

Row Spacing Effects on Various Crops

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Indian Head Agricultural Research Foundation

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Funding and Acknowledgments

- **Contributing Scientists: Dr. Guy Lafond & Bill May (AAFC)**
- **Financial support for this work was provided by:**
  - Saskatchewan Canola Development Commission
  - Saskatchewan Oat Development Commission
  - Saskatchewan Pulse Growers
  - ADOPT Program (SK Ministry of Agriculture and AAFC)
  - Agriculture & Agri-Food Canada (AIP Program & Indian Head Research Farm)
- **Additional in-kind support provided by:**
  - SeedMaster Manufacturing, Saskatchewan Flax Development Commission, Bayer CropScience, Dupont-Pioneer, BASF, Syngenta and Dow AgroSciences

Row Spacing Challenges

- Commonly accepted that narrow row spacing gives the greatest potential grain yields for majority of crops under most circumstances
- No-till combined w/retaining residues (i.e. taller stubble) & continuous cropping is also beneficial but creates seeding challenges
- One solution has been to increase row spacing but there are limits as to the extent to which this can be done without compromising yield
- Most research shows that spacing of at least 12” is possible without reducing yield for most crops; however, results can vary depending on crop management & environmental conditions
- Challenging to avoid biases in row spacing research due to:
  - Soil disturbance
  - Fertilizer placement
  - Harvest area and managing edge effects

Equipment

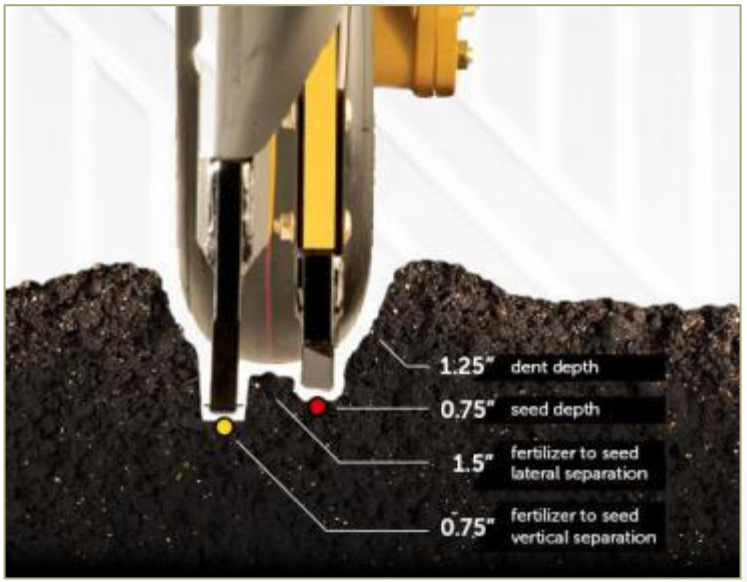

Image Source: www.seedmaster.ca

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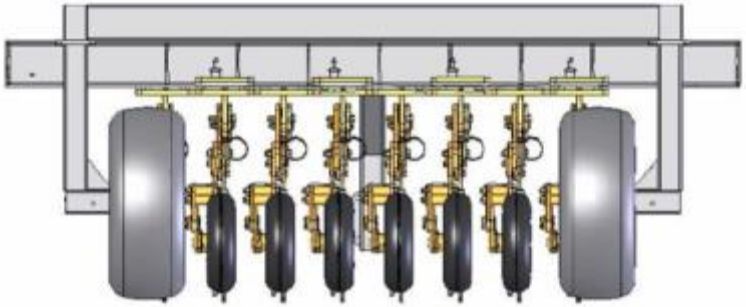
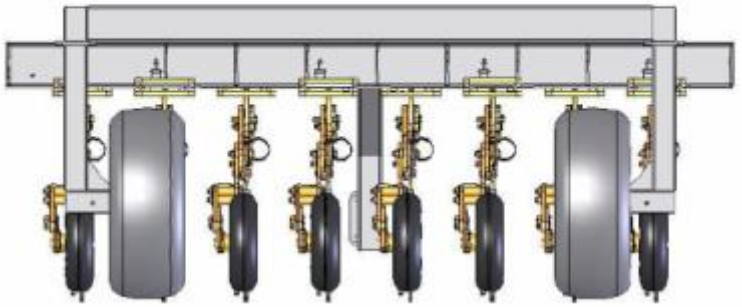
Equipment

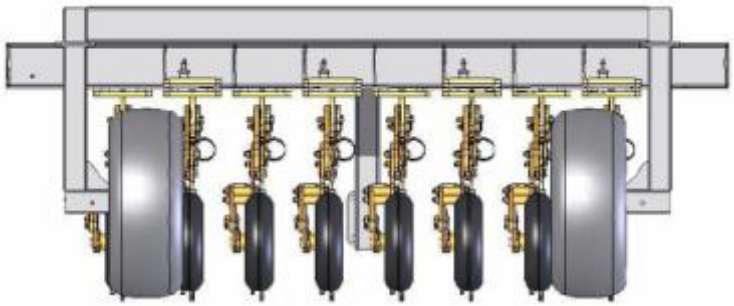
10 inch spacing



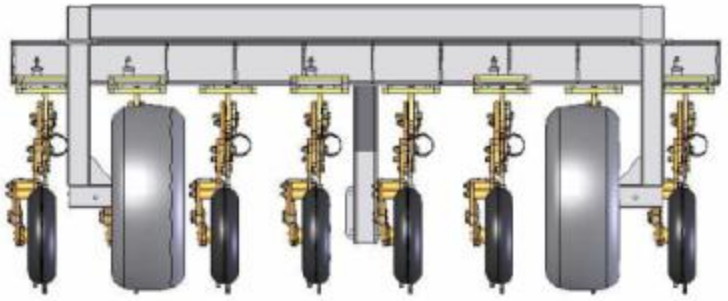
14" cm Spacing



12" cm spacing



16" cm Spacing



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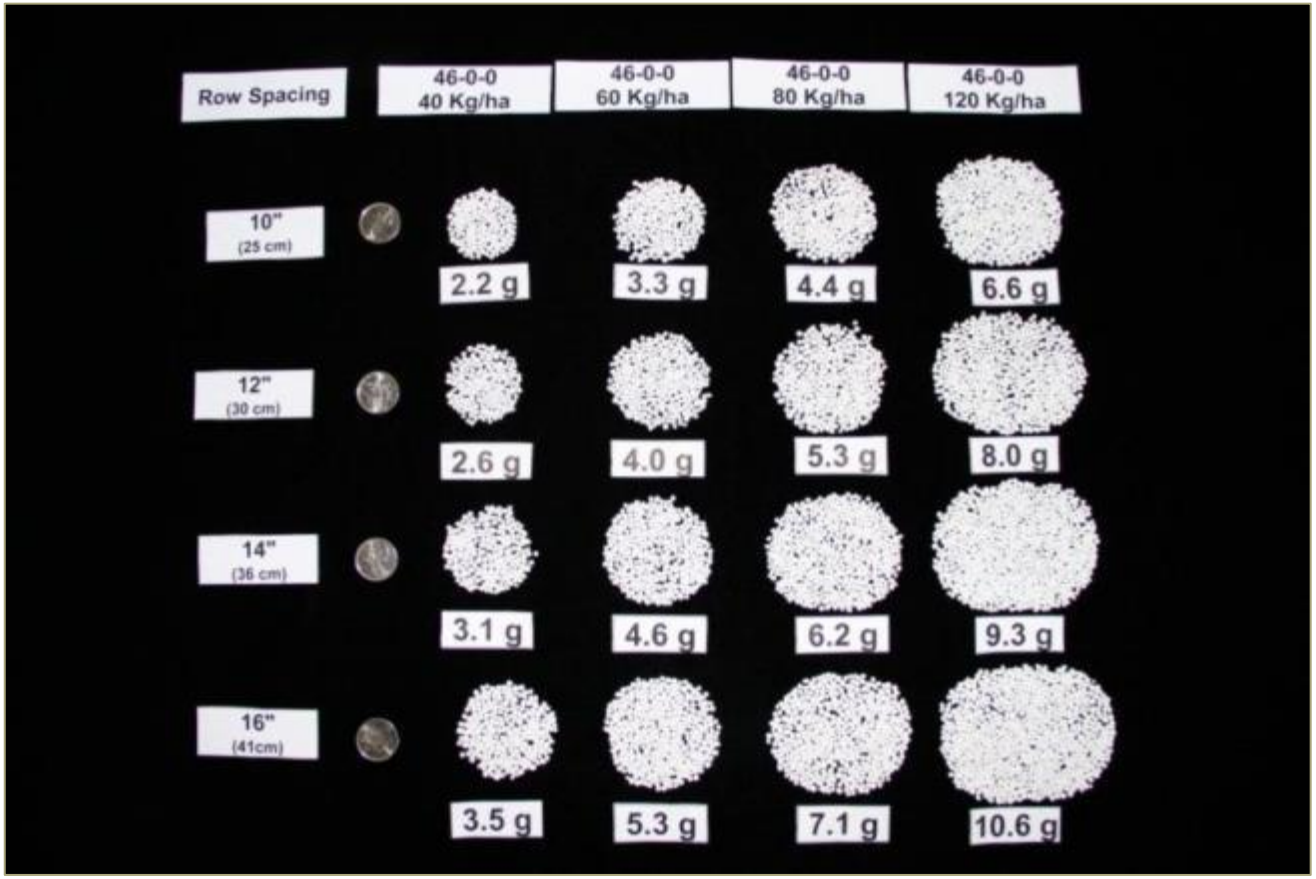
Recent/Current Field Trials

- Since acquiring the described drill in 2009, IHARF & AAFC have been conducting row spacing research with a variety of crop types
  - Oat: 2009-2011 (SODC)
  - Canola: 2012-16 (SCDC)
  - Soybean: 2014-2017 (SPG/AAFC)
  - Flax: 2014-2016 (ADOPT/SFDC)
  - Spring Wheat: 2013-2016 (AAFC)

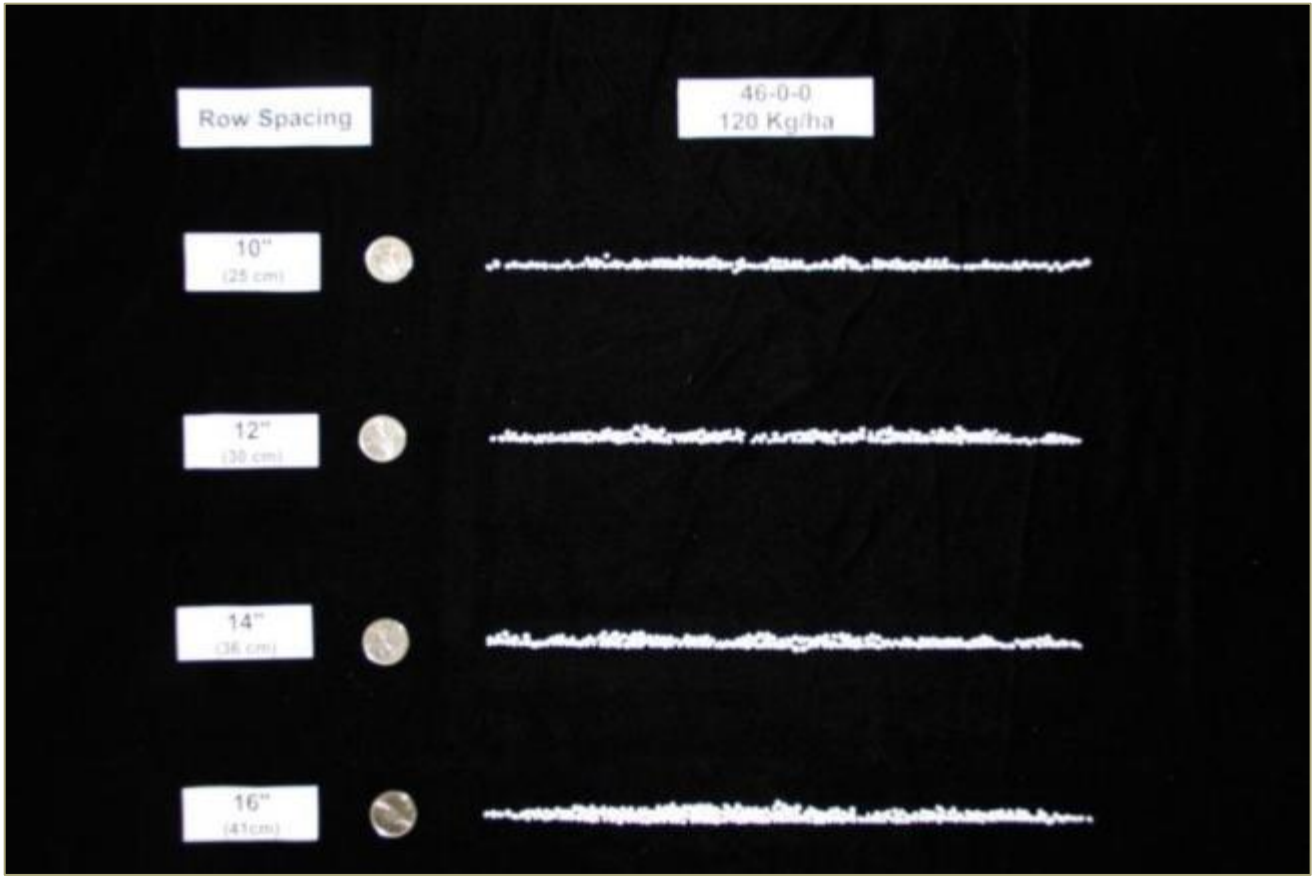
- Row spacing treatments range from 10-24” (25-61 cm) & were combined with other factors such as side-banded N rate, seeding rate, weed control & fungicide applications

Row Spacing Effect on Banded Fertilizer Concentrations



- per 1 meter length of crop row

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.

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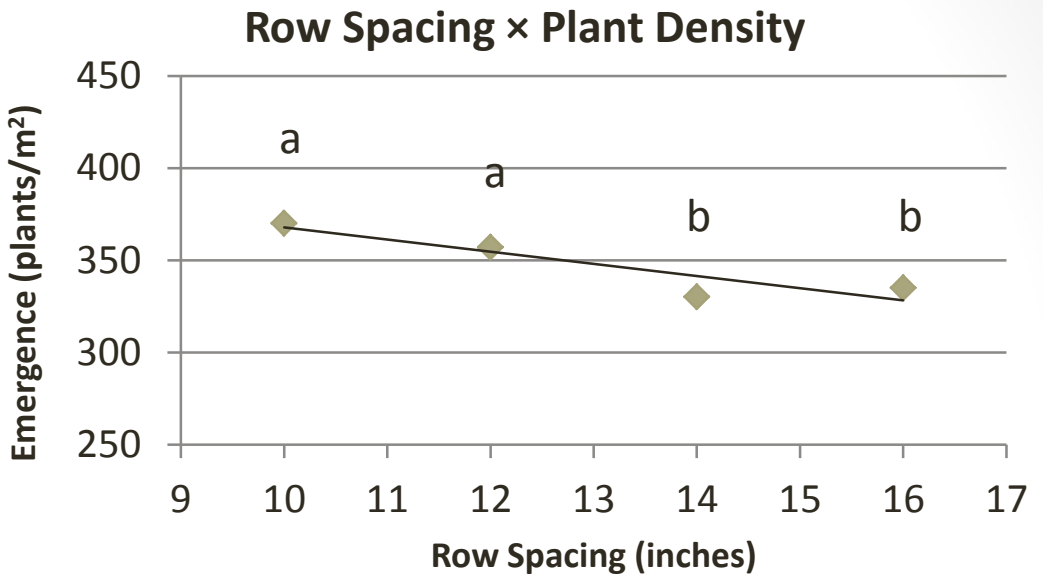
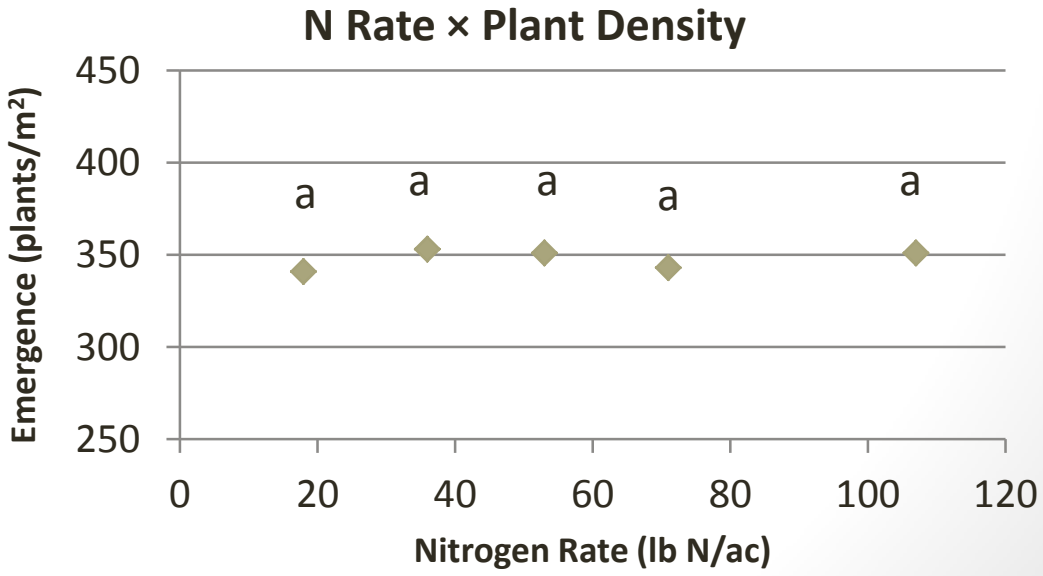
Oats: Effects on Plant Density

