

AAFC Agronomy Research

**William May and
AAFC**

Indian Head and Swift Current

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and L. SHAW



Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada

Canada 

Canaryseed

Macro and Micro Nutrient Trial

Nutrients	Treatments										
	1	2	3	4	5	6	7	8	9	10	11
N	0	15	30	30	30	60	60	60	60	60	90
P	0	0	0	30	30	30	30	30	30	30	30
CL		18	18	18	18	18	0	18	18	18	18
S					15	15	15	15	15	15	15
Cu								3			
Zinc									3		
Cu, Z, Mn, B										Yes	Yes



Locations

- **Indian Head – Indian Head Agricultural Research Foundation**
- **Swift Current - Wheatland Conservation Association**
Redvers – South East Research Farm
- **Yorkton – East Central Research Foundation**
- **Melfort – Melfort Research Farm**
- **Scott – Scott Research Farm**



Overall Results

- N Fertilizer: response at 18 out of 19 site-years
Optimum amount (eyeing the trend)
 - 15 kg/ha – 3 out of 19
 - 30 kg/ha – 8 out of 19
 - 60 kg/ha – 4 out of 19
 - 90 kg/ha – 4 out of 19

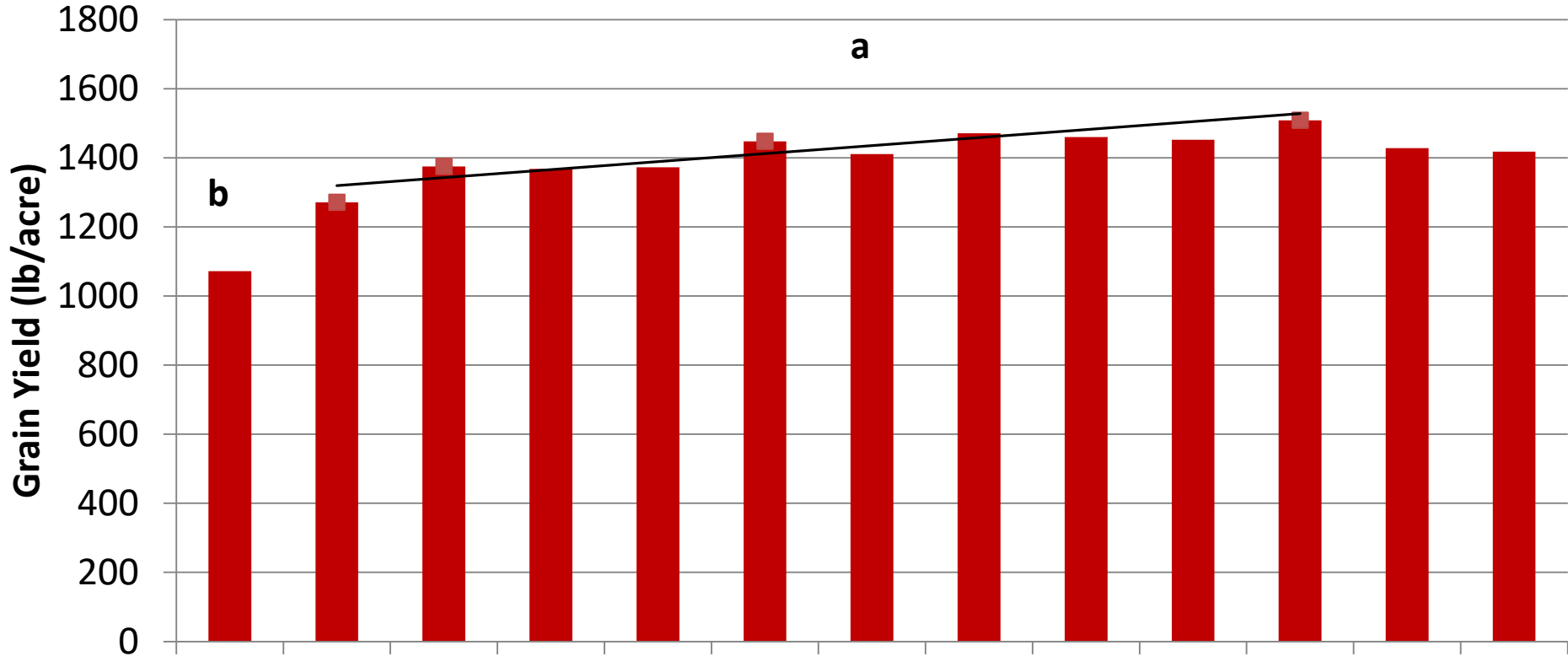


Overall Results

- Chloride: response at 7 out of 19
 Hard to predict site response to chloride
- Phosphate: response at 1 or 2 out of 19
- Zinc: response at 1 out of 19 locations

