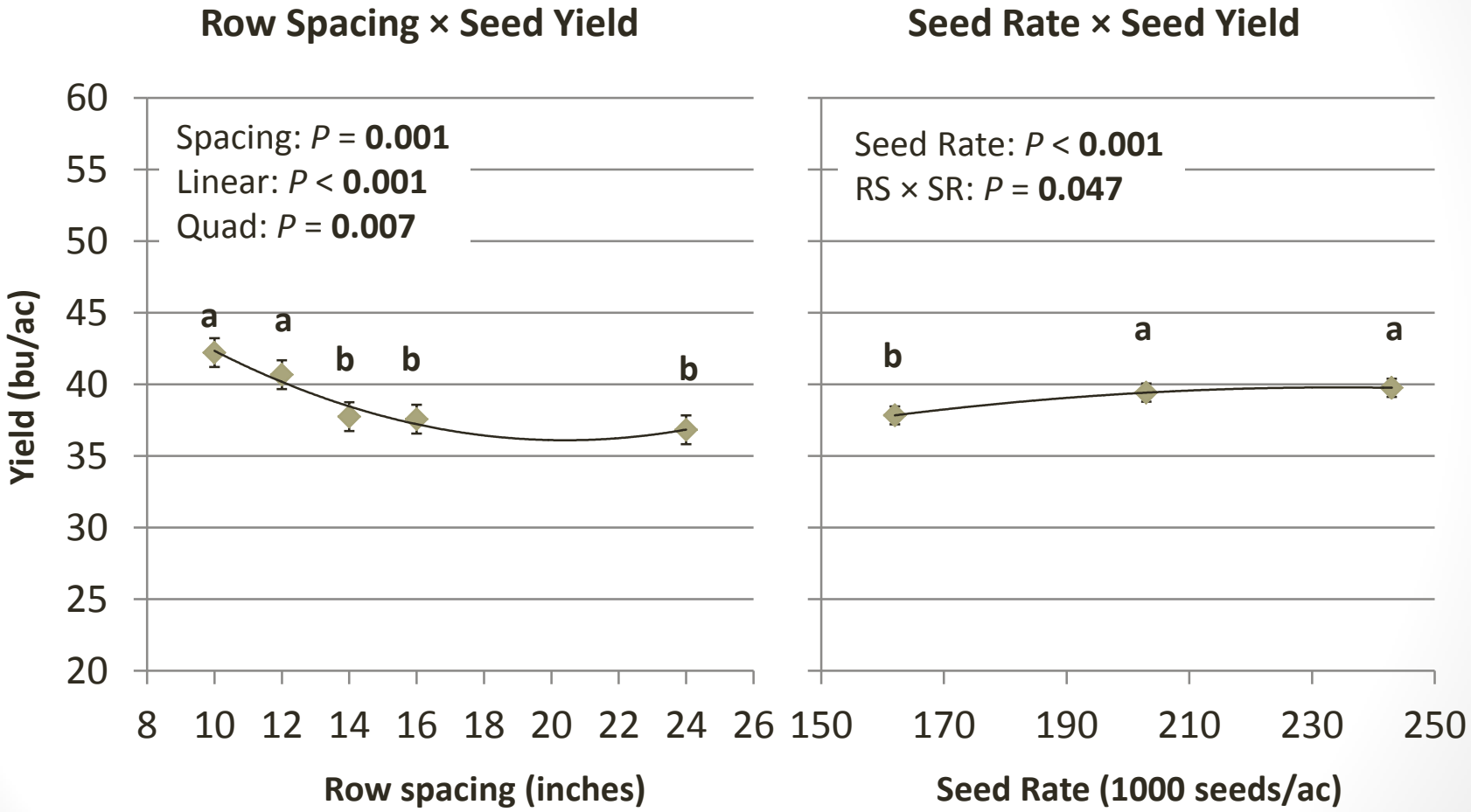
Agriculture and Agri Food Canada | Agriculture et Agroalimentaire Canada

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Soybeans: Effects on Seed Yield (IH-2014)



Soybeans: Effects on Seed Yield (IH-2015)

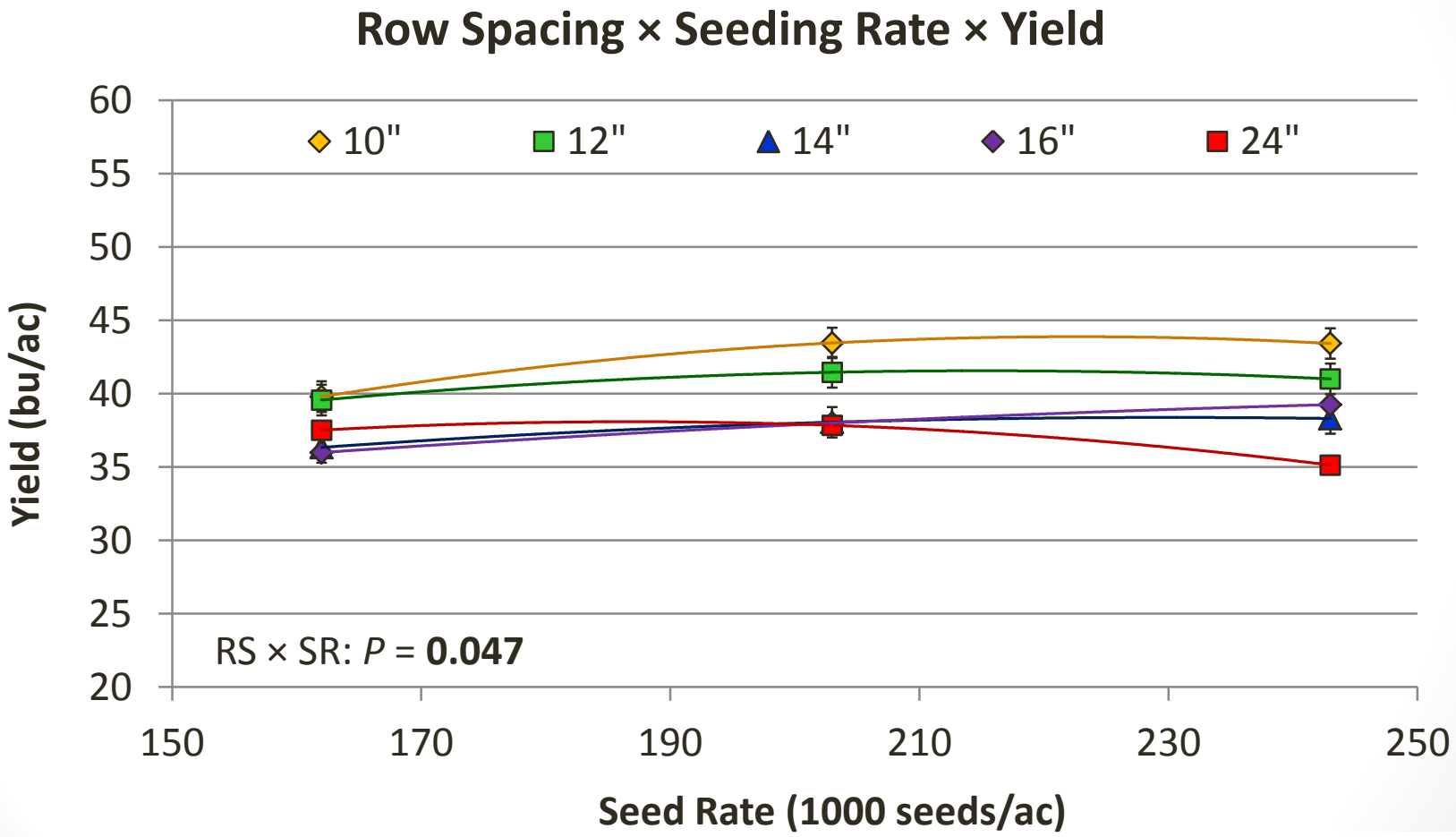


IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Agriculture and Agri Food Canada | Agriculture et Agroalimentaire Canada