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





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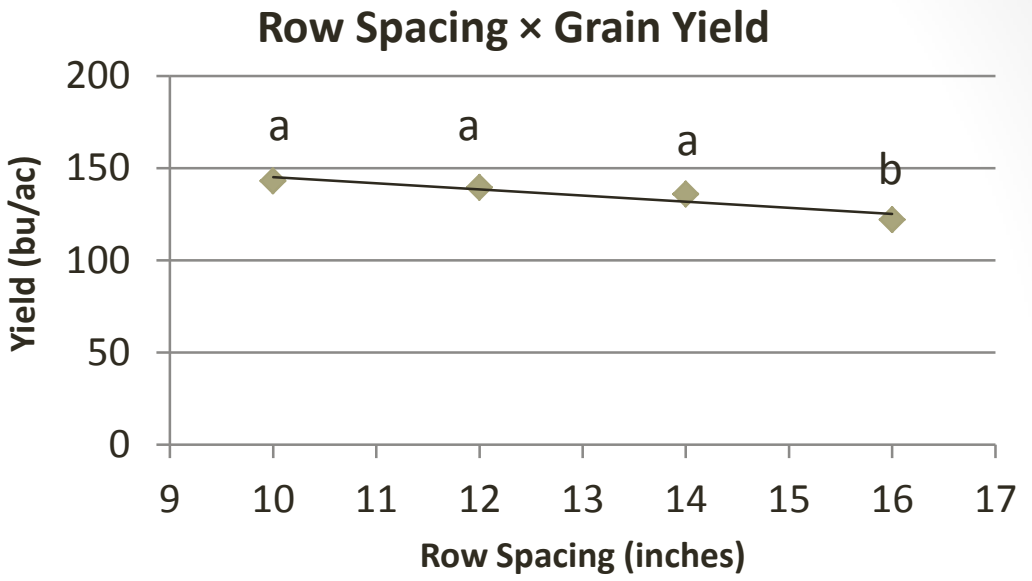
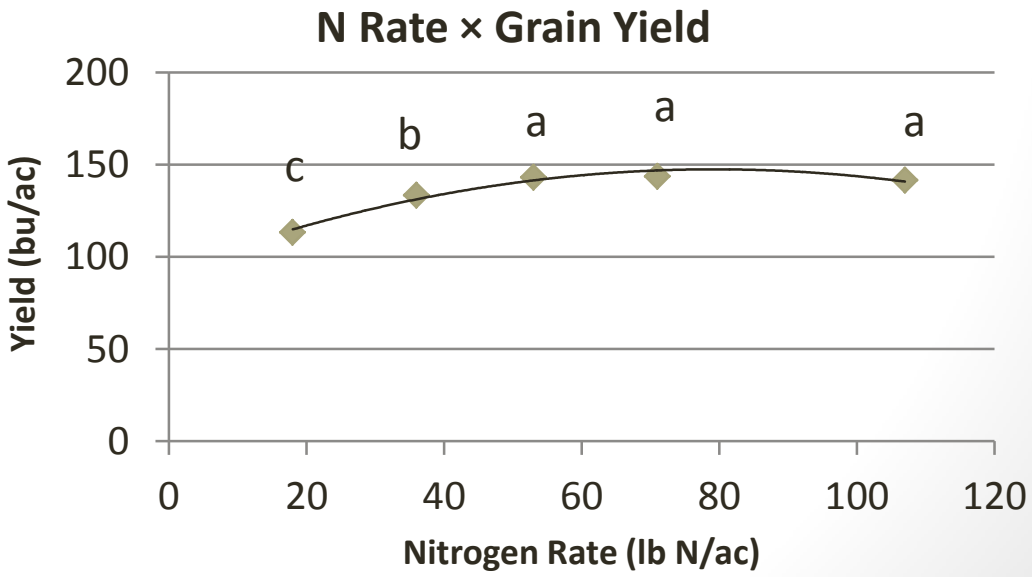
Oats: Effects on Grain Yield

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





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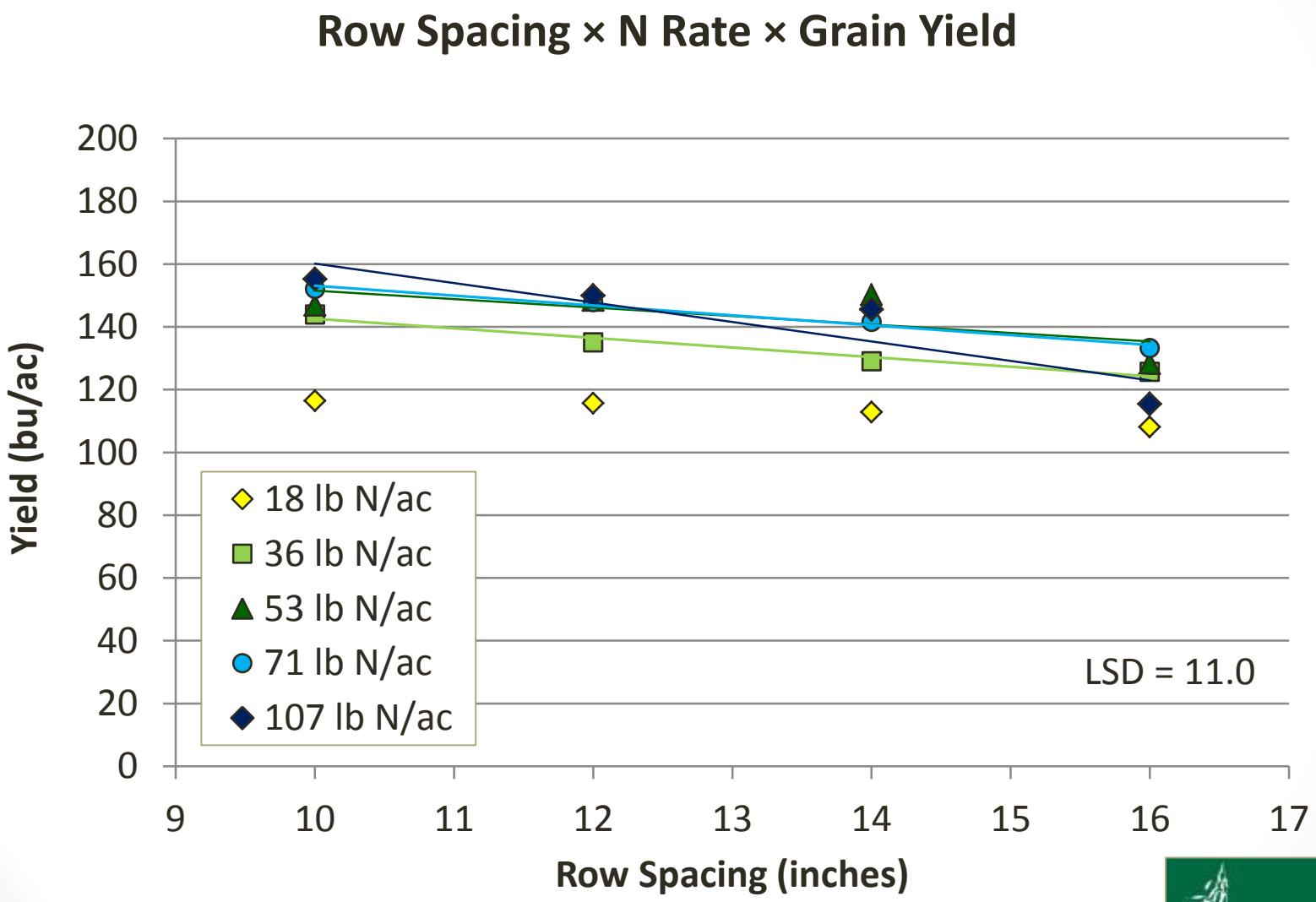
Oats: Effects on Grain Yield



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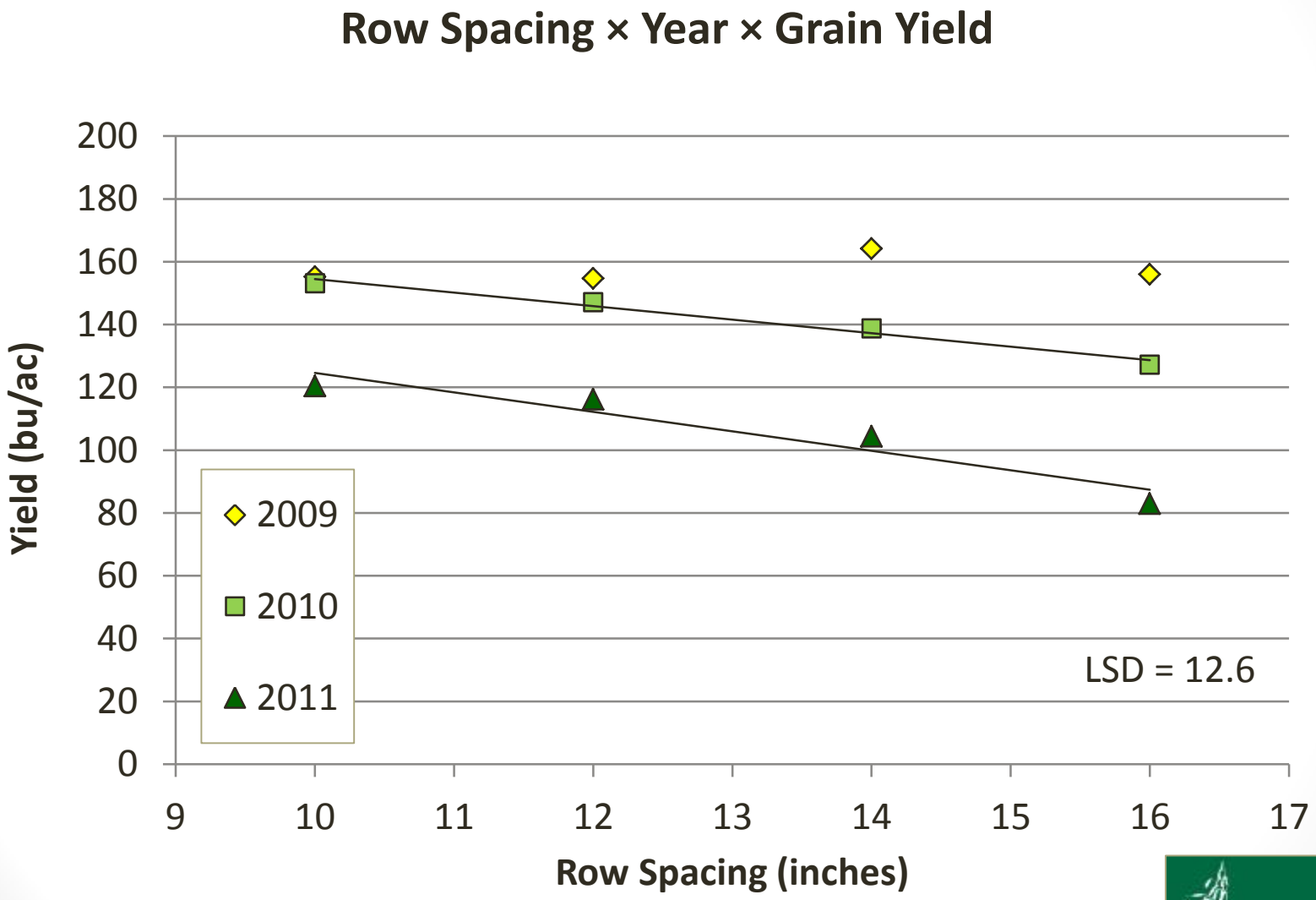
Oats: Effects on Grain Yield



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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

Wheat: Effects on Grain Yield

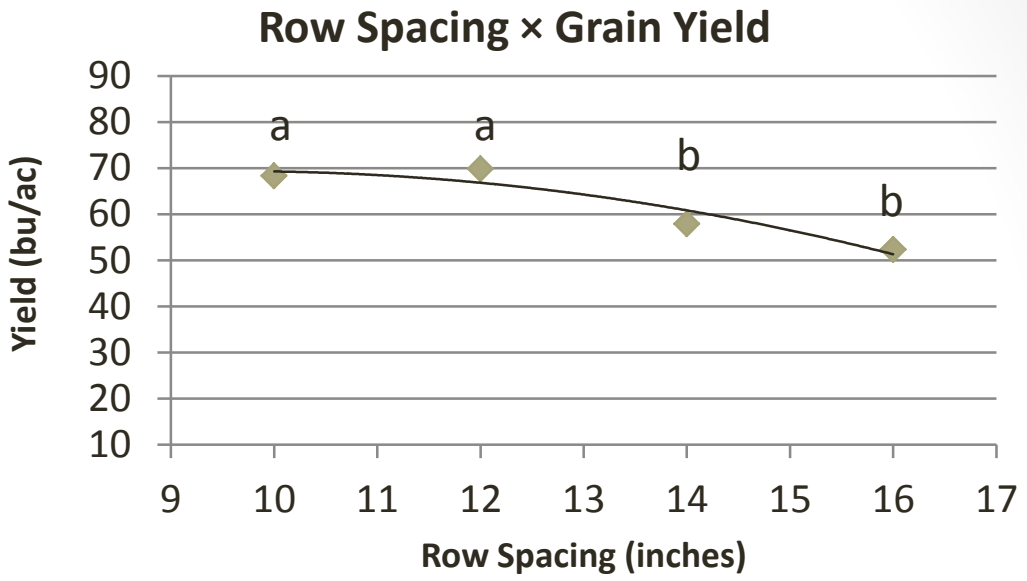
INDIAN HEAD - 2013

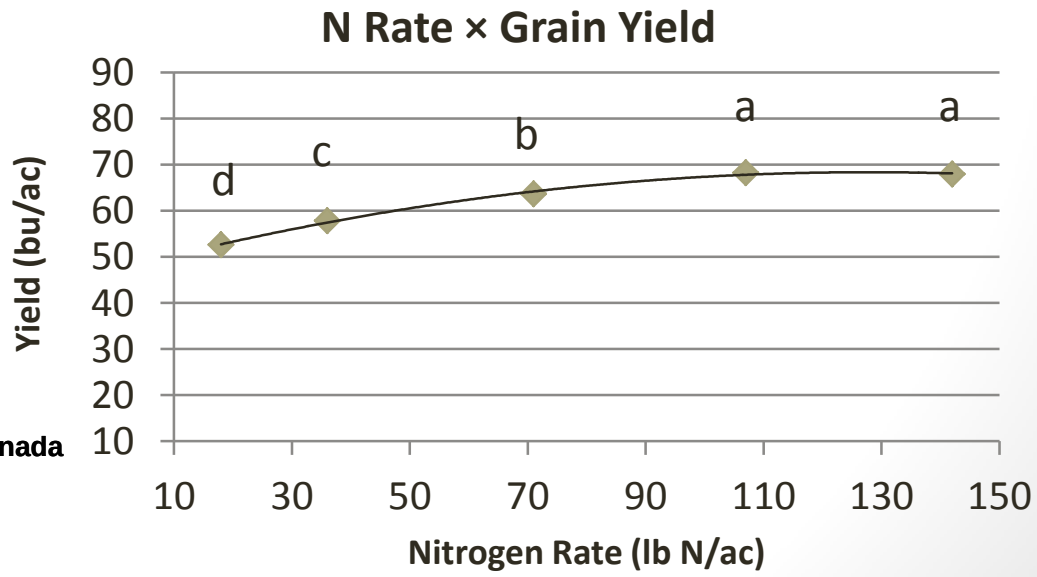
Tests of Fixed Effects:

Row spacing (R): *P* = 0.010

N Rate (N): *P* <0.001

R × N: *P* = 0.939





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Wheat: Effects on Grain Yield

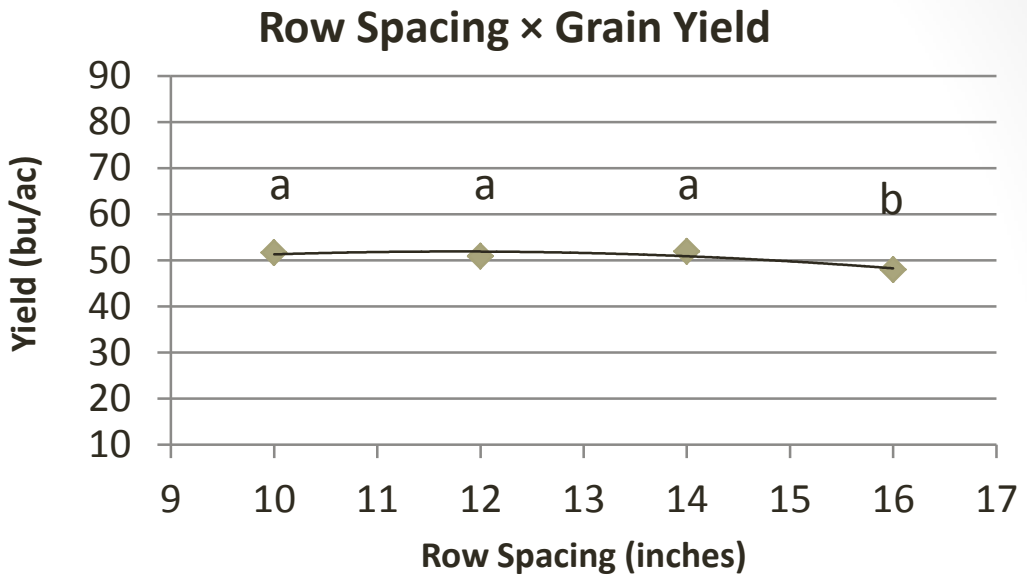
INDIAN HEAD - 2014

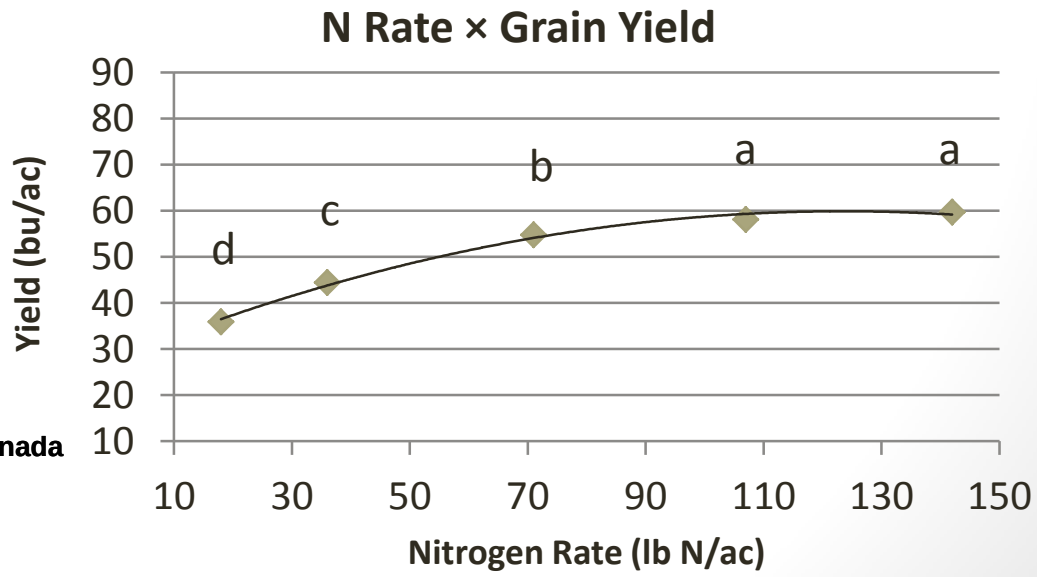
Tests of Fixed Effects:

Row spacing (R): *P* = 0.033

N Rate (N): *P* <0.001

R × N: *P* = 0.437





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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)
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
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

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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

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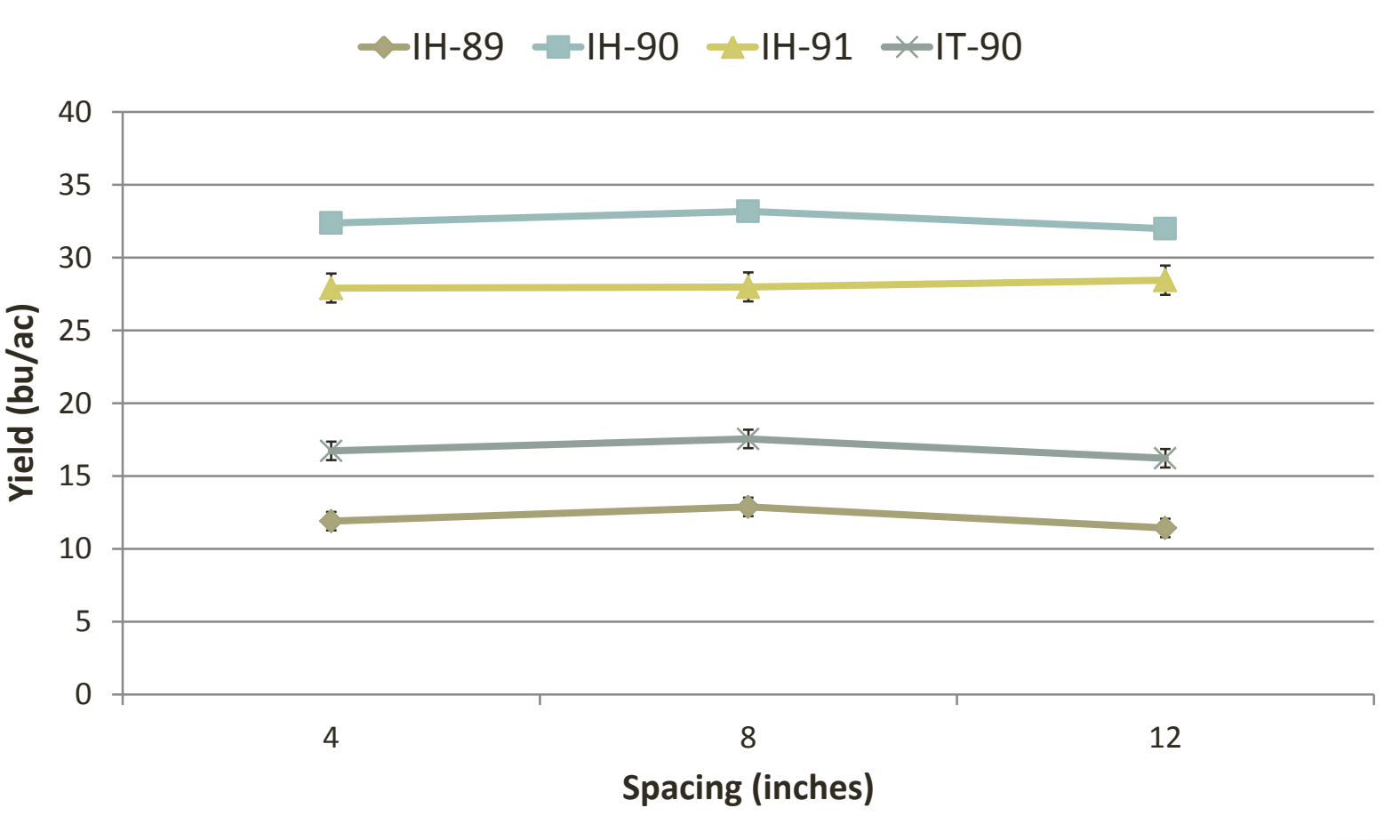
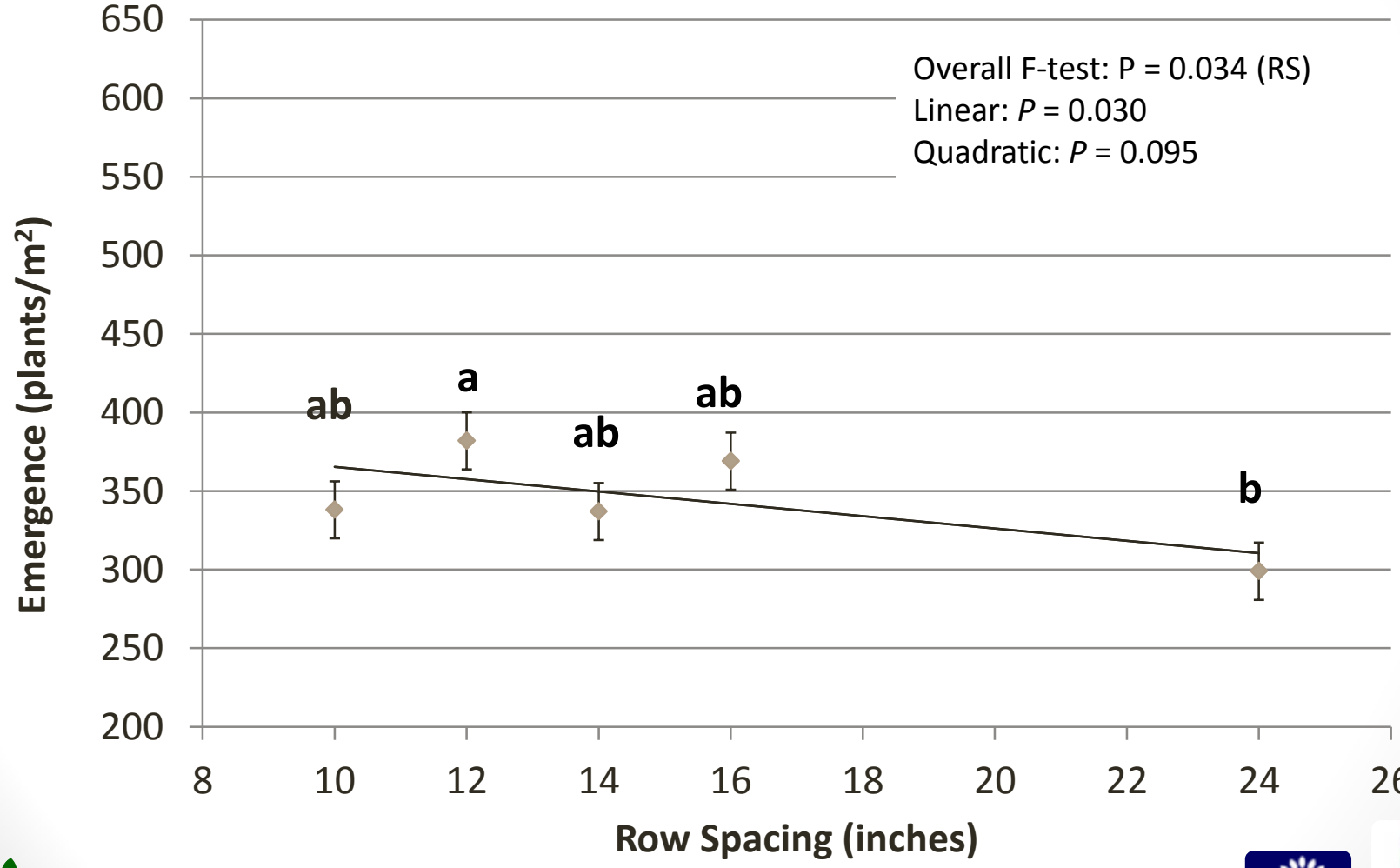
Optimum Row Spacing for Flax



- 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 Plant Density (IH-2014)



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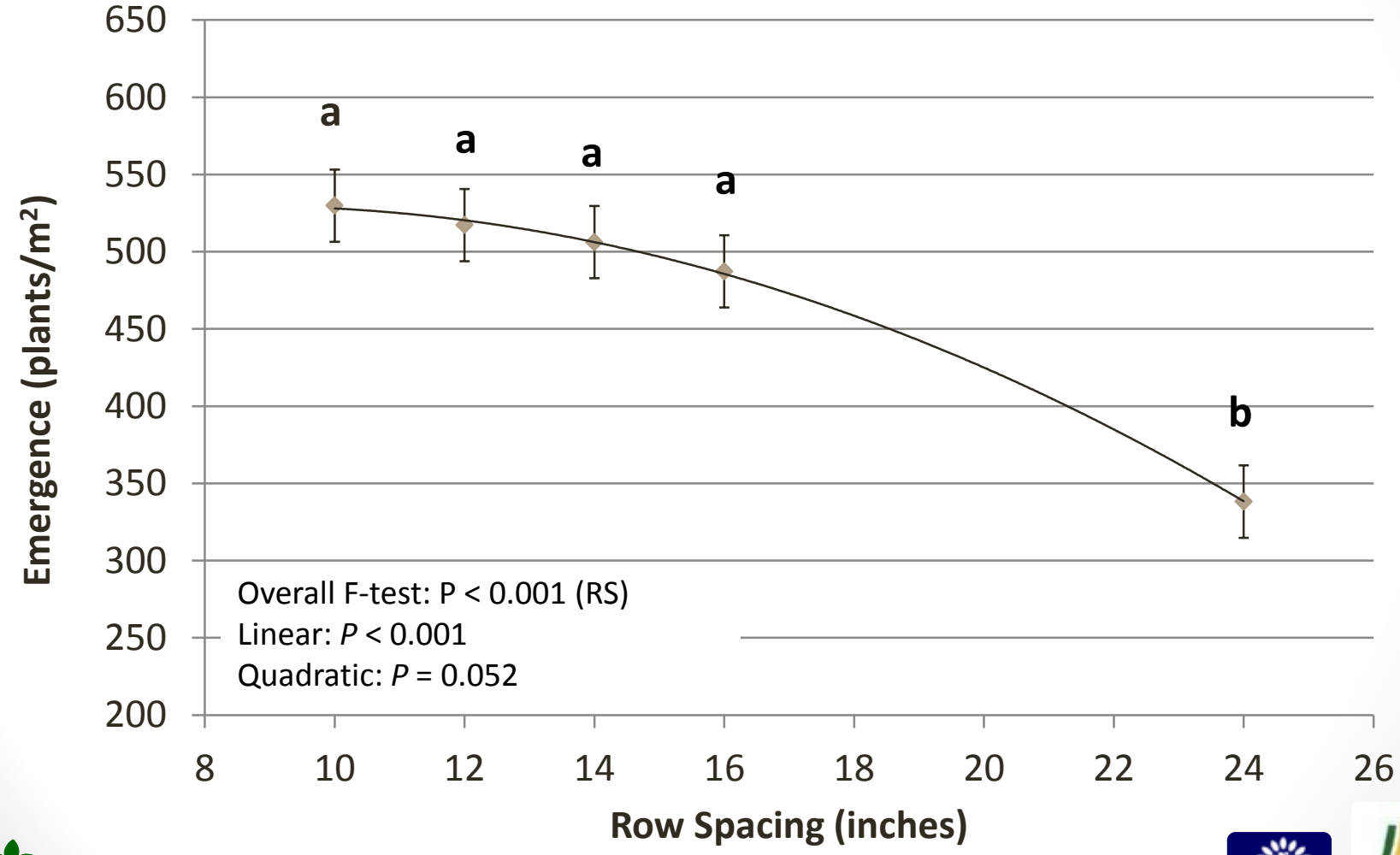
Flax: Effects on Plant Density (IH-2015)