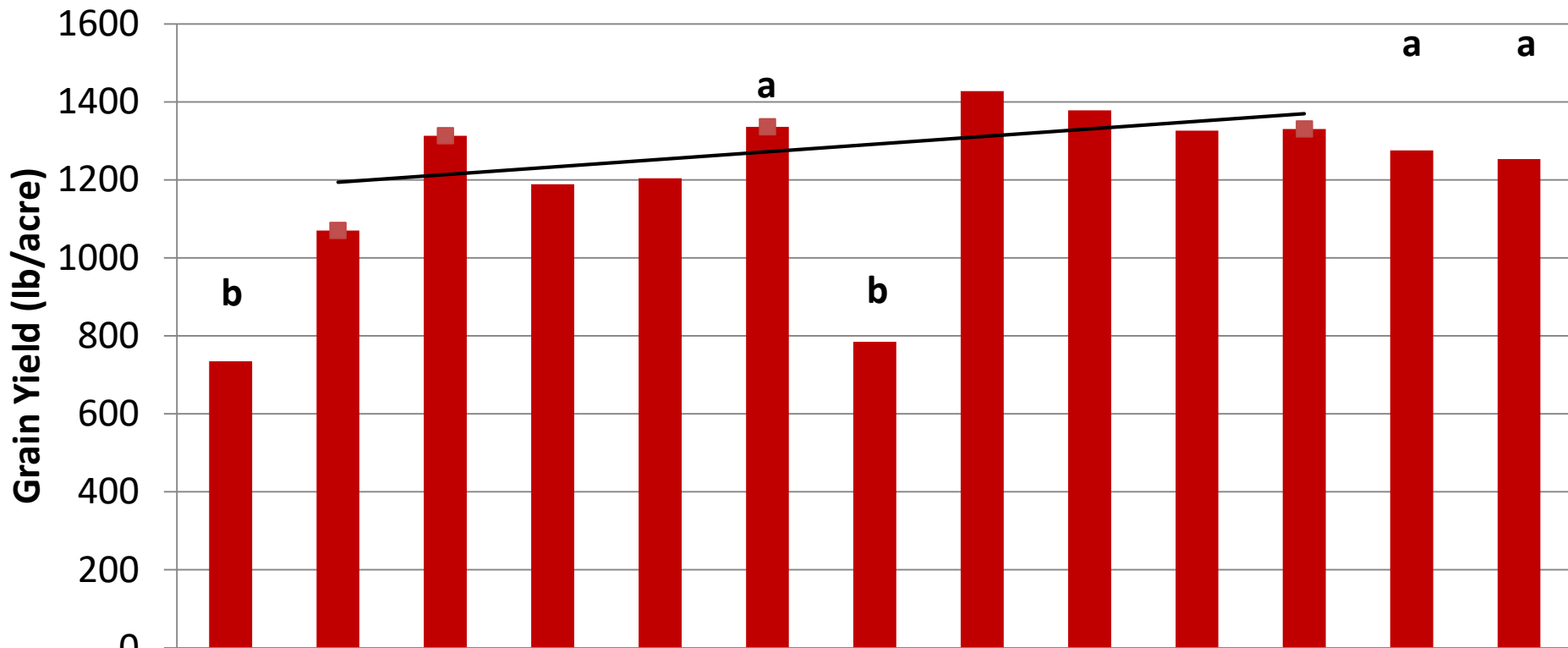


Non Responsive Sites to Chloride



N	0	15	30	30	30	60	60	60	60	60	90	60	60
P	0	0	0	30	30	30	30	30	30	30	30	30	30
CL		18	18	18	18	18	0	18	18	18	18	KCl	CaCl
S				15	15	15	15	15	15	15	15	15	15
Cu							3						
Zinc								3					
Cu, Z, Mn, B										Yes	Yes		

Chloride Responsive Sites



N	0	15	30	30	30	60	60	60	60	60	90	60	60
P	0	0	0	30	30	30	30	30	30	30	30	30	30
CL		18	18	18	18	18	0	18	18	18	18	KCl	CaCl
S				15	15	15	15	15	15	15	15	15	15
Cu								3					
Zinc									3				
Cu, Z, Mn, B										Yes	Yes		

Foliar Micronutrients

Treatment	Copper	Zinc	Mn	Boron