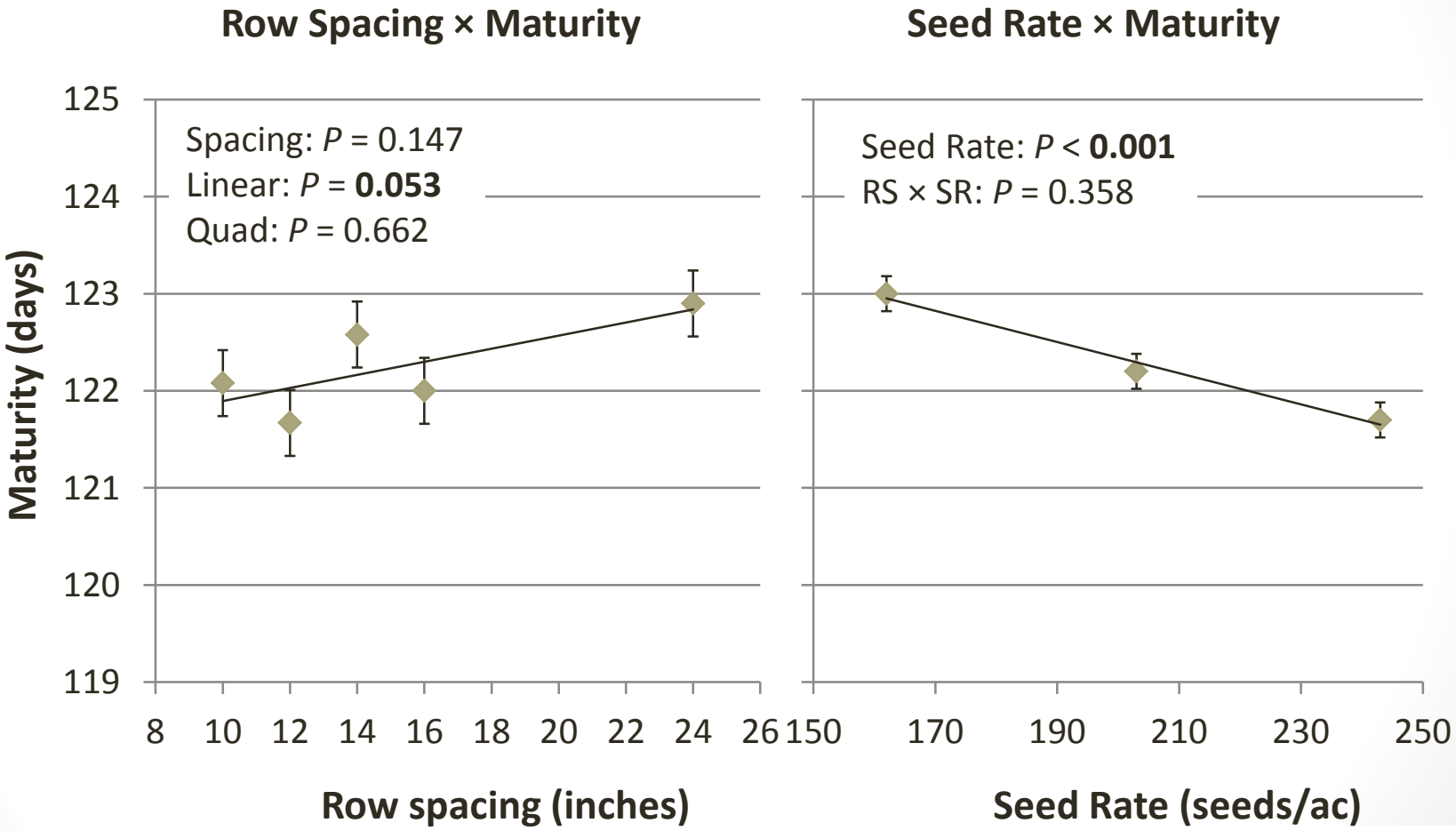
SASKATCHEWAN pulse Growers

Soybeans: Effects on Seed Yield (IH-2015)



IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION
Agriculture and Agri Food Canada
Agriculture et Agroalimentaire Canada
SASKATCHEWAN pulse Growers

Soybeans: Effects on Maturity (IH-2015)



Canola Response to Row Spacing

Duration: 2013-16 (4 yr)

Treatments (20, 20 & 10):

- 10, 12, 14, 16 & 24” row spacing (all trials)
- 0, 45, 90, 134 lb N/ac
- 30, 60, 90 & 120 seeds/m^2 (1.1-5.3 lb/ac)
- No in-crop herbicide & herbicide applied

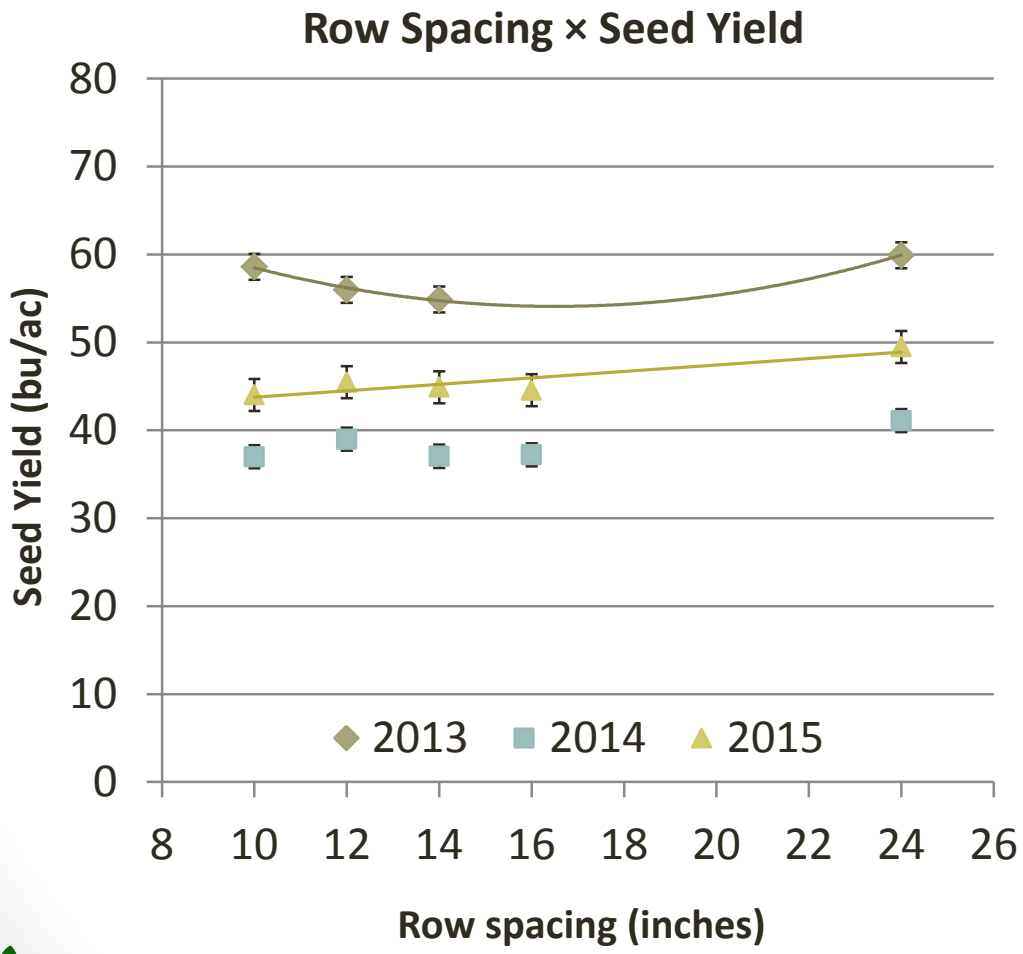
Data Collected:

- Plant density
- Flower dates
- Crop & weed biomass
- Maturity
- Seed yield
- 1000 seed weight
- Green Count

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SaskCanola™

Canola: RS Effects on Yield 2013-15 (RS × NR)