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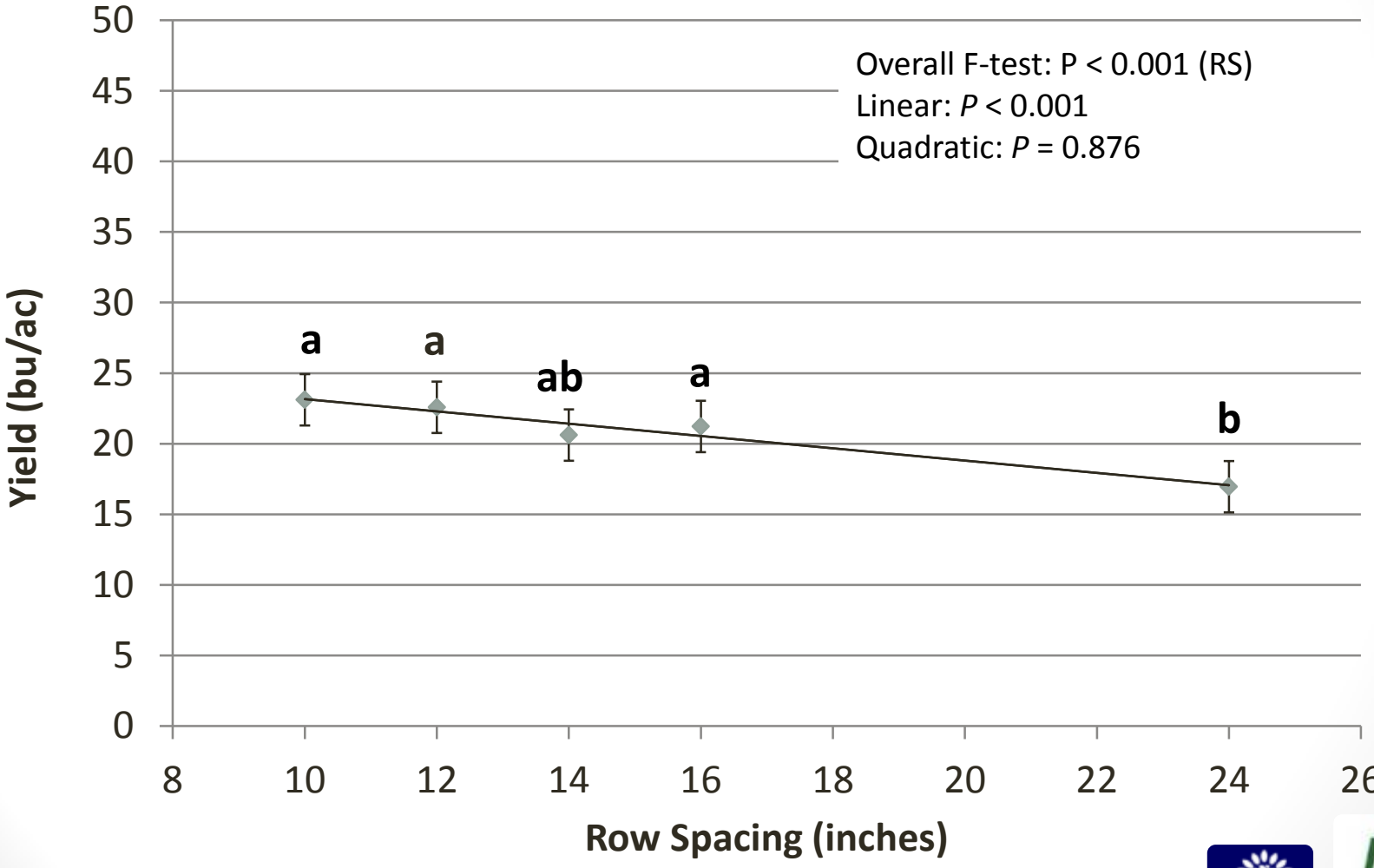
Flax: Effects on Seed Yield (IH-2014)



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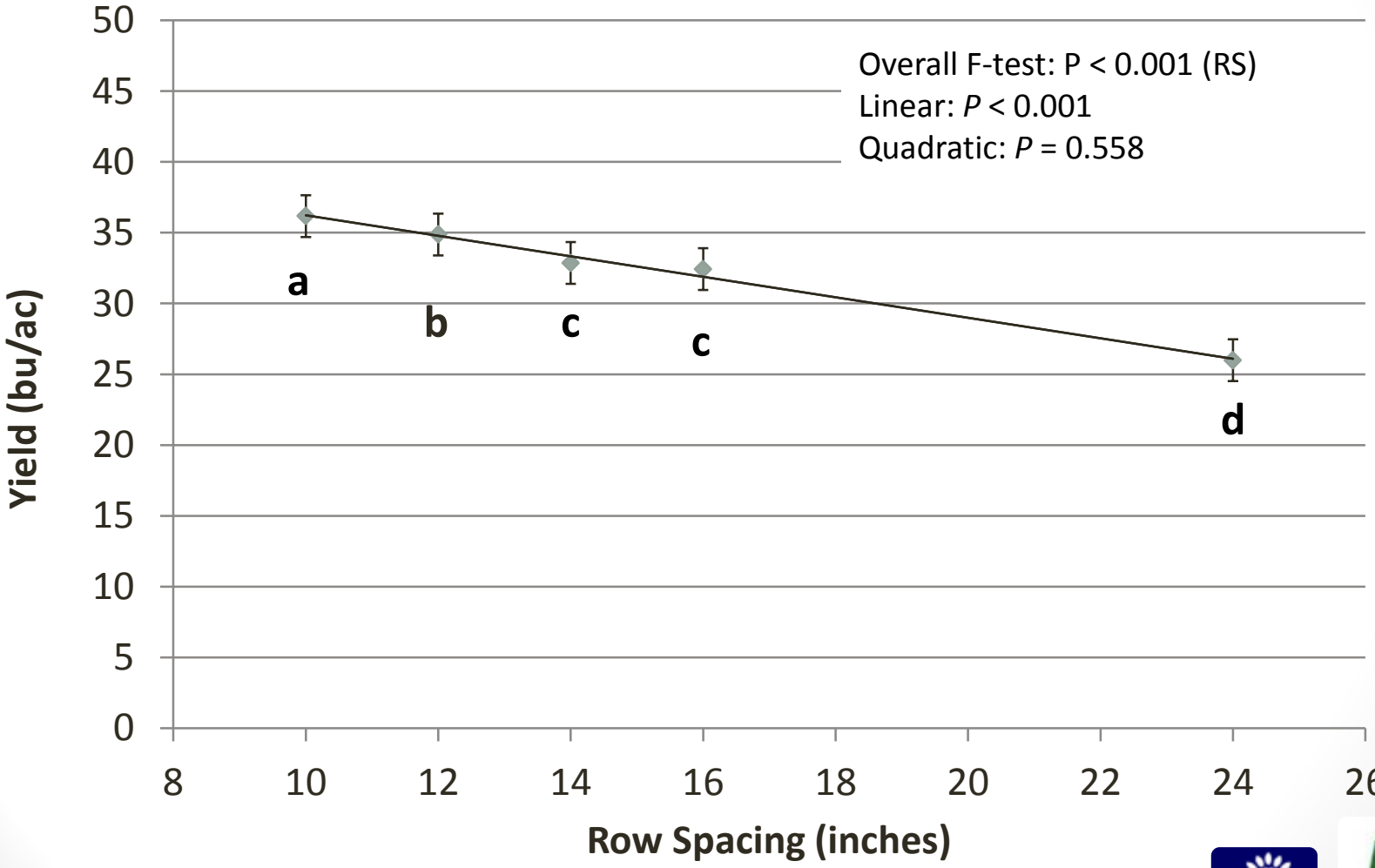
Flax: Effects on Seed Yield (IH-2015)



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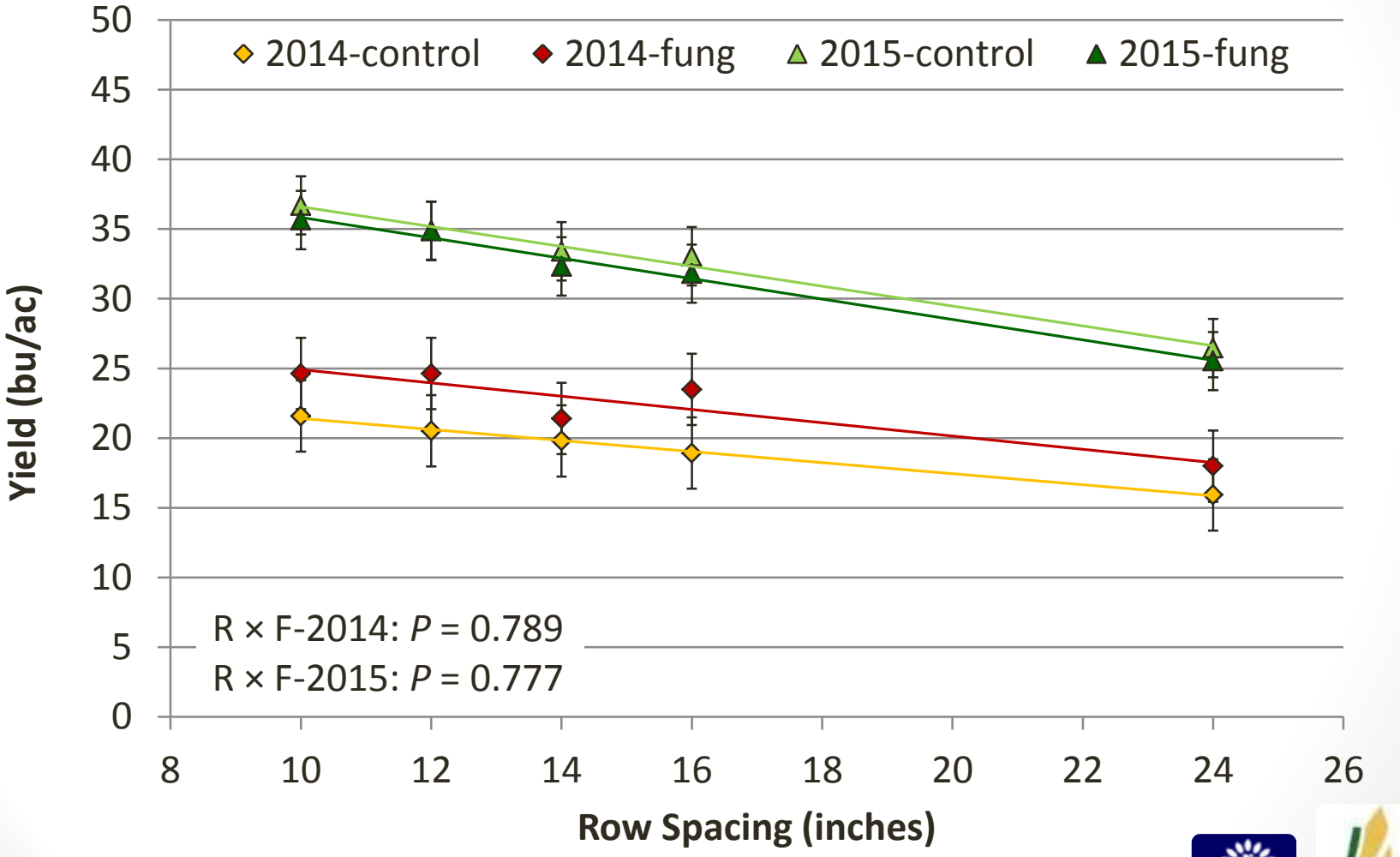
Row Spacing × Fungicide Effects on Flax Yield



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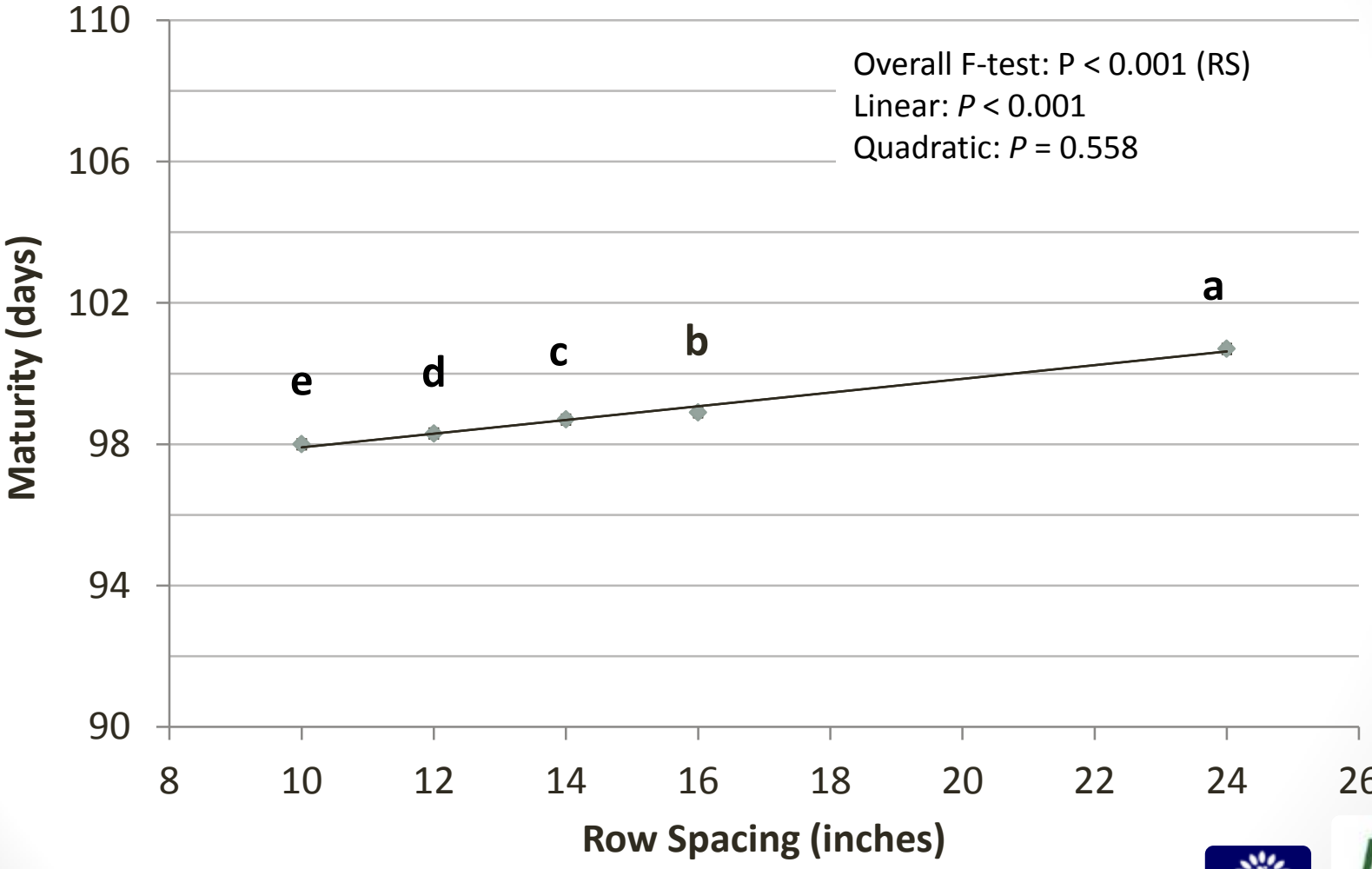
Flax: Effects on Maturity (IH-2015)



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Flax at Varying Row Spacing (IH-2015)

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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