	Kg/ha of nutrient			
1	No fertilizer			
2	60, 30, 24, 18.1, 15 of N, P, K, Cl, and S			
3	3	3	3	3
	Foliar at 3-6 leaf			
4	0.25			
5		0.35		
6			0.55	
7				0.5
	Foliar at Flag leaf			
8	0.25			
9		0.35		
10			0.55	
11				0.5

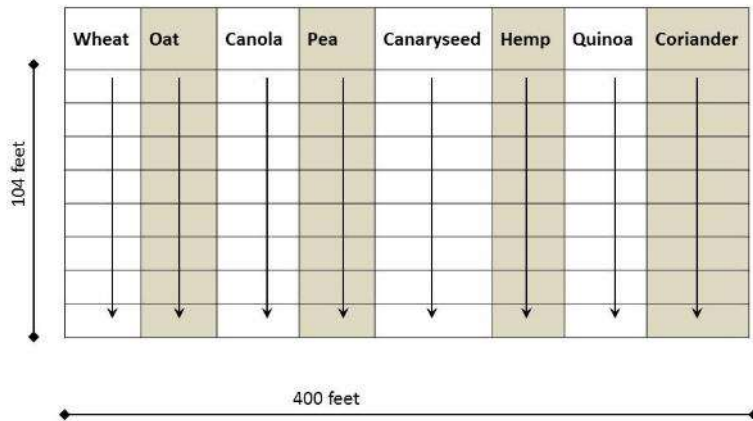
Crop Sequencing of Large acreage crops and special crops

- **First year** – all eight crops are seeded in strips
- **Second year** – all eight crops are seeded across the strips set up in the first year
- **Crops:**
 - 1) Hemp
 - 2) Wheat
 - 3) Oat
 - 4) Canola
 - 5) Pea
 - 6) **Canaryseed**
 - 7) Quinoa
 - 8) Coriander