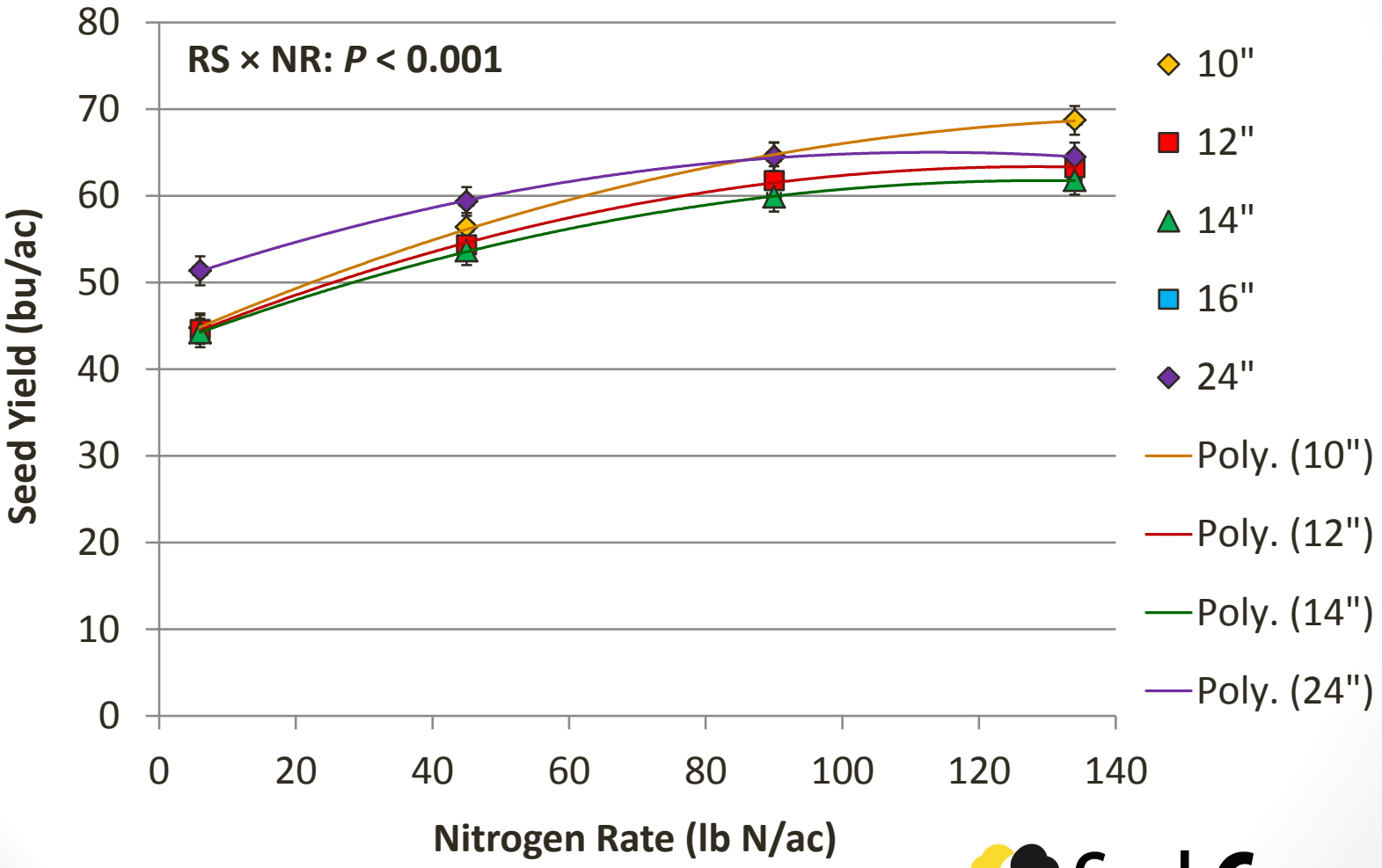


Effect	2013	2014	2015
	------- p-value -------		
RS	**0.024**	0.195	**0.009**
NR	**<0.001**	**<0.001**	**<0.001**
RS × NR	<0.001	0.391	**<0.001**
RS lin	0.061	0.195	**0.001**
RS quad	**<0.001**	0.063	0.169

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SaskCanola

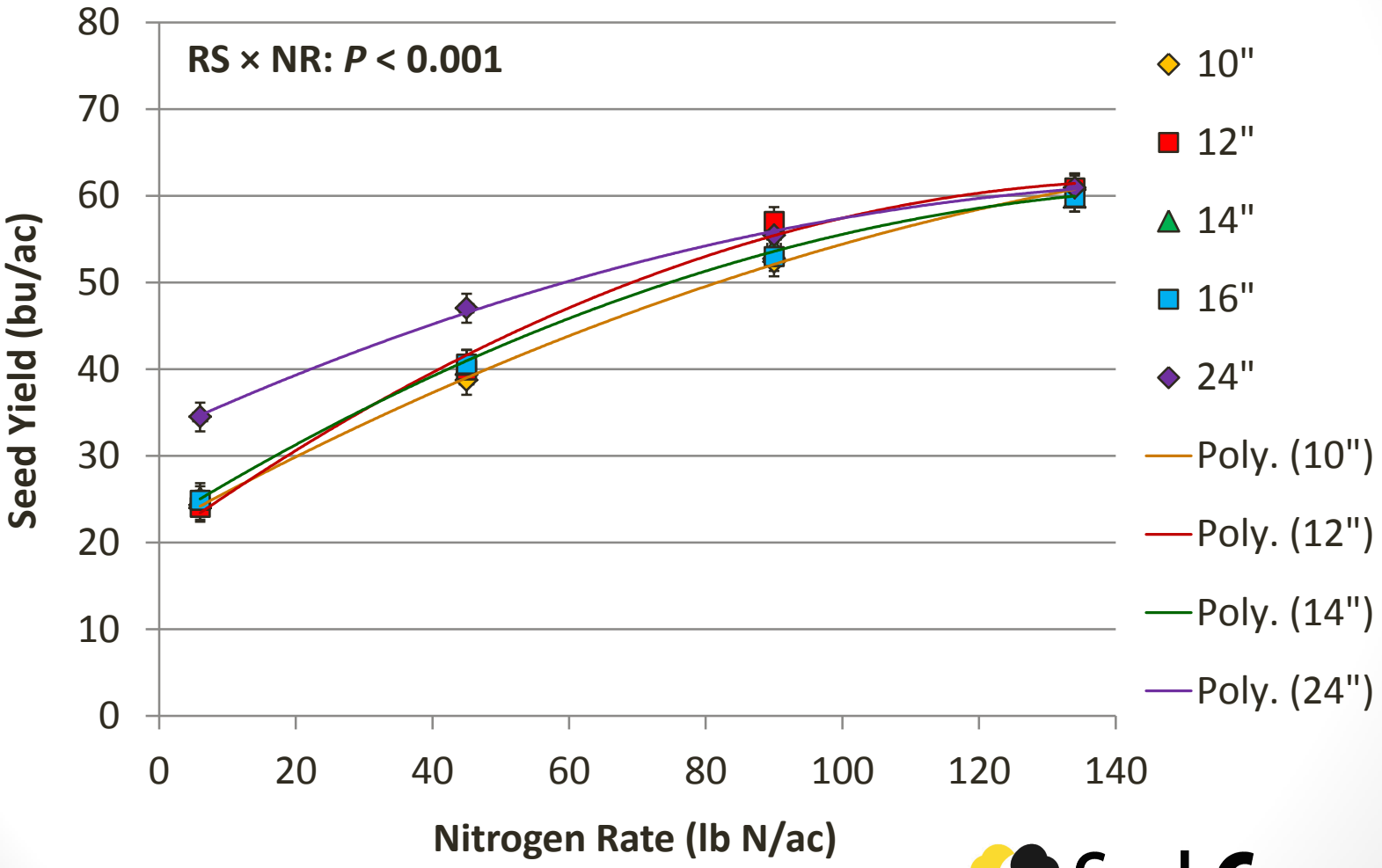
Row Spacing x N Rate Interactions (Indian Head 2013)



IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SaskCanola

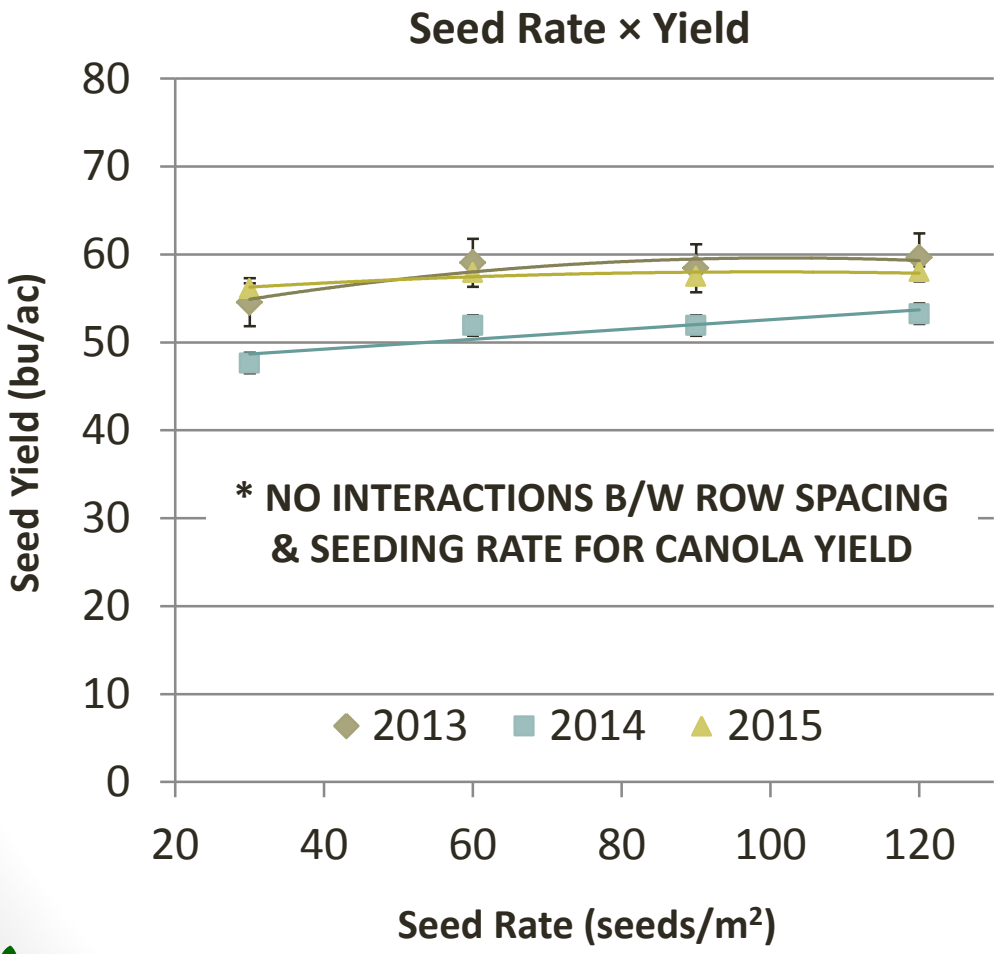
Row Spacing x N Rate Interactions (Indian Head 2015)



IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SaskCanola

Canola: SR Effects on Yield 2013-15 (RS × SR)

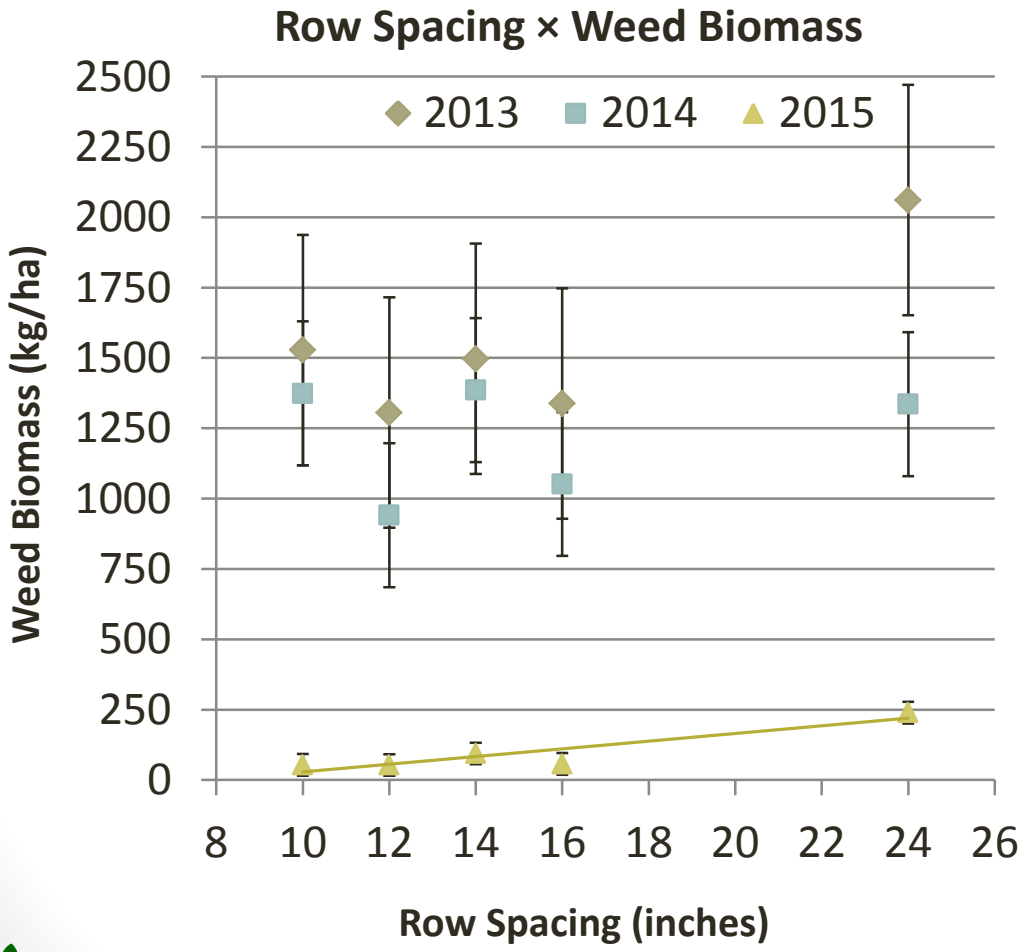


Effect	2013	2014	2015
	------- p-value -------		
RS	**0.002**	0.216	**<0.001**
SR	**<0.001**	**<0.001**	**<0.001**
RS × SR	0.748	0.807	0.072
SR lin	**<0.001**	**0.054**	**<0.001**
SR quad	**<0.001**	0.884	**0.031**

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SaskCanola

Canola: RS Effects on Weed Biomass 2013-15 (RS × HERB)

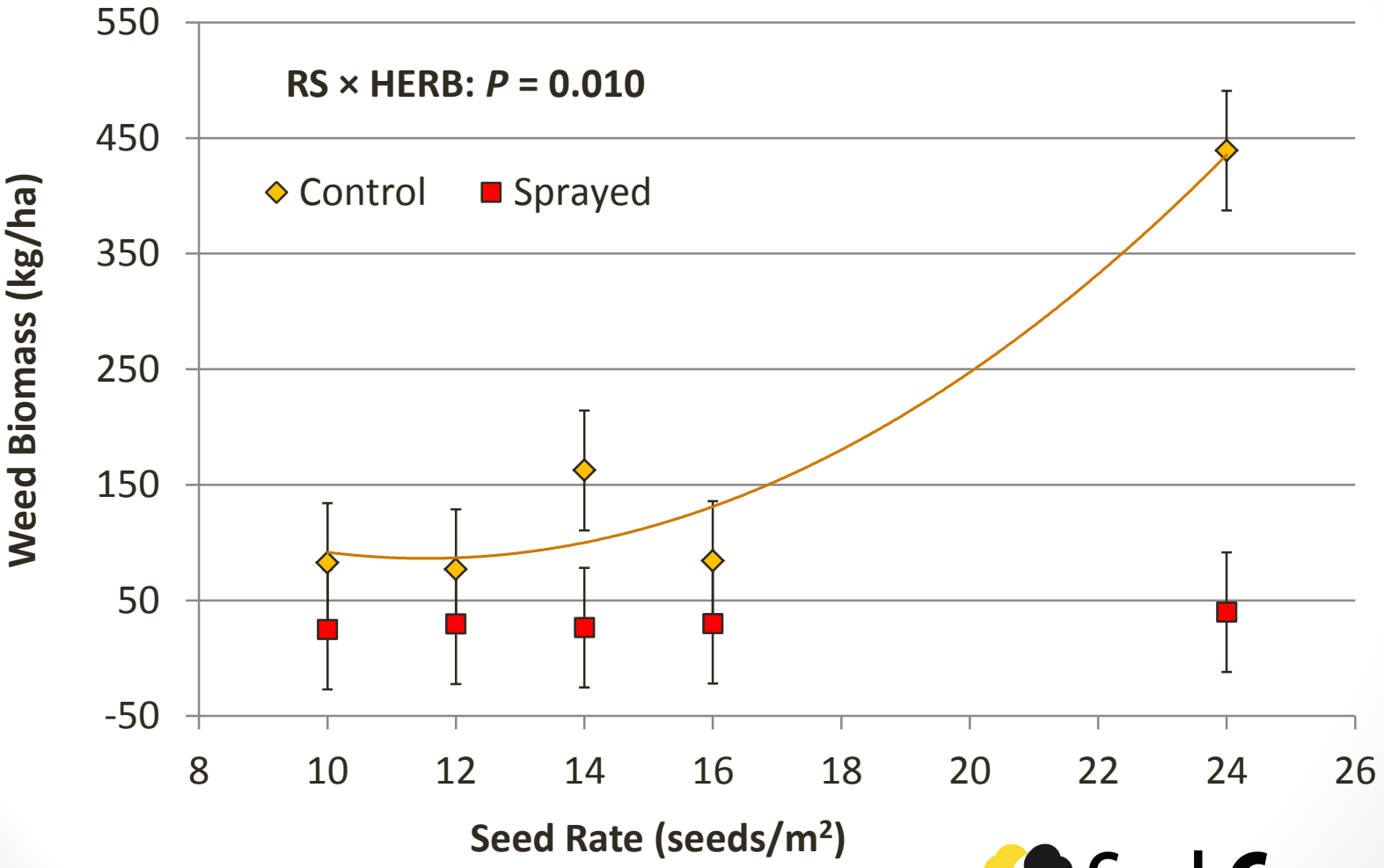


Effect	2013	2014	2015
	-------- p-value --------		
RS	0.440	0.546	**0.011**
HERB	**<0.001**	**<0.001**	**<0.001**
RS × HERB	0.657	0.594	**0.012**
SR lin	0.131	0.760	**0.001**
SR quad	0.316	0.482	0.176