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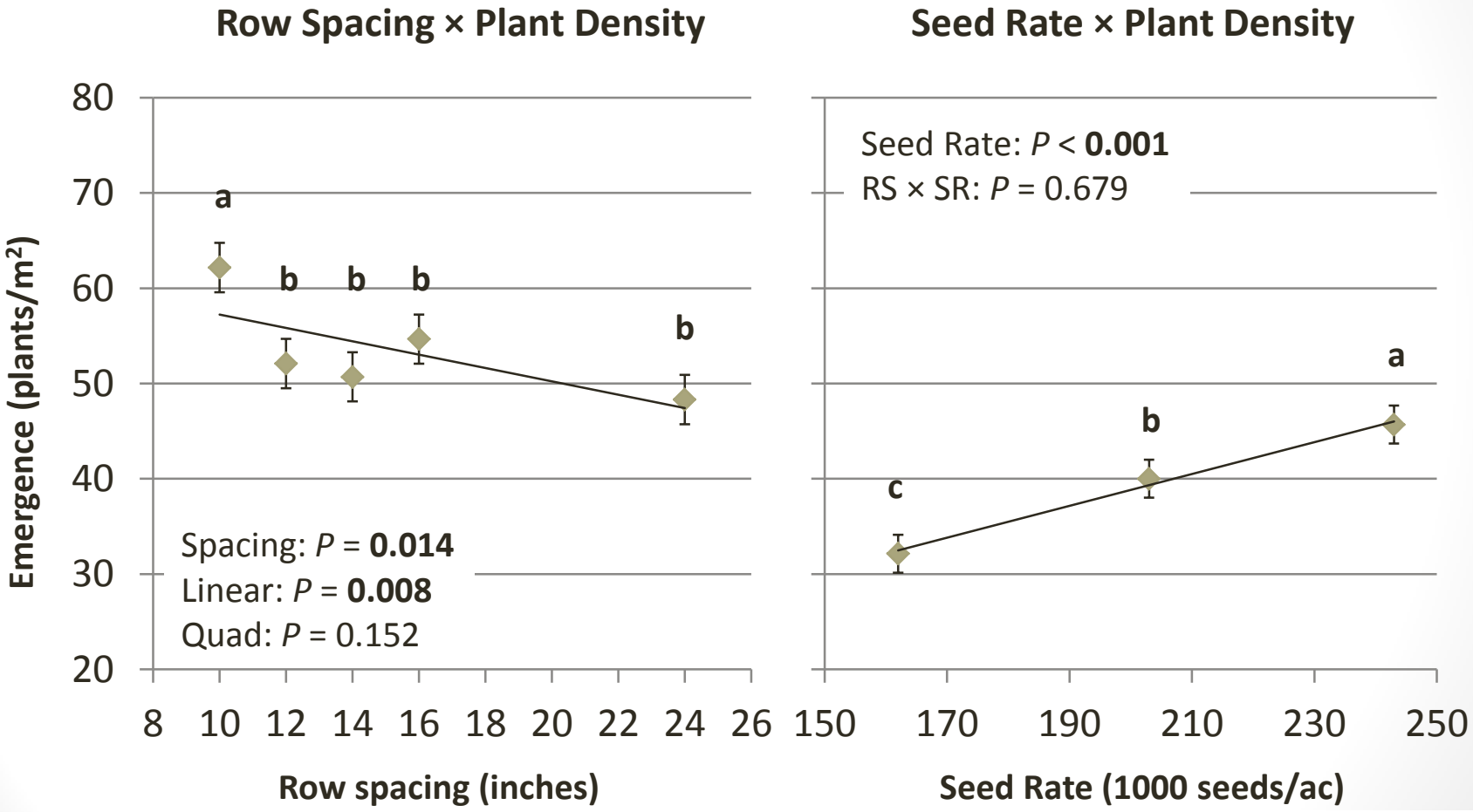
Soybeans: Effects on Emergence (IH-2014)



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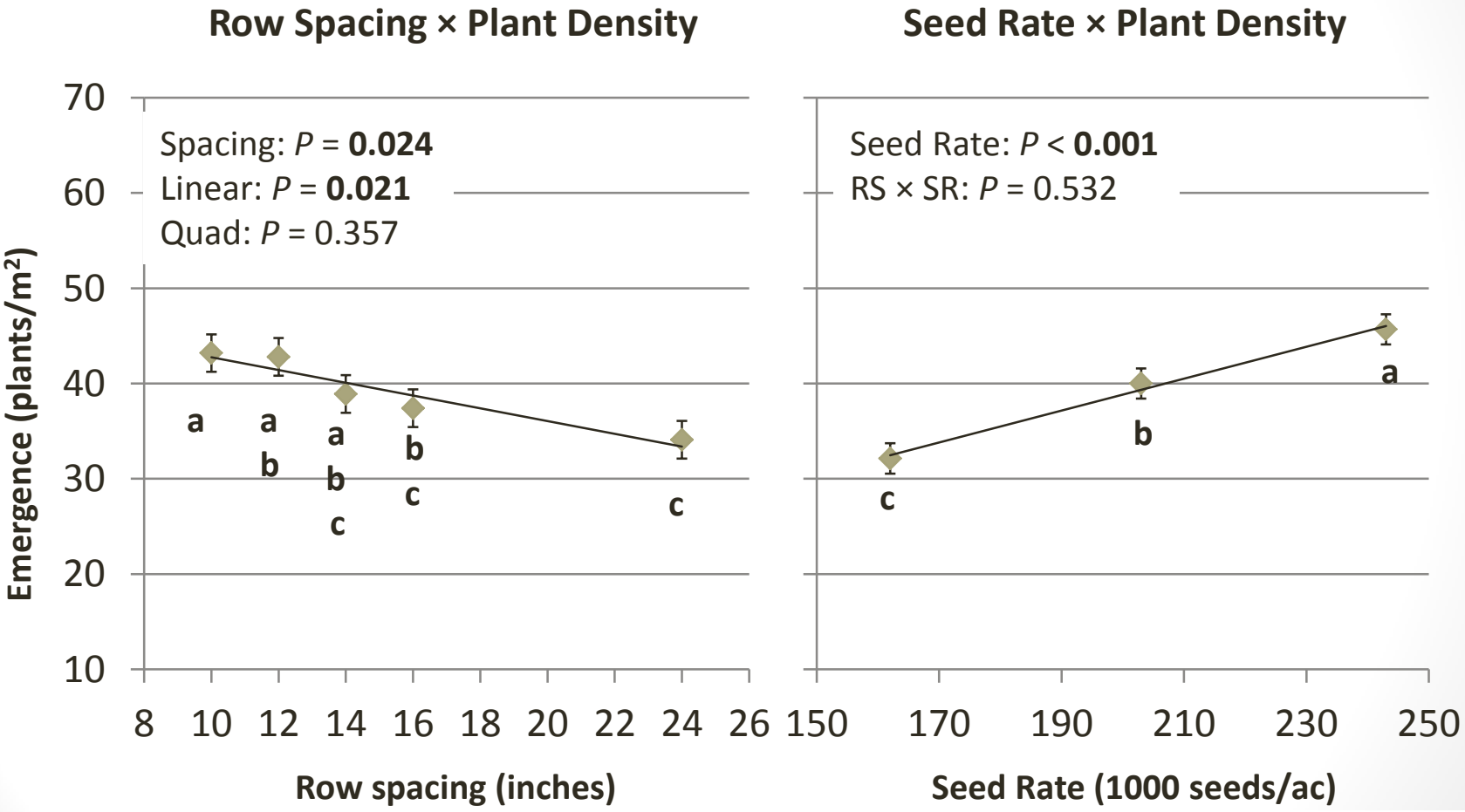
Soybeans: Effects on Emergence (IH-2015)



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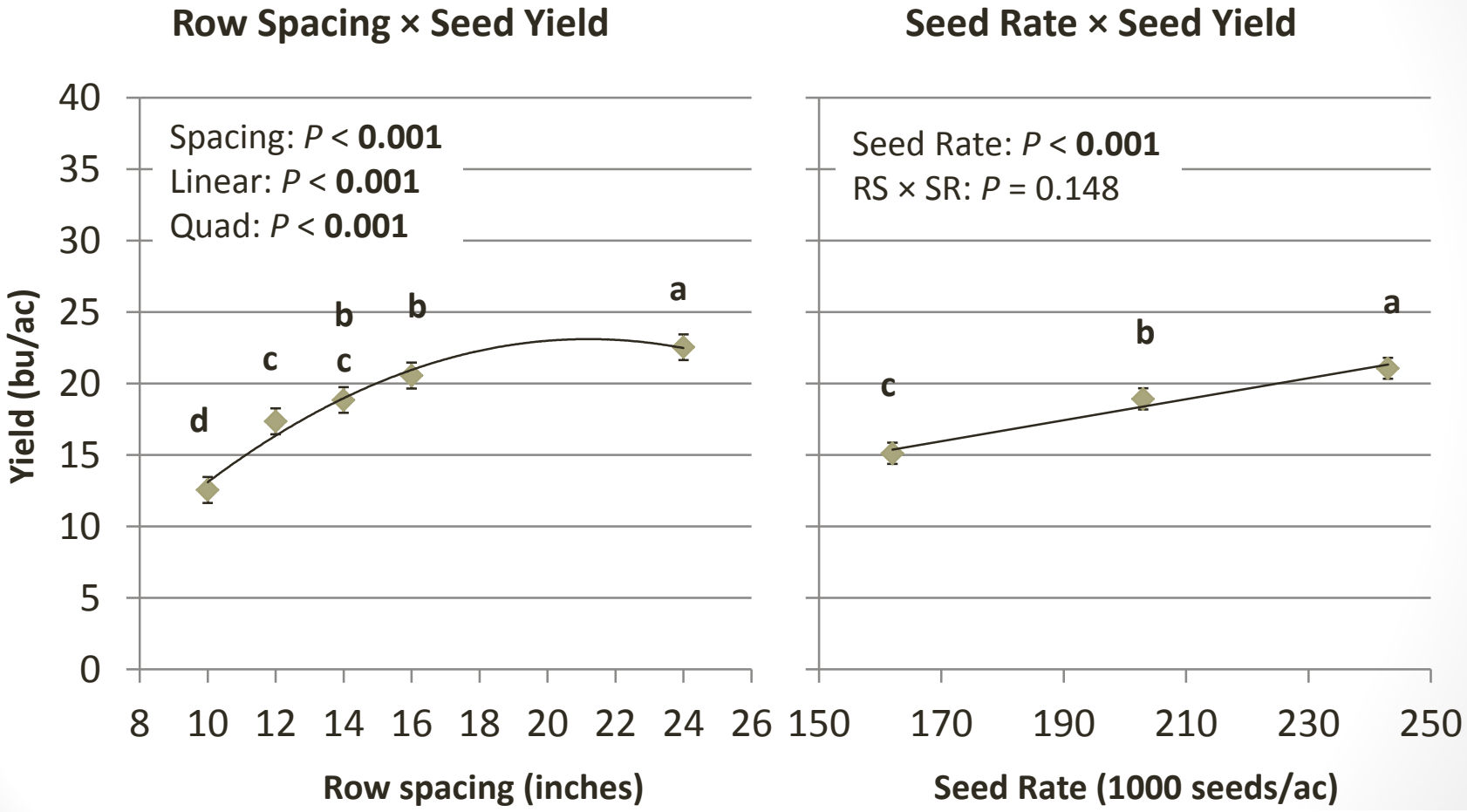
Soybeans: Effects on Seed Yield (IH-2014)



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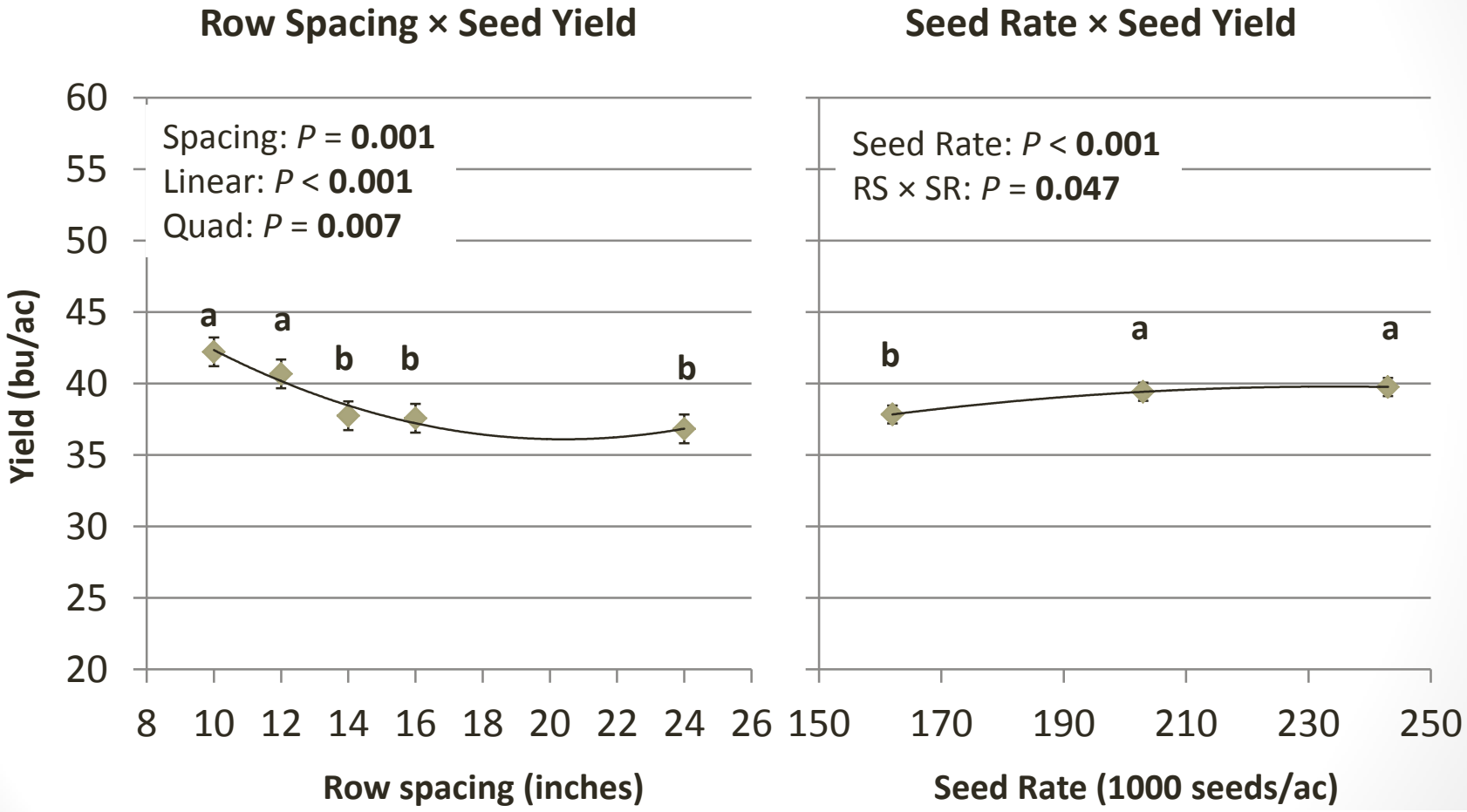
Soybeans: Effects on Seed Yield (IH-2015)



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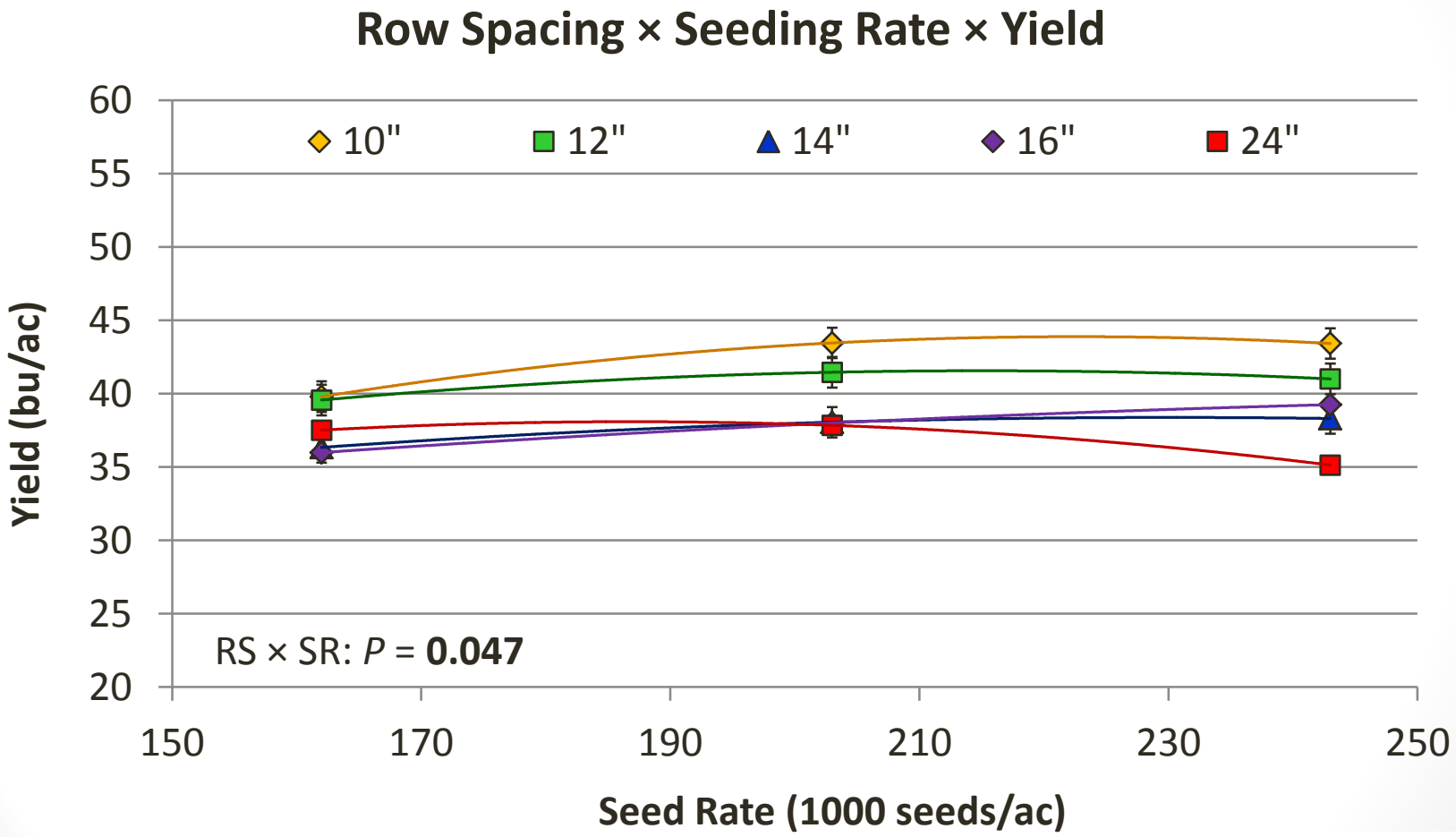
Soybeans: Effects on Seed Yield (IH-2015)