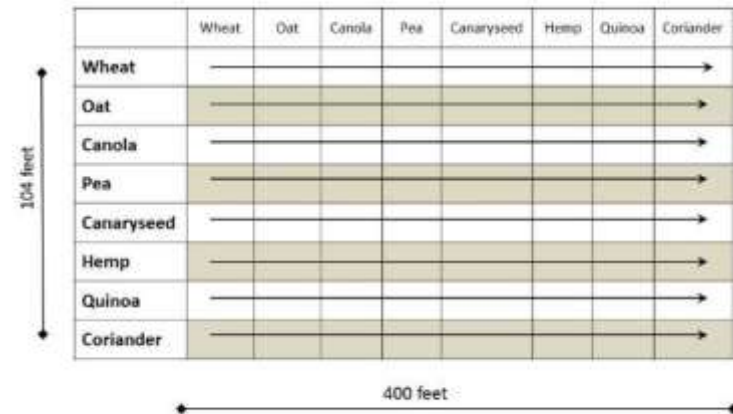


Crop Sequencing of Large acreage crops and special crops

Year A Replicate 1



Year B Replicate 1







Canaryseed

19/07/2017



19/07/2017

Crop Sequencing of Large acreage crops and special crops

- **First year** – 2015, 2016, 2017
- **Second year** – 2016, 2017, 2018
- **Locations:**
 - 1) Swift Current
 - 2) Saskatoon
 - 3) Indian Head
 - 4) Melfort



Funding

- 1) Government of Saskatchewan
- 2) Saskatchewan Wheat Development Commission
- 3) Western Grains Research Foundation
- 4) Canaryseed Development Commission of SK
- 5) Prairie Oat Growers Association
- 6) Agriculture and Agri-Food Canada



Agronomics

	Crop	Variety	Seeding Rate	Estimated field emergence (%)	N rate (kg/ha)
1	Wheat	Unity (2013)	250 plants/m ²	90	80
2	Oat	AAC Justice	300 plants/m ²	90	80
3	Canola	L252	75 plants/m ²	60	80
4	Pea	Amarillo	80 plants/m ²	80	10
5	Canaryseed	Bastia (Melfort- Calvi)	35 kg/ha	100	80
6	Hemp	Katani	110 plants/m ²	70	80
7	Quinoa		11 kg/ha	100	80
8	Coriander		33 kg/ha	100	80



Plant Density of Harvested Crop Indian Head 2016

	Harvested Crop							
	Wheat	Oat	Canola	Pea	Canary	Hemp	Quinoa	Coriander
Stubble	Plant Density (plants m ⁻²)							
Wheat	170	129	79	50	179	38	35	77
Oat	294	221	37	69	177	51	38	127
Canola	214	244	38	63	204	82	41	136
Pea	204	242	56	55	227	62	43	138
Canary	208	230	37	65	183	59	43	138
Hemp	210	246	32	64	239	46	20	130
Quinoa	237	210	49	67	238	75	23	151
Coriander	206	271	35	65	216	81	33	408



Indian Head 2017 Broadleaf stubble



19/07/2017

Indian Head 2017 Cereal stubble



19/07/2017

Plant Density of Wheat

Harvested Crop

	IH 2016	IH 2017	IH 2018	SC 2016	SC 2017	Sask 2016	Sask 2017
Stubble	Plant Density (plants m⁻²)						
Wheat	170	141	167	148	164	176	120
Oat	294	128	201	189	219	160	114
Canola	214	120	176	186	212	114	113
Pea	204	141	187	192	242	179	177
Canary	208	119	199	160	177	155	109
Hemp	210	123	190	189	211	122	76
Quinoa	237	142	182	218	209	191	109
Coriander	206	145	203	215	182	126	69



Grain Yield of Wheat

Harvested Crop

	IH 2016	IH 2017	IH 2018	SC 2016	SC 2017	Sask 2016	Sask 2017
Stubble	Grain Yield (kg ha⁻¹)						
Wheat	3216	3656		3838	2832	4899	4288
Oat	3283	3713		3809	2857	4706	4504
Canola	3579	3322		3556	2800	4530	4064
Pea	3648	3948		4147	2778	4432	4809
Canary	3581	3915		4014	2697	4326	3946
Hemp	3647	3376		4167	2882	4337	3946
Quinoa	3639	3676		3965	2754	5316	4048
Coriander	3453	3608		3867	2622	4104	3739