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SaskCanola

Row Spacing x Herbicide Interactions (Indian Head 2015)



IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

SaskCanola

Take-home Messages

- Crops types evaluated vary in their ability to compensate for wide row spacing (work required on pea, lentil, faba bean & other cereals)

MOST SENSITIVE: FLAX > WHEAT ≥ OATS > SOYBEANS > CANOLA **:LEAST SENSITIVE**

- Seedling mortality increases with row spacing but still can achieve adequate plant populations & no negative row spacing effects on grain quality observed
- Maturity delays by row spacing less than that from ↑ fertility or ↓ plant density
- Sound agronomic management (i.e. timely & thorough weed removal) may be more critical with wider row spacing
- Overall, more yield variability with wider spacing but offsets to this include:
  - Reduced equipment cost, fuel consumption & horsepower requirements (per acre)
  - Reduce or eliminate tillage operations (including heavy harrowing) or other undesirable practices such as burning and seed under more challenging conditions
  - More timely seeding to due reduced land preparation requirements and/or larger drills
  - Improved soil & water conservation due to reduced disturbance & enhanced residues
  - Better suited for inter-row seeding resulting in improved seed-placement & further improvements in water conservation

Safe Rates of Seed-Placed vs Side-Banded Phosphorus Fertilizer in Canola

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Canada

2015 Canola P Demo (ADOPT)

Treatments (5 rates x 2 placements):

- 18, 36, 53, 71 & 89 lb P_2O_5 ha^{-1} either side-banded or seed-placed plus a 0P control (P source = 11-52-0)

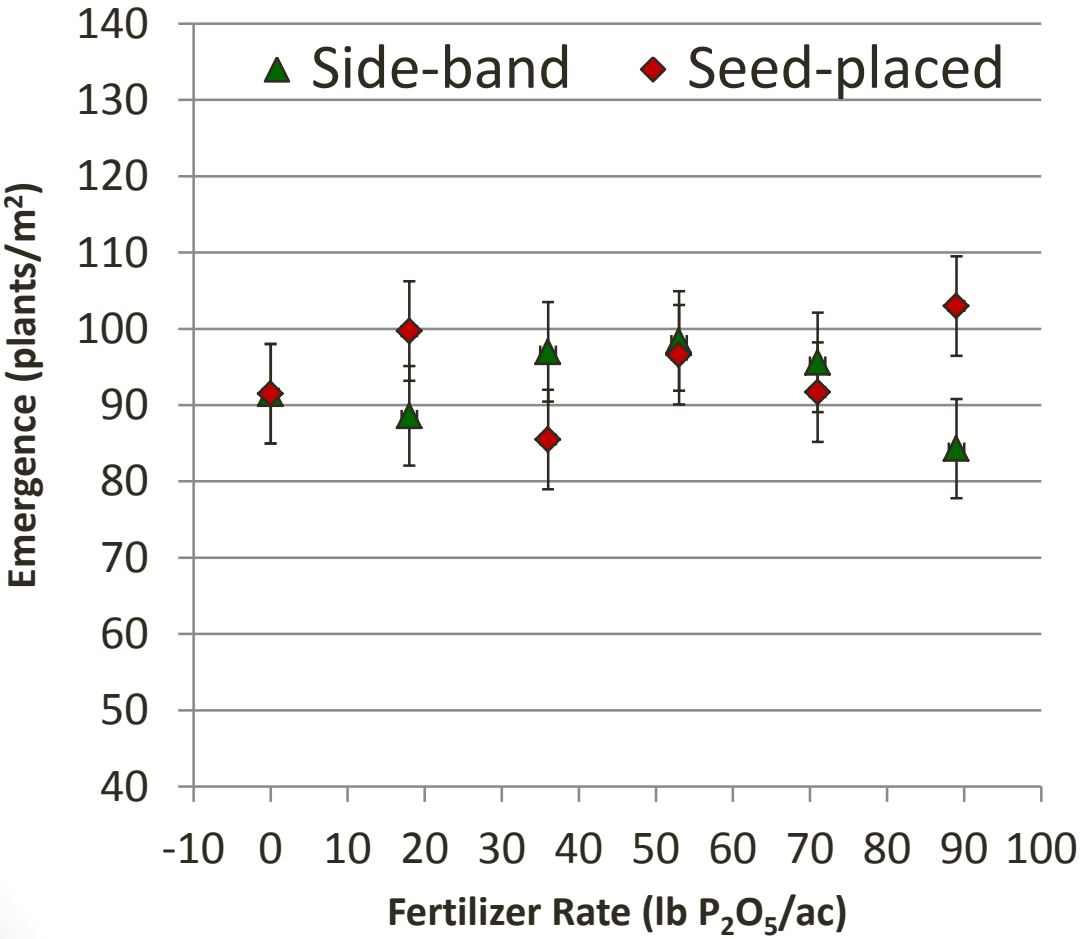
Data Collected:

- Emergence @ 2, 3 & 4 weeks past seeding
- Biomass @ 4 weeks past seeding
- Maturity
- Above-ground biomass
- Seed yield
- Thousand seed weight
- Percent green seed

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Canada

P Effects on Canola Emergence
(4 wk after planting)

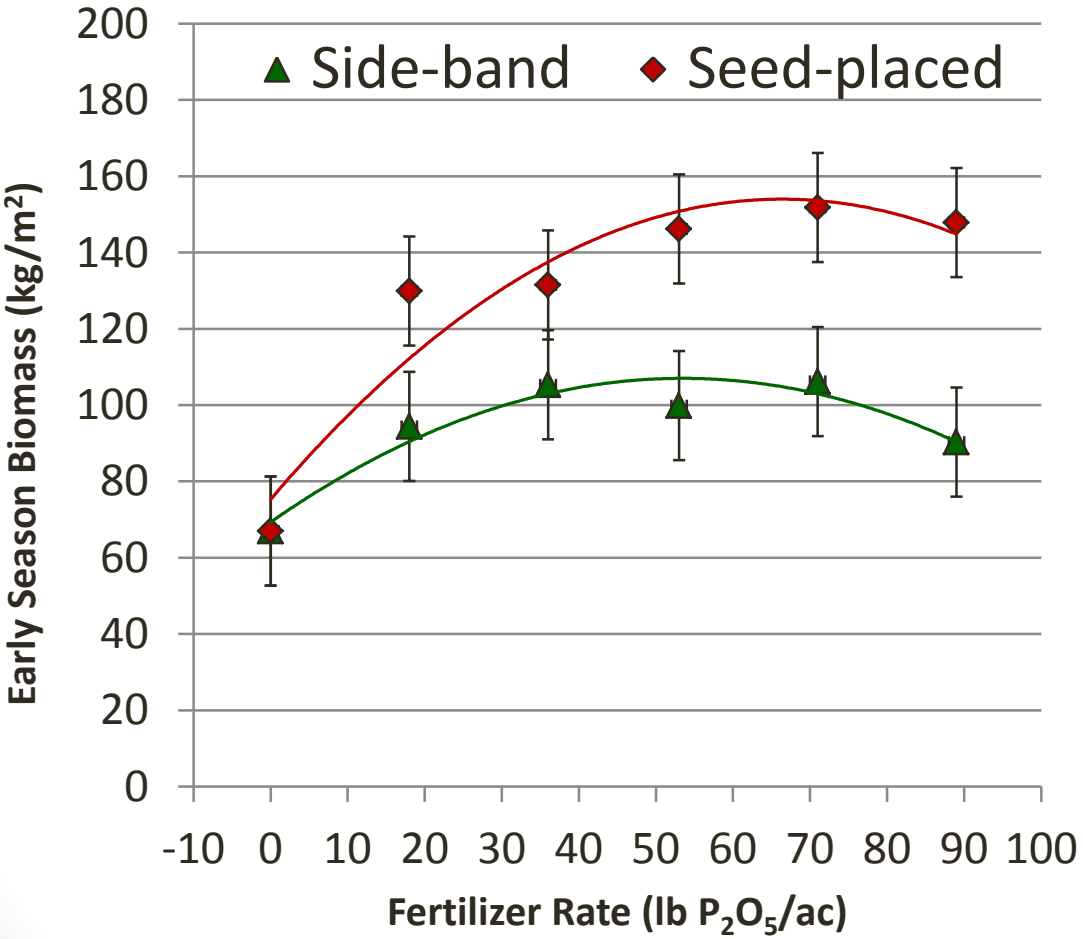


Effect / Contrast	Side-Band	Seed-Placed
Pr. > F	0.596	
Lin	0.804	0.422
Quad	0.156	0.387
0 P vs P	0.713	
SB vs SR	0.549	

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Canada

P Effects on Canola Biomass
(4 wk after planting)