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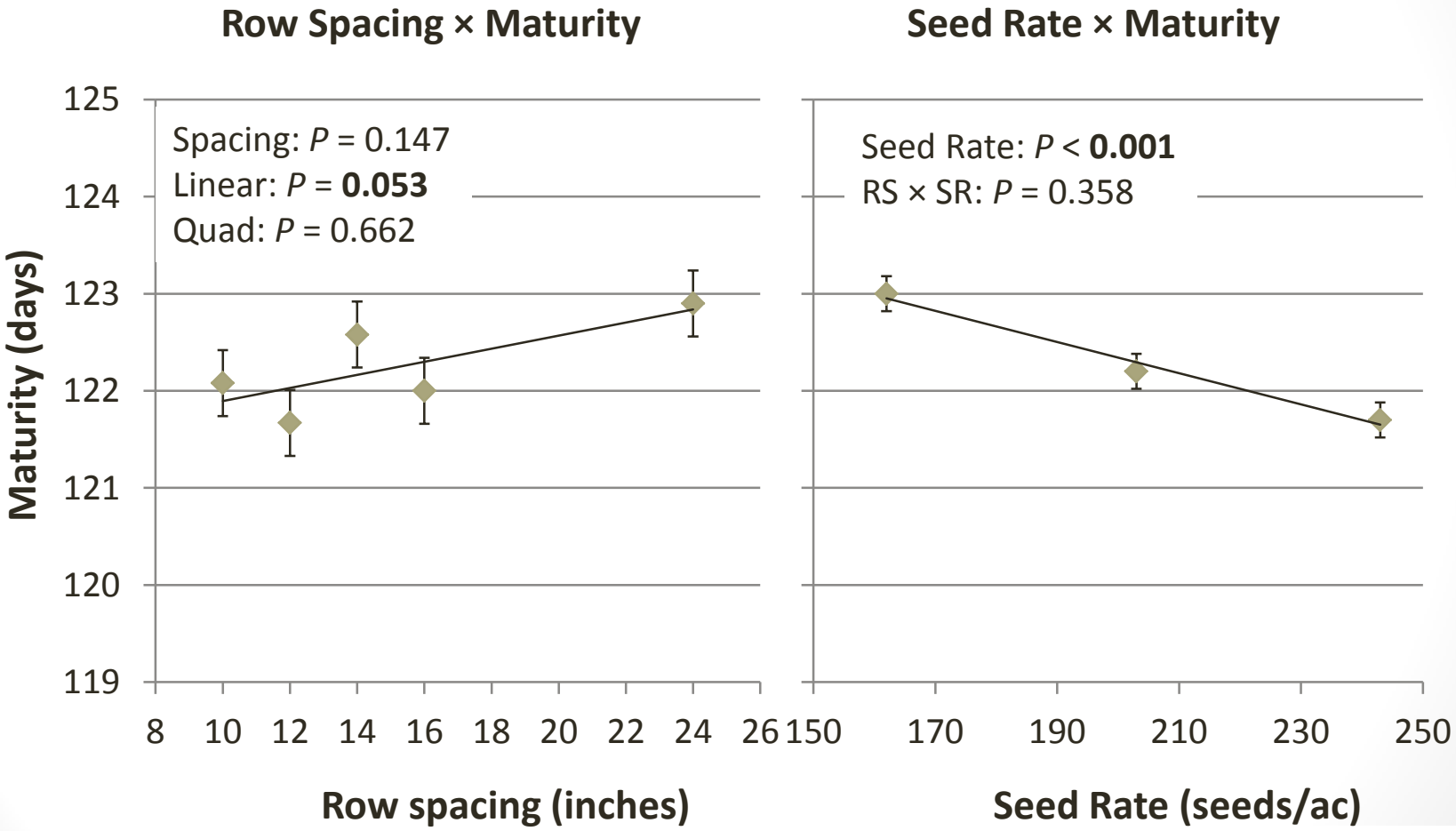
Soybeans: Effects on Maturity (IH-2015)



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

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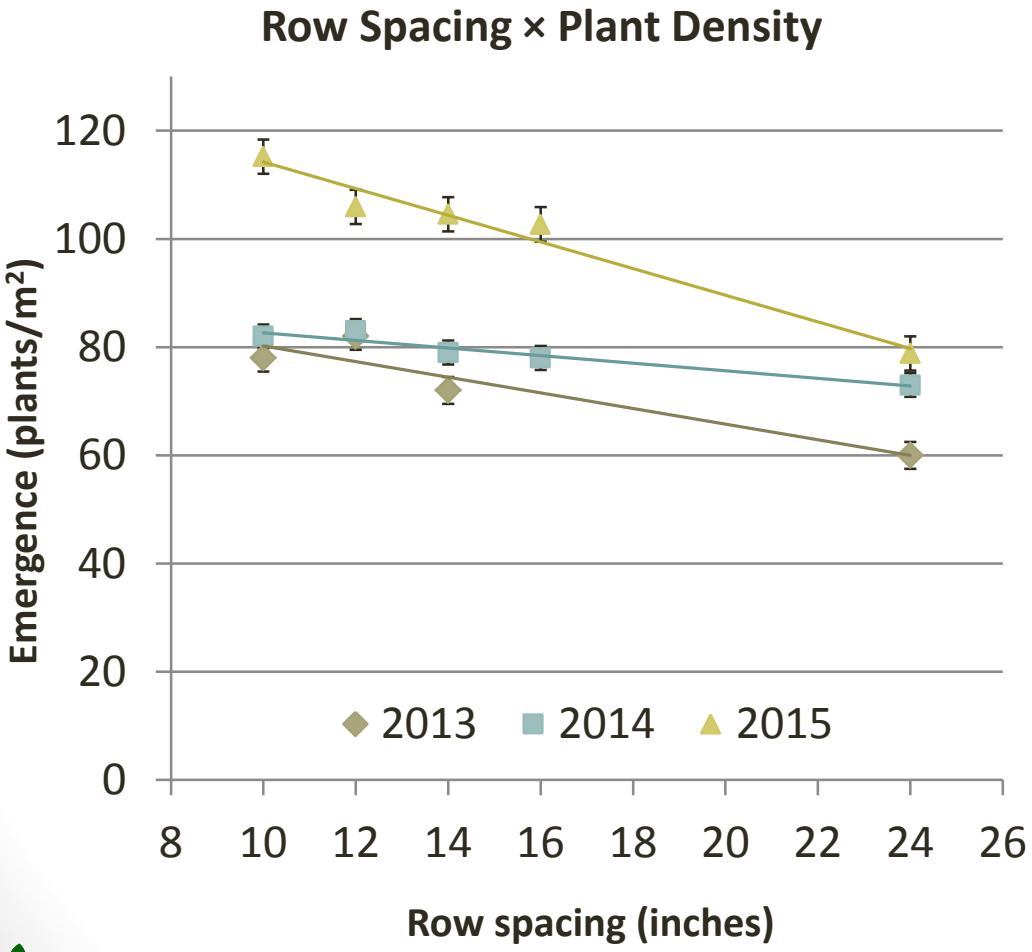
Canola: RS Effects on Emergence 2013-15 (RS × NR)



Effect	2013	2014	2015
	------- p-value -------		
RS	**<0.001**	**0.046**	**<0.001**
NR	**<0.001**	**<0.001**	**<0.001**
RS × NR	0.095	**0.016**	0.106
RS lin	**<0.001**	**0.004**	**<0.001**
RS quad	0.832	0.983	0.475

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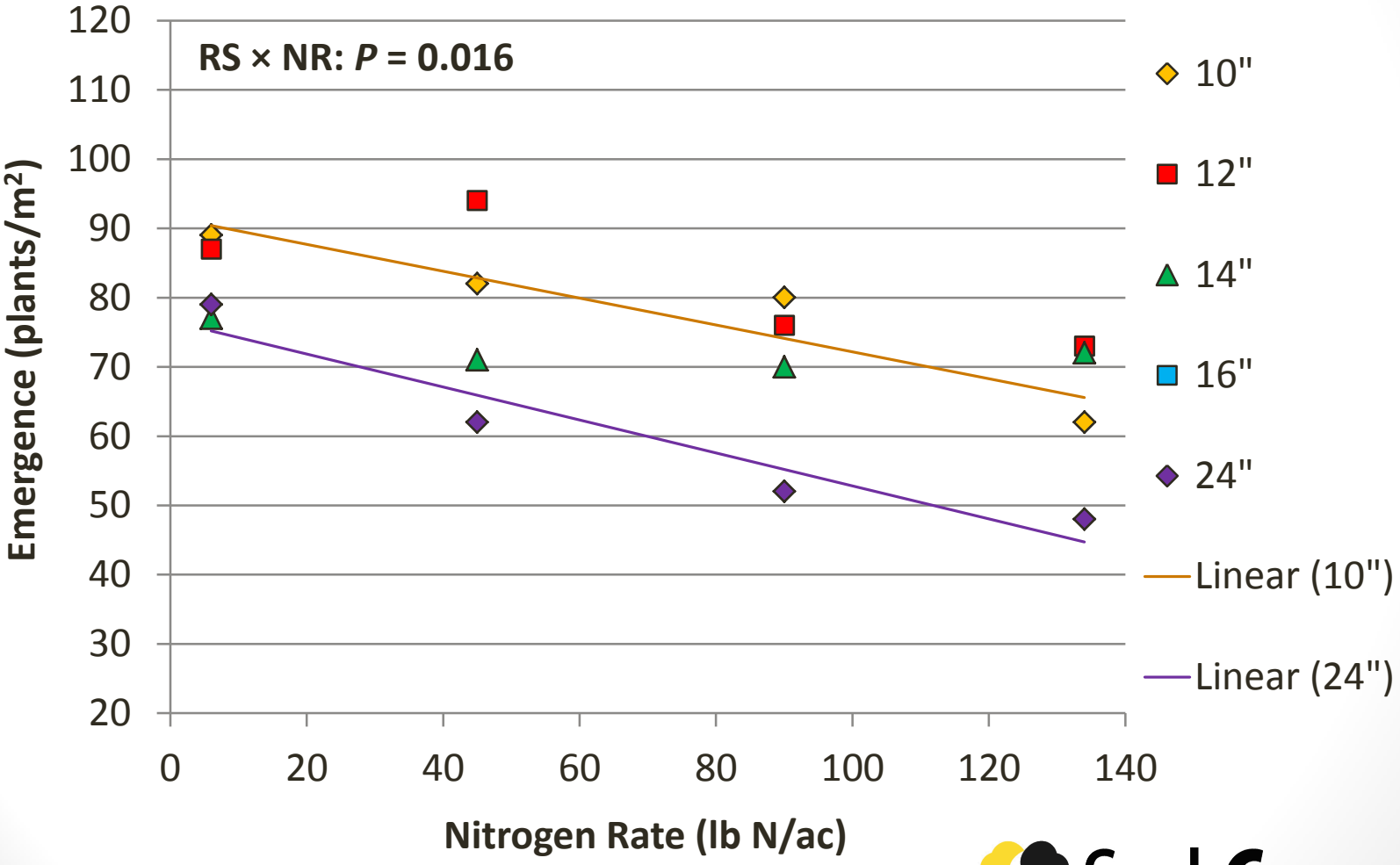
Row Spacing x N Rate Interactions (Indian Head 2014)



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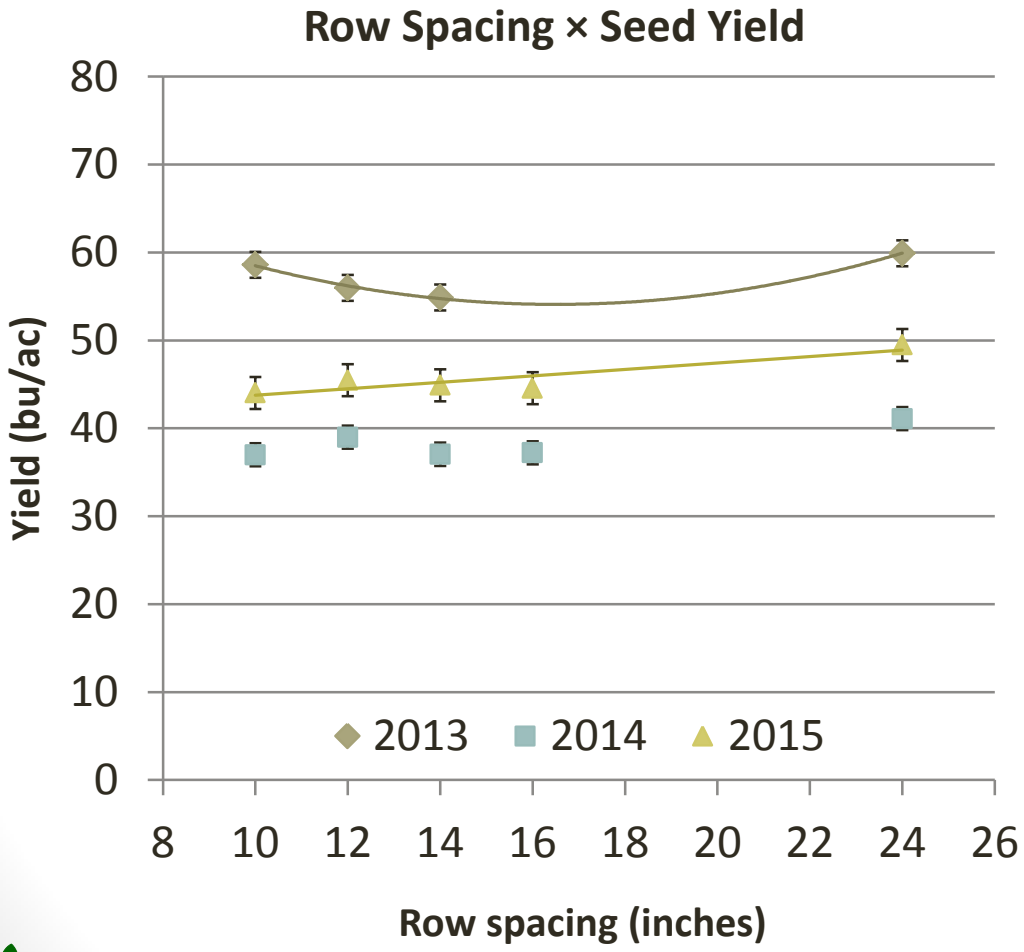
Canola: RS Effects on Yield 2013-15 (RS × NR)