Plant Density of Canola

Harvested Crop

	IH 2016	IH 2017	IH 2018	SC 2016	SC 2017	Sask 2016	Sask 2017
Stubble	Plant Density (plants m⁻²)						
Wheat	79	47	28bcd	67	90	54	29
Oat	37	47	39 a	87	101	71	46
Canola	38	30	18d	92	95	54	34
Pea	56	49	31 abc	81	102	69	41
Canary	37	42	25 bcd	76	122	62	23
Hemp	32	28	33 ab	68	88	50	23
Quinoa	49	46	23 cd	79	106	57	39
Coriander	35	41	26 bcd	71	95	56	41



Grain Yield of Canola

Harvested Crop

	IH 2016	IH 2017	IH 2018	SC 2016	SC 2017	Sask 2016	Sask 2017
Stubble	Grain Yield (kg ha⁻¹)						
Wheat	2025	2248		2844	844	3985	1526
Oat	2100	1983		2767	741	4041	1436
Canola	1891	1596		2625	1030	3712	872
Pea	2274	2135		3202	427	4952	1356
Canary	2148	2067		2758	514	2731	1492
Hemp	2136	1336		3096	591	3380	736
Quinoa	2288	2056		2920	753	3646	1081
Coriander	1516	2066		2957	529	1921	1350



Plant Density of Oat

	IH 2016	IH 2017	SC 2016	SC 2017	Sask 2016	Sask 2017
Stubble	Plant Density (plants m⁻²)					
Wheat	129.3 b	107.9 a	190.3 a	261.5 a	179.4 ab	148.8 a
Oat	220.9 ab	134.1 a	225.3 a	212.8 a	186.8 ab	135.9 a
Canola	243.8 a	130.4 a	233 a	250 a	111.0 c	114.3 abc
Pea	241.9 a	115.6 a	230.5 a	250 a	174.6 ab	125.2 ab
Canary	230.0 ab	122.2 a	197 a	224.8 a	169.4 abc	134.3 a
Hemp	245.8 a	114.8 a	251 a	227.3 a	131.9 bc	69.4 d
Quinoa	210.0 ab	128.8 a	210.8 a	241 a	203.5 a	87.9 bcd
Coriander	271.2 a	140.3 a	209.5 a	233 a	125.0 bc	80.7 cd



Grain Yield of Oat

	IH 2016	IH 2017	SC 2016	SC 2017	Sask 2016	Sask 2017
Stubble	Grain Yield (bu/acre)					
Wheat	145.4 abc	114.1 a	161.9 bcd	54.8 a	206.2 abc	71.0 a
Oat	134.8 bc	109.4 a	152.8 d	54.3 a	164.2 c	72.8 a
Canola	145.7 abc	105.9 a	158.3 cd	52.3 a	218.8 ab	86.1 a
Pea	150.0 abc	109.3 a	183.5 ab	52.2 a	217.8 ab	69.7 a
Canary	133.3 c	107.5 a	164.4 a-d	52.8 a	179.4 bc	80.9 a
Hemp	159.8 a	95.9 a	184.1 a	55.5 a	185.8 bc	86.7 a
Quinoa	157.6 ab	112.5 a	182.8 ab	61.8 a	232.9 a	75.3 a
Coriander	149.4 abc	112.8 a	177.0 abc	50.6 a	169.6 c	74.5 a



Test Weight of Oat

	IH 2016	IH 2017	SC 2016	SC 2017	Sask 2016	Sask 2017
Stubble	Test Weight (g 0.5L)					
Wheat	272.9 ab	262.9 ab	261.5 b	192.47 c		274.8 a
Oat	270.1 b	264.6 a	262.6 b	196.92 bc		264 a
Canola	273.3 ab	260.4 ab	264.8 ab	205.18 abc		287 a
Pea	272.8 ab	255.6 b	268.5 a	206.16 abc		285.3 a
Canary	275.0 a	260.8 ab	262.1 b	205.13 abc		280.7 a
Hemp	270.1 b	257.3 ab	264.5 b	219.62 a		284.4 a
Quinoa	272.7 ab	259.9 ab	264.3 b	224.95 a		274.6 a
Coriander	273.0 ab	263.1 a	264.6 b	214.92 ab		265.3 a