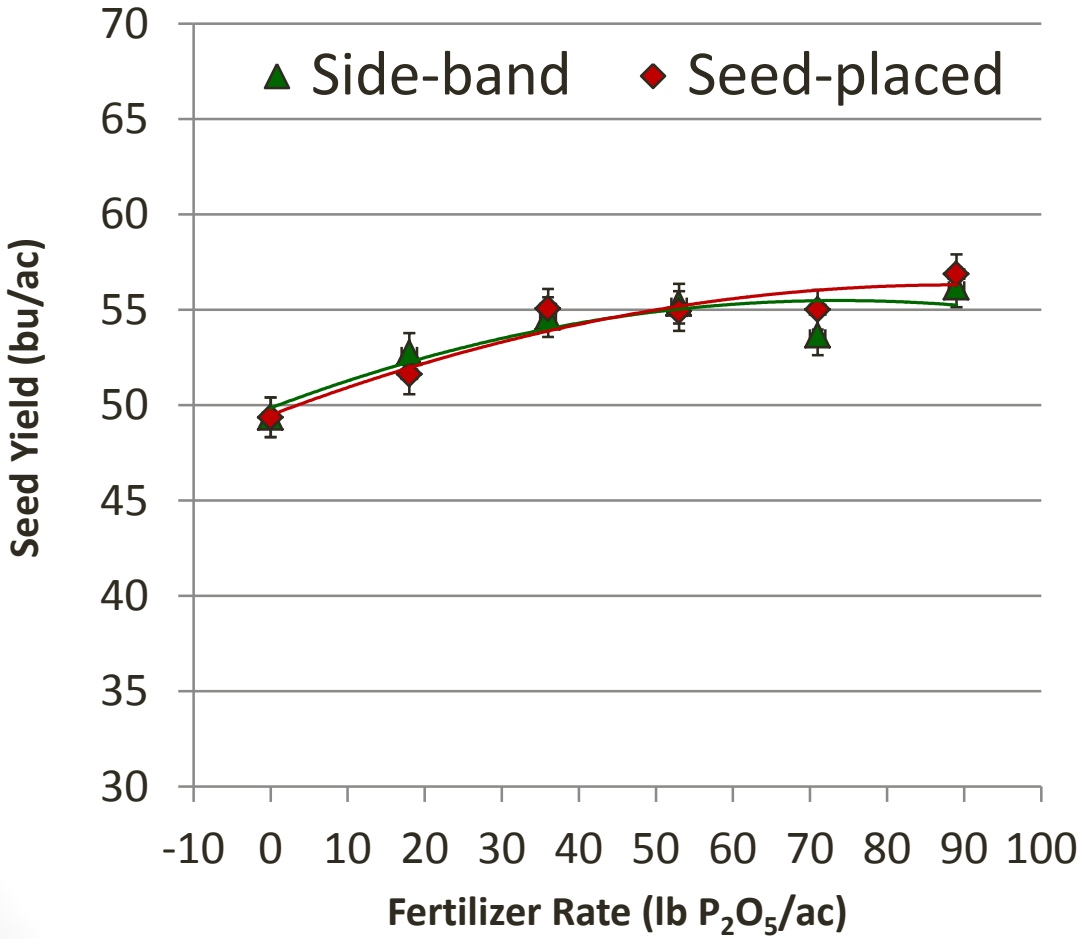


Effect / Contrast	Side-Band	Seed-Placed
Pr. > F	0.002	
Lin	0.228	0.000
Quad	0.081	0.021
0 P vs P	0.001	
SB vs SR	< 0.001	

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Canada

P Effects on Canola Yield



Effect / Contrast	Side-Band	Seed-Placed
Pr. > F	< 0.001	
Lin	< 0.001	< 0.001
Quad	0.010	0.017
0 P vs P	< 0.001	
SB vs SR	0.275	

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Canada

Take-home Messages

- **ONLY A SINGLE SITE-YEAR OF DATA, RESULTS MAY NOT BE REPEATABLE UNDER A BROADER RANGE OF CIRCUMSTANCES**
- 11-52-0 rate or placement had no effect on canola emergence
  - Clay loam soil, < 4% organic matter, 9 lb Olsen-P ac^{-1} (~6 ppm)
  - Seed-bed utilization ~6%, seeded into moisture then very dry
- Significant benefit to seed-placement for early season biomass (popup effect) but did not carry through to yield
  - May have economic value under some conditions (i.e. heavy flea beetles)
- Very strong overall yield response to P fertilization
  - 12% yield increase with rates of 36-89 lb P_2O_5, regardless of placement
- At ~55 bu ac^{-1}, this crop exported 52-63 lb P_2O_5 ac^{-1} upon harvest
  - P fertilization is for long-term productivity of fields and not just short term profitability of individual crops



Seed Rates & Fungicide to Manage FHB in Durum

2015 Durum FHB Demo (ADOPT)

Treatments (3 seed rates x 4 fungide):

- 200, 300 & 400 seeds m^{-2} seed rate
- Control, GS57-59, Fungicide @ GS60-65 & Dual application

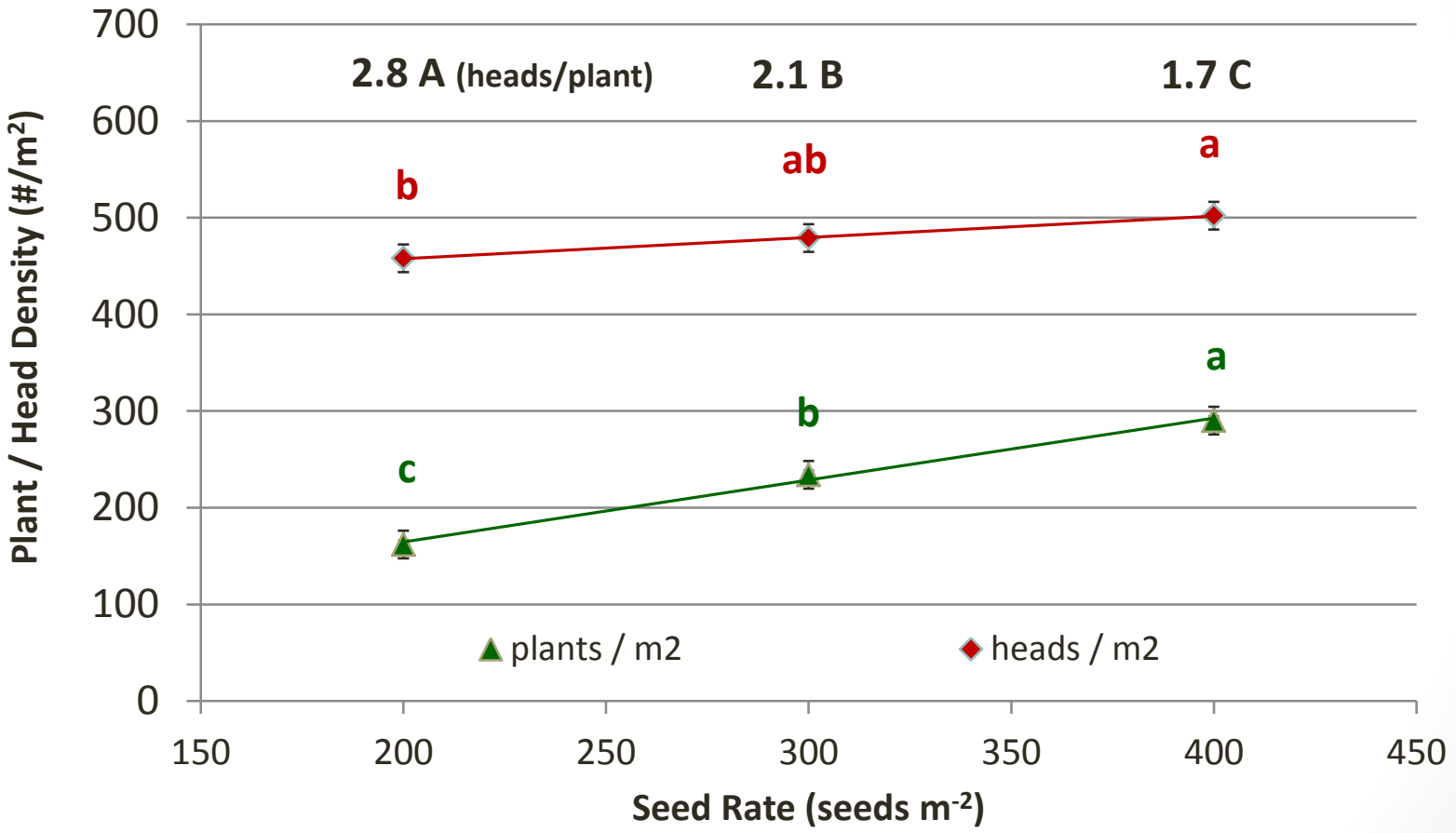
Data Collected:

- Plant density, head density, heads per plant
- Visible FHB ratings
- Grain yield
- Test weight
- Thousand seed weight
- Fusarium damaged kernels

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Canada

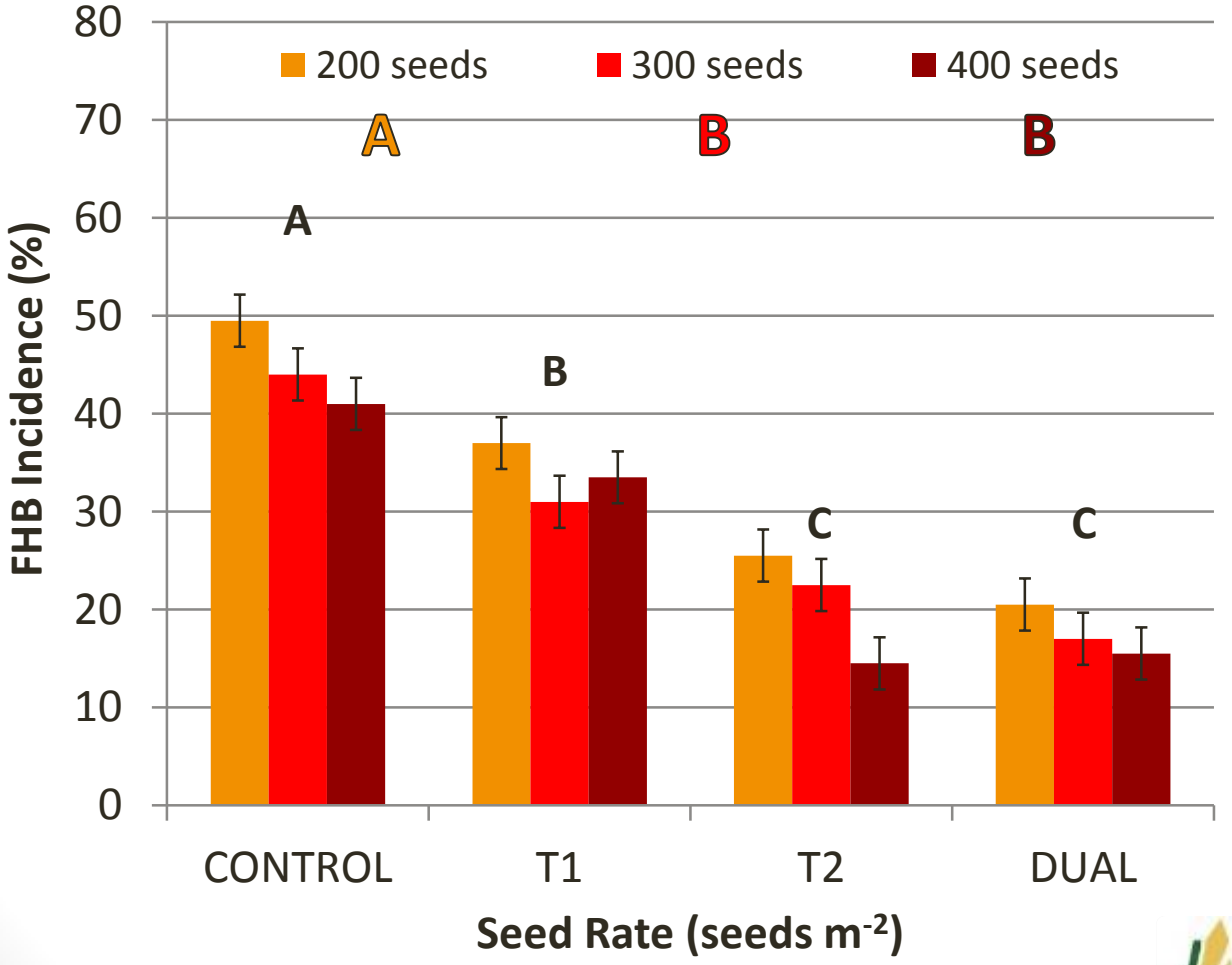
Seed Rate Effects on Durum Emergence, Head Density & Tillers (IH-2015)



IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Canada

Seed Rate / Fungicide Effects on FHB Incidence (IH-2015)

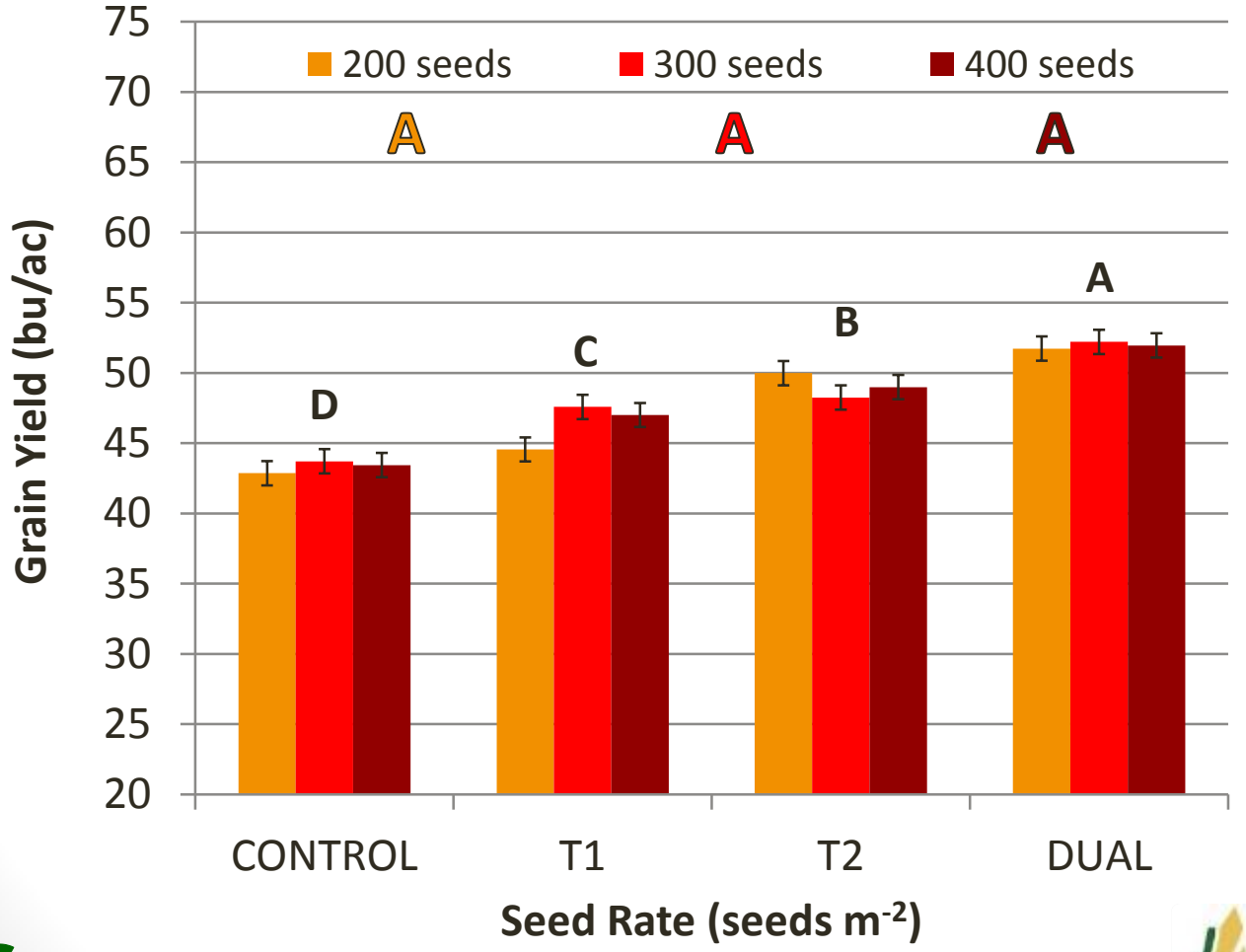


FHB Index (%)	
	p-value
Fung	< 0.001
SR	0.003
F × SR	0.601
C.V. (%)	18.1

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Canada

Seed Rate / Fungicide Effects on Grain Yield (IH-2015)