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

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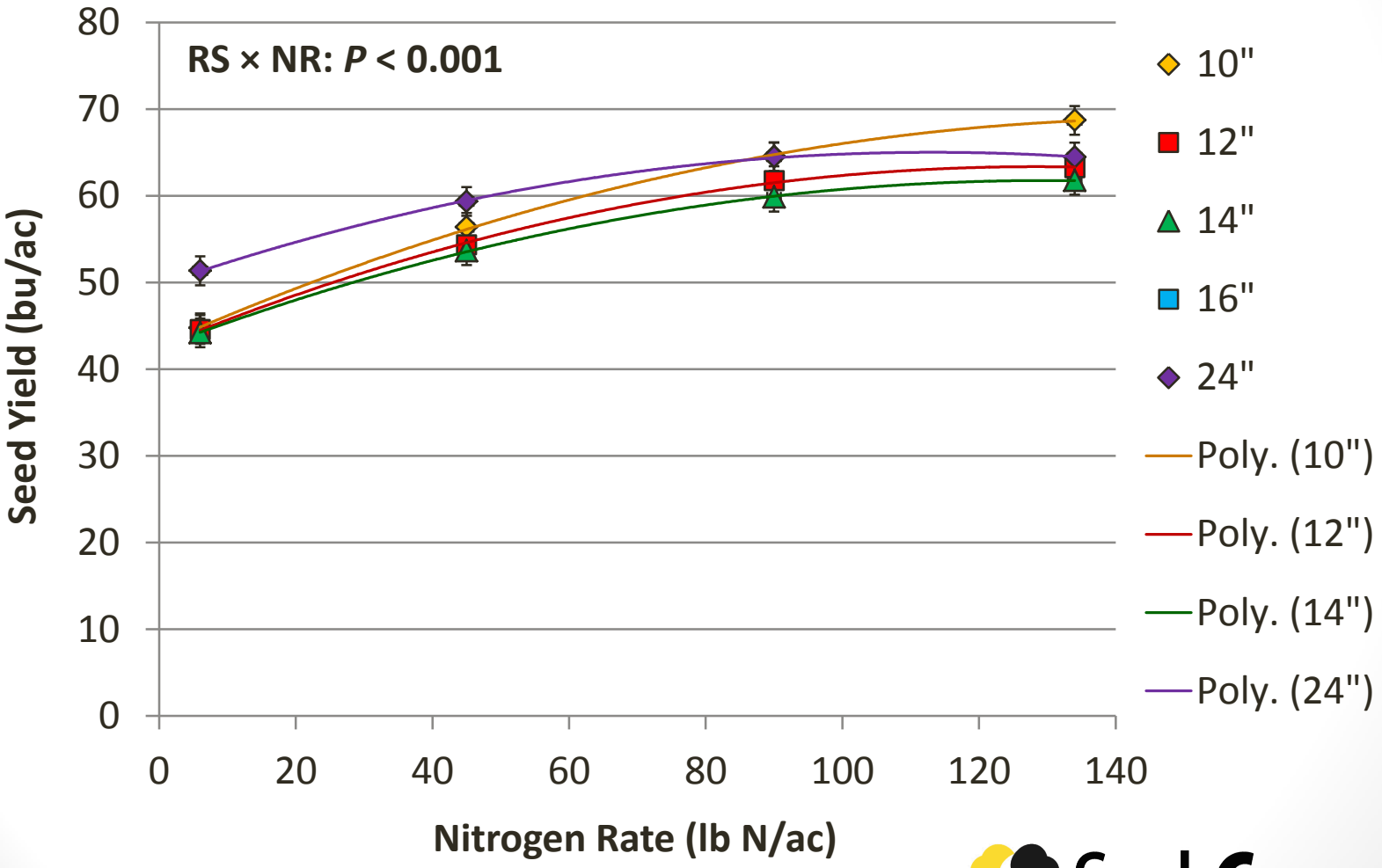
Row Spacing x N Rate Interactions (Indian Head 2013)



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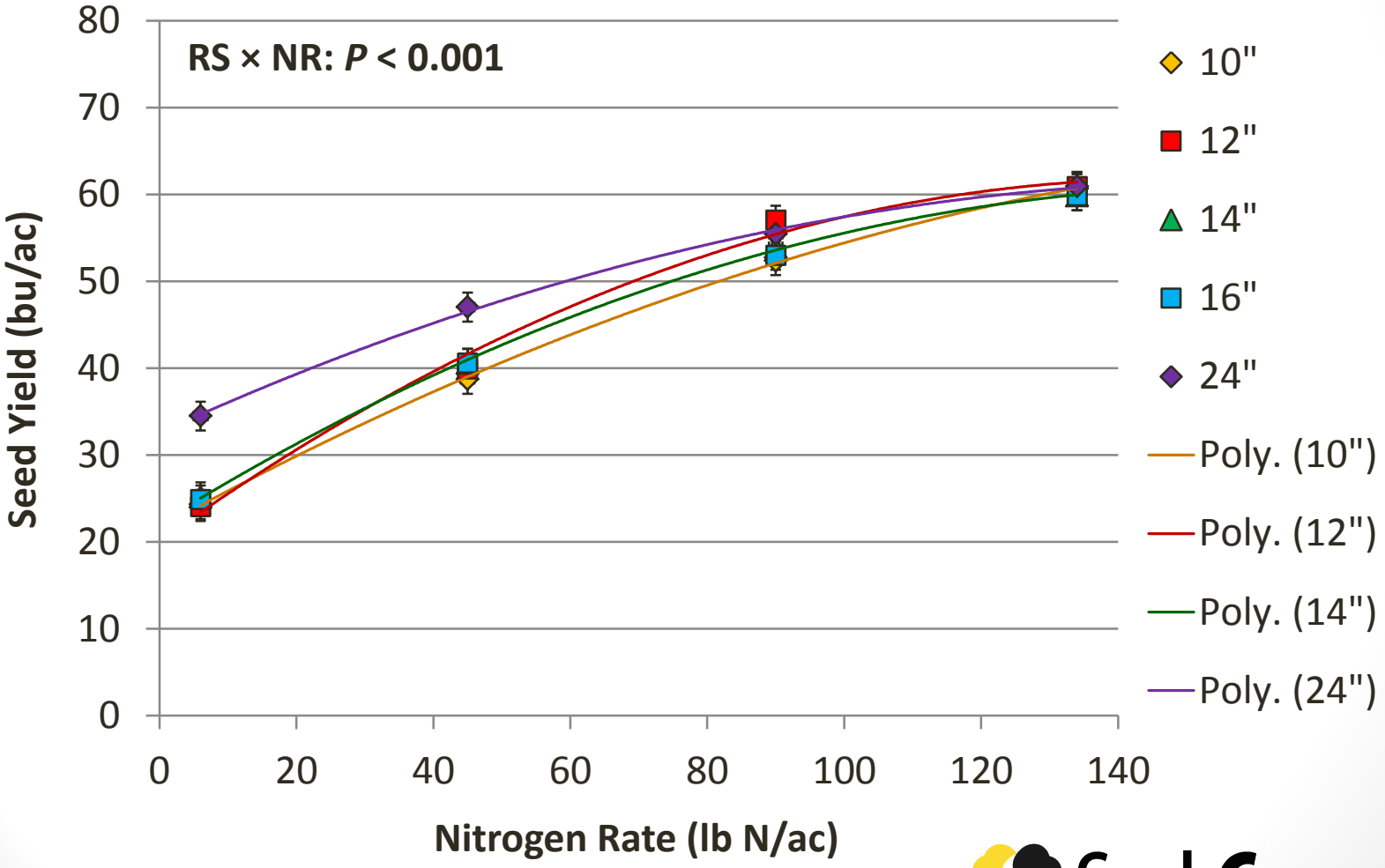
Row Spacing x N Rate Interactions (Indian Head 2015)



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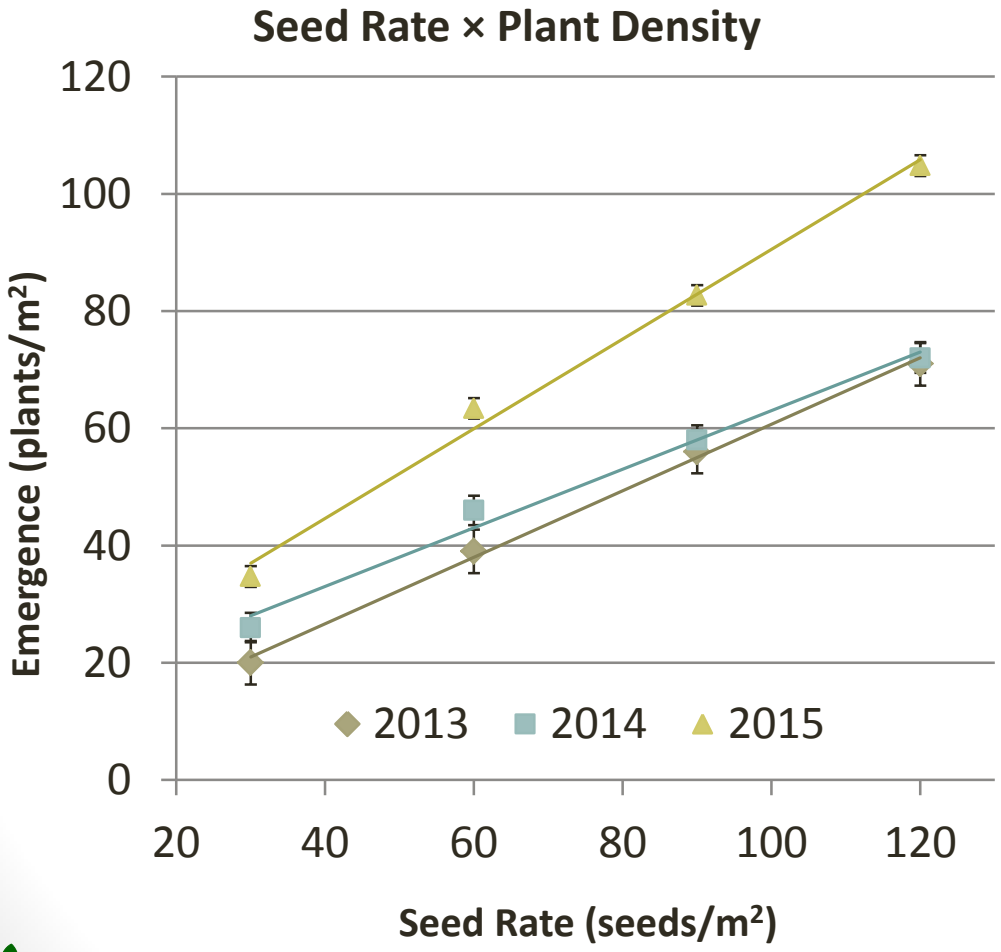
Canola: SR Effects on Emergence 2013-15 (RS × SR)



Effect	2013	2014	2015
	------- p-value -------		
RS	**<0.001**	**0.046**	**<0.001**
SR	**<0.001**	**<0.001**	**<0.001**
RS × SR	0.095	**0.016**	**<0.001**
SR lin	**<0.001**	**<0.001**	**<0.001**
SR quad	0.241	0.155	**0.046**

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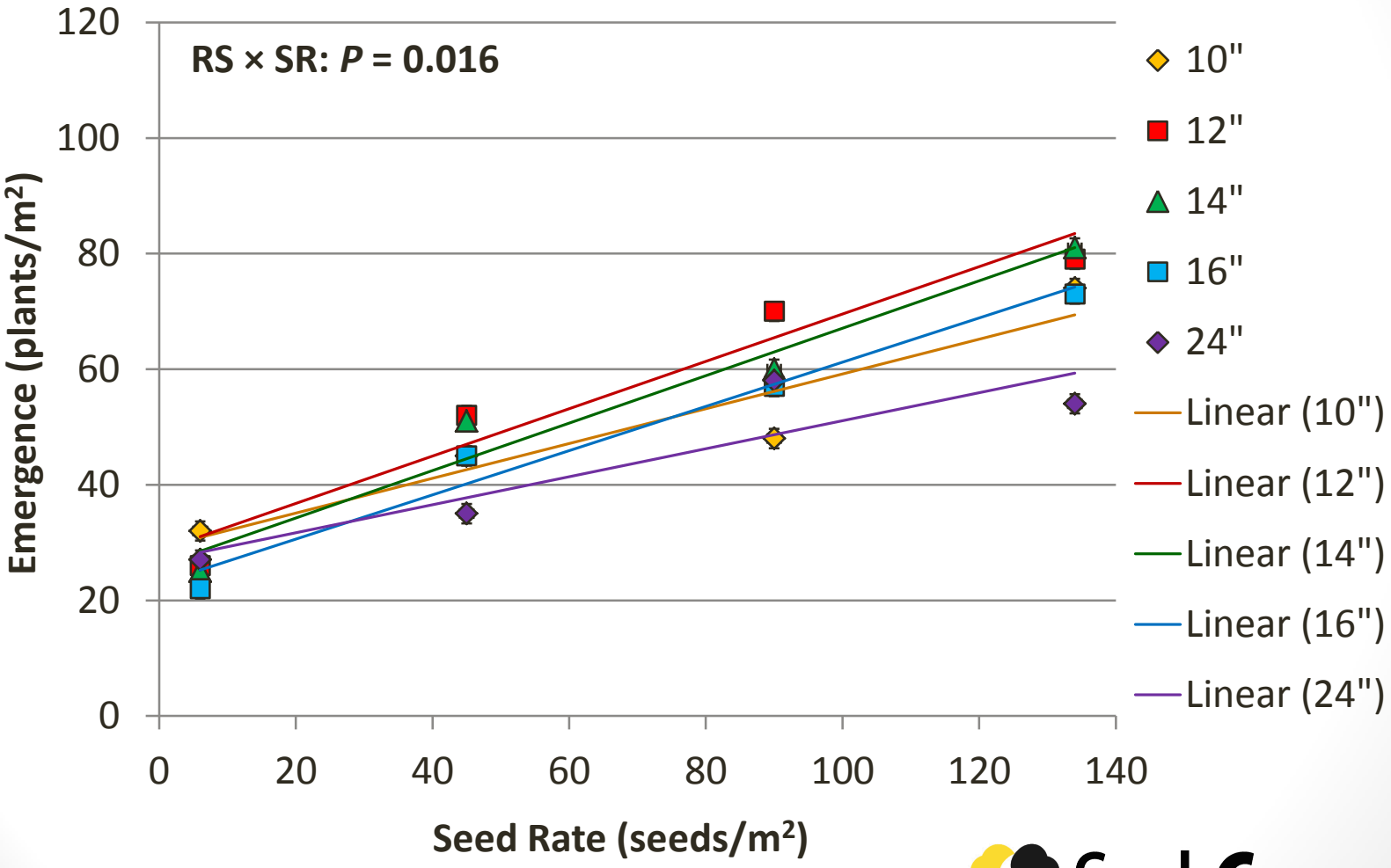
Row Spacing x Seed Rate Interactions (Indian Head 2014)



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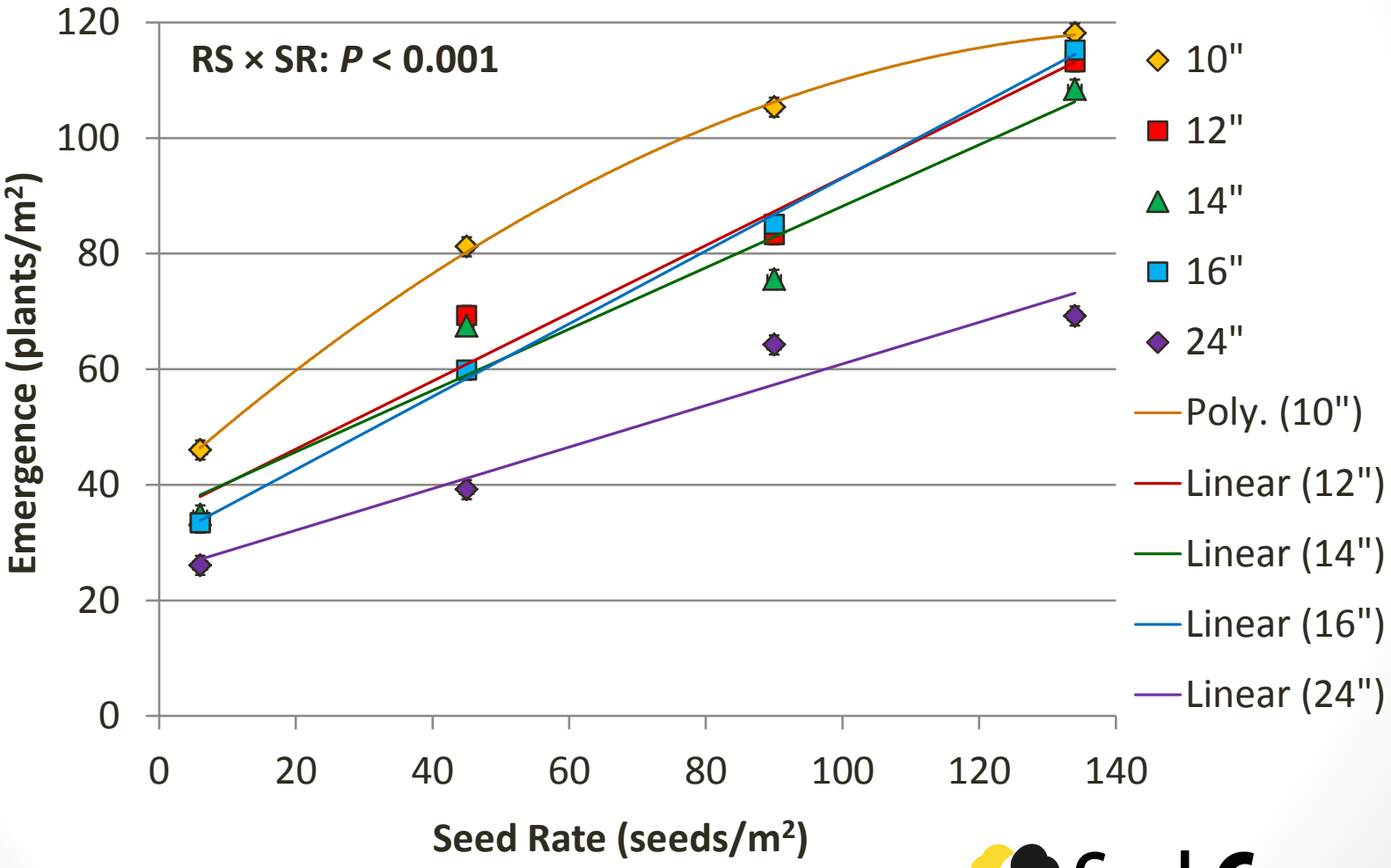
Row Spacing x Seed Rate Interactions (Indian Head 2015)