FHB Index (%)	
	p-value
Fung	< 0.001
SR	0.523
F × SR	0.252
C.V. (%)	3.6

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

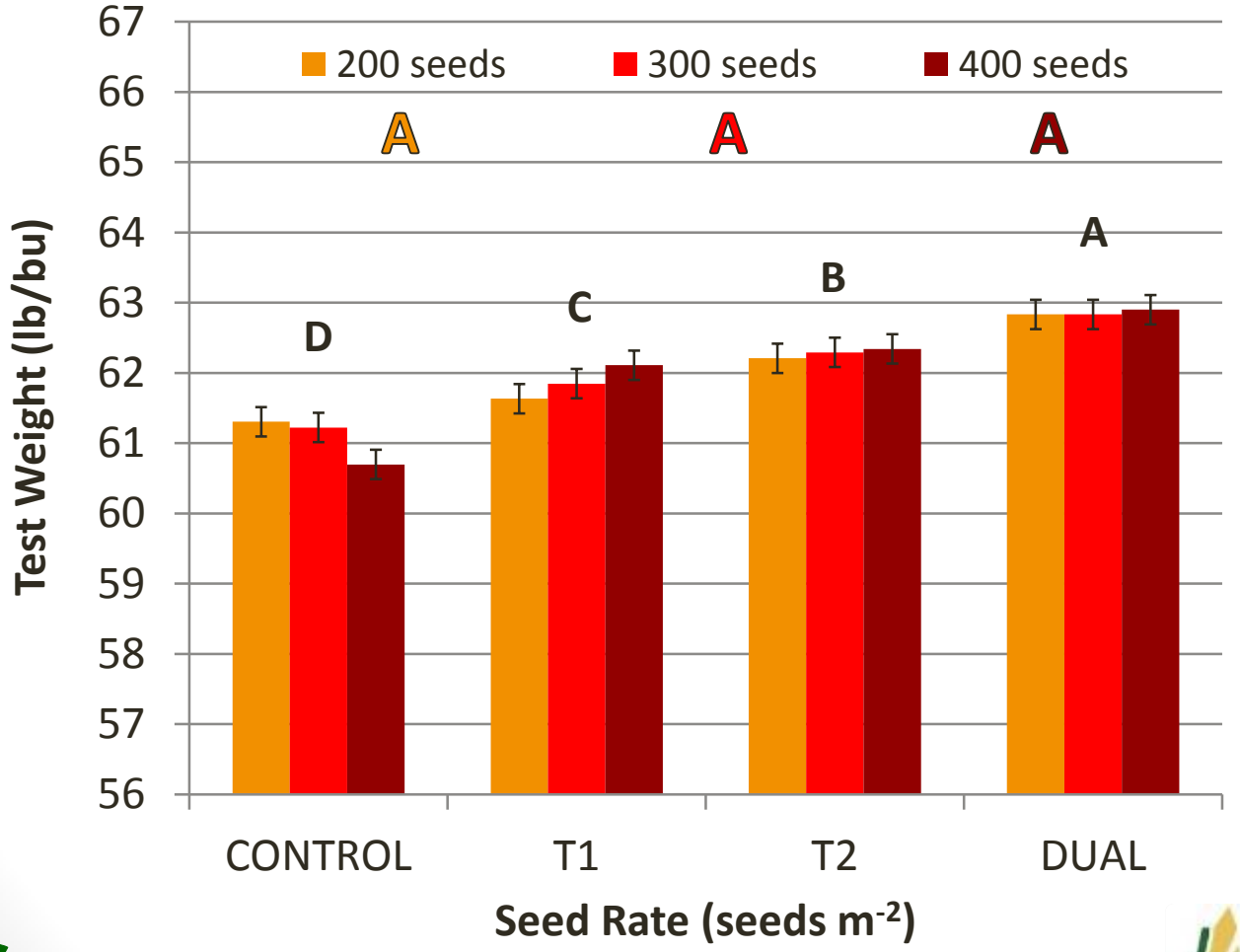
Canada

Fungicide Effects on Leaf Disease in Durum (Aug 10, 2015)

Unsprayed

Prosaro 250 EC at heading

Seed Rate / Fungicide Effects on Test Weight (IH-2015)

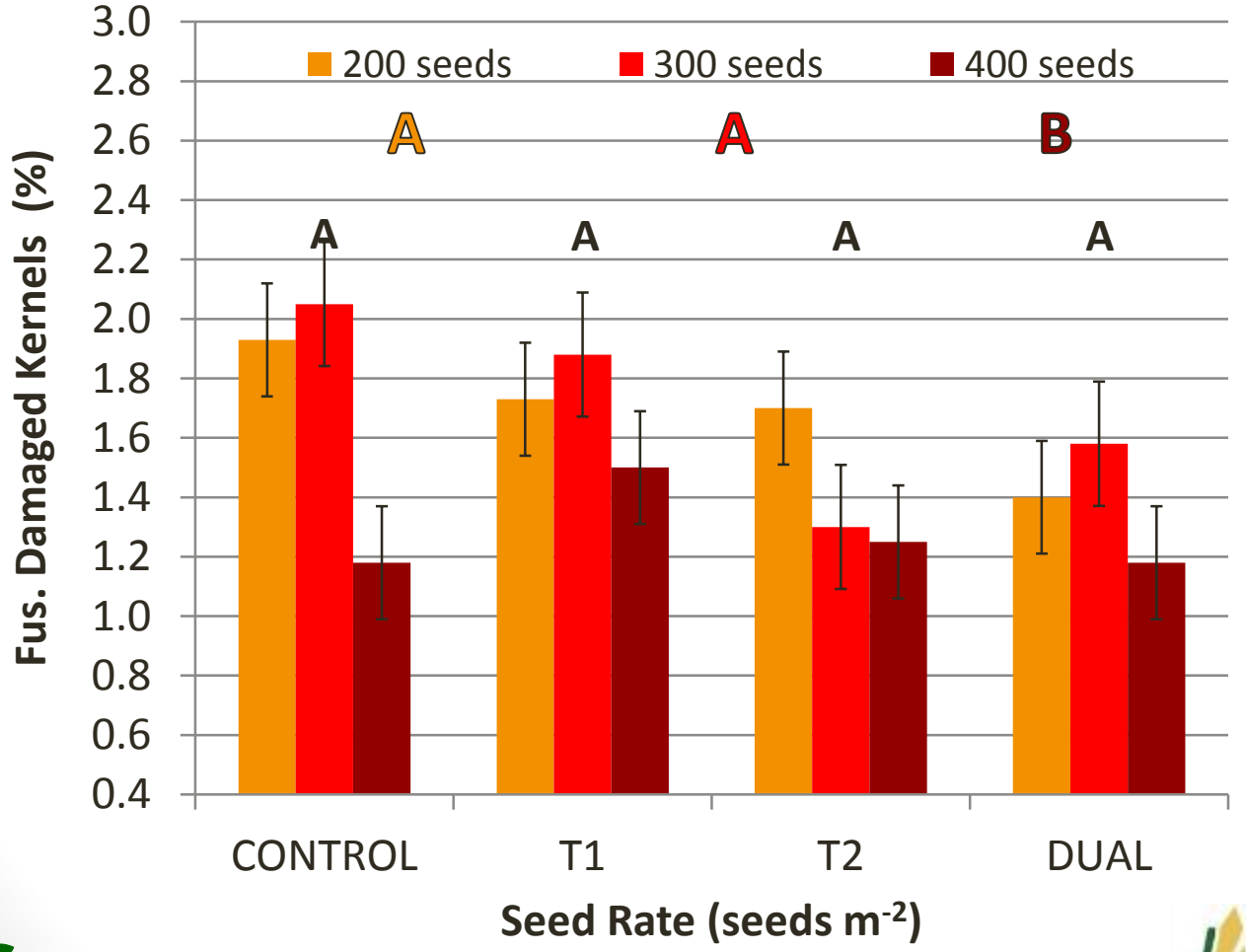


FHB Index (%)	
	p-value
Fung	< 0.001
SR	0.932
F × SR	0.294
C.V. (%)	0.7

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Canada

Seed Rate / Fungicide Effects on Fusarium Damaged Kernels (IH-2015)



FHB Index (%)	
	p-value
Fung	0.066
SR	0.004
F × SR	0.349
C.V. (%)	24.5

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Canada

Take-home Messages

- **ONLY A SINGLE SITE-YEAR OF DATA, RESULTS MAY NOT BE REPEATABLE UNDER A BROADER RANGE OF CIRCUMSTANCES**
- ↑ seed rates reduced tillering & promoted uniform heading
- Fungicide reduced visible FHB infection but timing critical
  - T2 much better than T1 which was < 3 days earlier
  - Tendency (not significant) for less visible FHB at high seed rates
- Strong yield response to fungicide (but not seed rate) where check < T1 < T2 < Dual (20% yield increase w/dual app)
- Fungicide increased test weight (check < T1 < T2 < Dual) but only slight (not significant) reduction in FDK (T2 & Dual only)
- High seeding rate (400 seeds m^{-2}) had a more consistent, positive impact on FDK than fungicide applications

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

THANK YOU

Chris Holzapfel, MSc Pag
Research Manager, IHARF
Phone; 306-695-4200
Email: cholzapfel@iharf.ca
Website: www.iharf.ca
Twitter: @IHARF_SK

IHARF Crop Management Field Day (July 19 2016)