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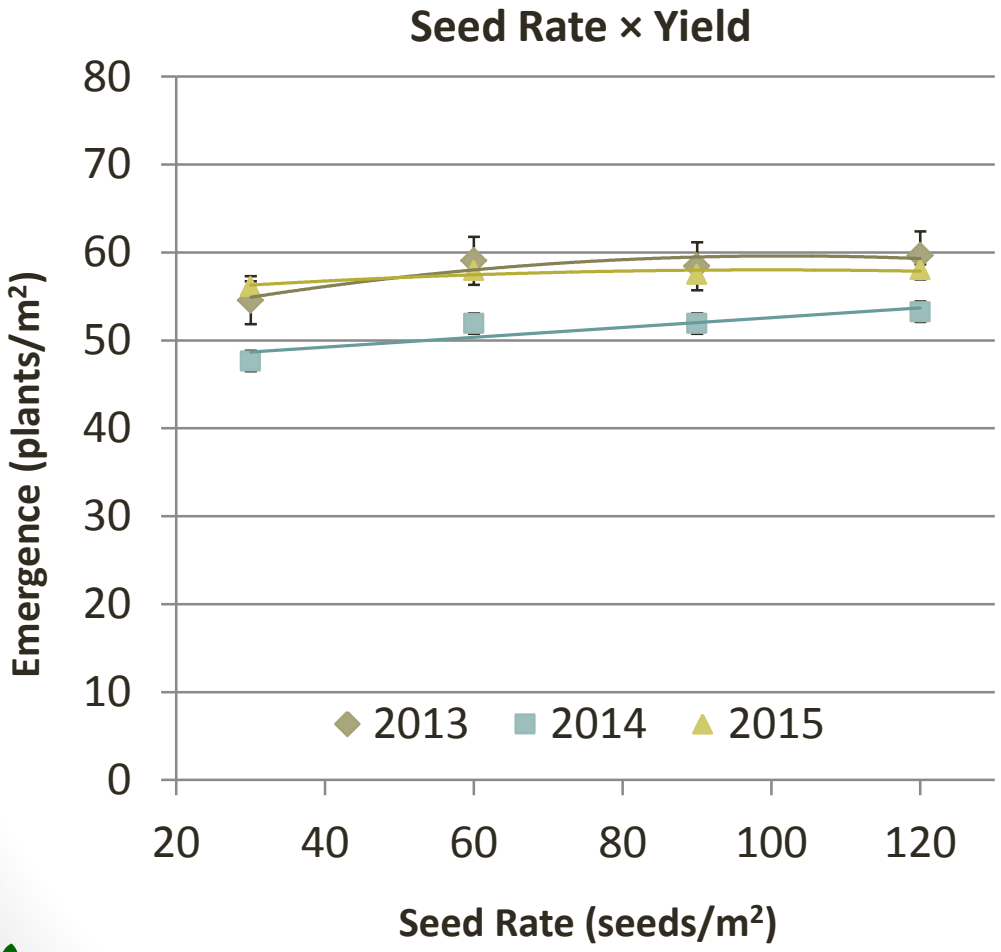
Canola: SR Effects on Yield 2013-15 (RS × SR)



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**

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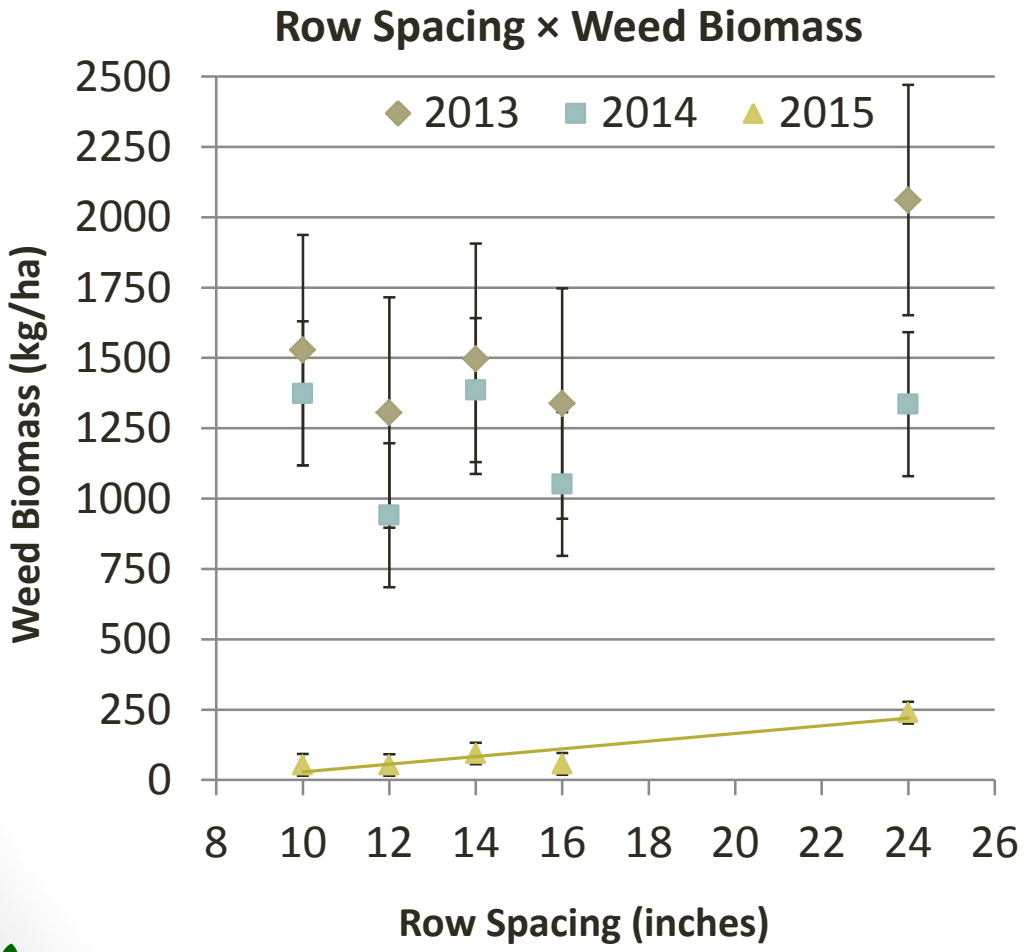
Canola: RS Effects on Weed Biomass 2013-15 (RS × HERB)



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

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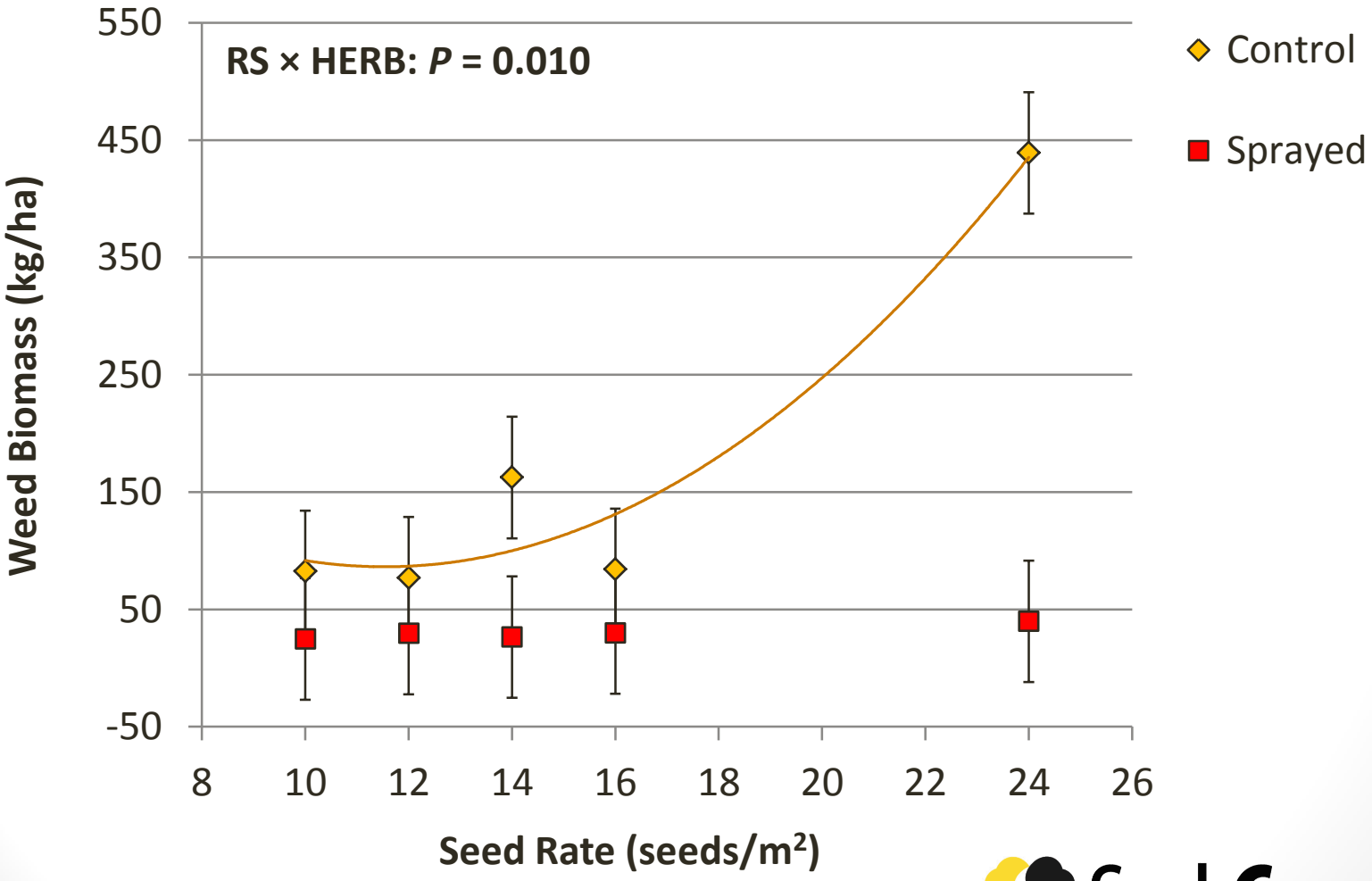
Row Spacing x Herbicide Interactions (Indian Head 2015)



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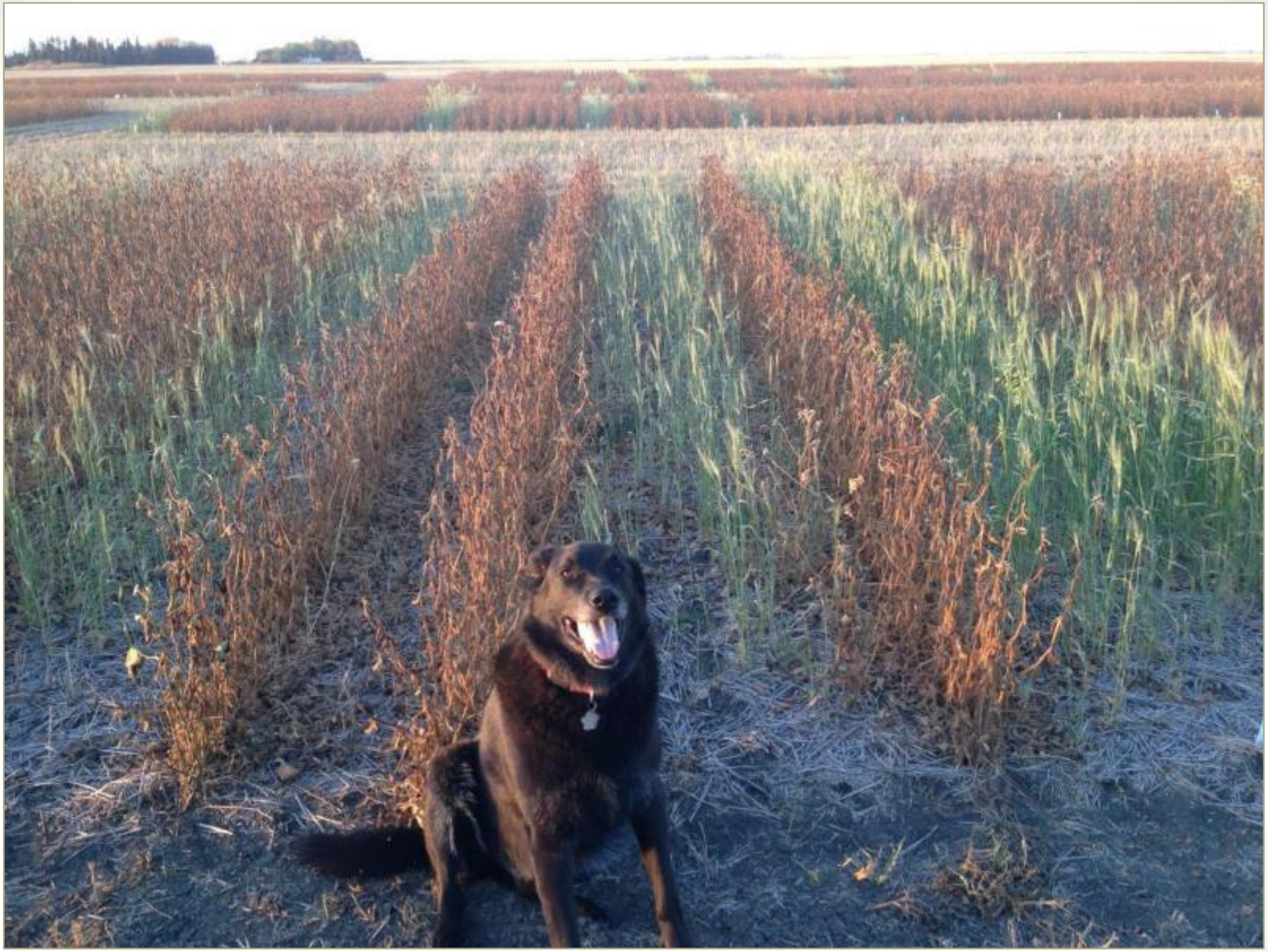

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SASKATCHEWAN pulse Growers

Take-home Messages

- Research at various stages, however crops types vary in their ability to compensate for wider row spacing (work required on pea, lentil, faba bean & other cereals)

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

- Plausible that sound agronomic management (i.e. timely & thorough weed removal) is more critical with wider row spacing
- Delays in maturity are minor & less than those caused by increased fertility or reduced plant populations
- Seedling mortality increases with row spacing but still able to achieve adequate plant populations & no detrimental effects on grain quality observed
- While yield variability increased with wider row spacing but this may be offset by:
  - 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

THANK YOU

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IHARF Soil & Crop Management Seminar (February 3 2016)

IHARF Crop Management Field Day (July 19 2016)

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