Canaryseed Plant Density

Stubble	IH 2016	IH 2017	SC 2016	SC 2017	Sask 2016	Sask 2017
	Plant Density (plants m⁻²)					
Wheat	179c	98a	239ab	94b	97ab	85a
Oat	177c	101a	234ab	120ab	114ab	77a
Canola	204abc	105a	216b	105b	63abc	55ab
Pea	227ab	93a	234ab	159a	113ab	69ab
Canary	183bc	91a	259ab	105b	124a	79a
Hemp	239a	75a	246ab	108b	29c	48ab
Quinoa	238a	87a	303a	90b	56abc	46ab
Coriander	216abc	89a	255ab	80b	43bc	27b



Canaryseed Grain Yield

Stubble	IH 2016	IH 2017	SC 2016	SC 2017	Sask 2016	Sask 2017
	Grain Yield (kg ha⁻¹)					
Wheat	1571 a	1373 a	774 bcd	127 ab	1731 ab	294 ab
Oat	1328 ab	1417 a	677 cd	174 ab	1825 a	332 ab
Canola	1553 a	1295 ab	658 d	217 a	1682 ab	420 ab
Pea	1363 ab	1111 abc	924 b	152 ab	1313 bc	510 a
Canary	849 c	1378 a	646 d	163 ab	1134 c	322 ab
Hemp	1224 b	960 bc	1146 a	171 ab	1302 bc	392 ab
Quinoa	1454 ab	883 c	1351 a	120 b	1702 ab	214 b
Coriander	1427 ab	1349 a	878 bc	165 ab	1612 abc	418 ab



Plant Density of Hemp

Harvested Crop

	IH 2016	IH 2017	IH 2018	SC 2016	SC 2017	Sask 2016	Sask 2017
Stubble	Plant Density (plants m⁻²)						
Wheat	38c	63abc	62b	24a	77a	100a	38a
Oat	51bc	70ab	59b	36a	68a	74a	32ab
Canola	82a	50bcd	67ab	24a	76a	71a	21bc
Pea	62abc	59a-d	94a	39a	80a	77a	19bcd
Canary	59abc	80a	70ab	23a	65a	93a	30ab
Hemp	46c	37d	69ab	10a	59a	138a	6d
Quinoa	75ab	45cd	51b	47a	64a	97a	14cd
Coriander	81ab	54bcd	68ab	31a	61a	97a	12cd



Grain Yield of Hemp

Harvested Crop

	IH 2016	IH 2017	IH 2018	SC 2016	SC 2017	Sask 2016	Sask 2017
Stubble	Grain Yield (kg ha⁻¹)						
Wheat	653 b	1035 ab	207 ab	653 b	826.7 ab	2602.7 a	938 a
Oat	692 ab	964 abc	168 b	692 ab	825.7 ab	2006.8 a	541 a
Canola	541 bc	775 cd	145 b	541 bc	710.3 bc	2494.9 a	614 a
Pea	960 a	936 abc	336 a	960 a	891 a	2618.8 a	774 a
Canary	788 ab	1089 a	194 ab	788 ab	725.3 bc	2674.1 a	840 a
Hemp	548 bc	743 cd	227 ab	548 bc	652 cd	2752.1 a	727 a
Quinoa	710 ab	640 d	218 ab	710 ab	576.6 cd	3058.6 a	594 a
Coriander	346 c	836 bcd	148 b	346 c	531.6 d	2126.5 a	632 a



Conclusions so far

- Canaryseed is very sensitive to canaryseed stubble in wet years.
- Canaryseed is able to grow on canaryseed stubble in dry years.



Alley Cropping Project

Objective

to compare an orchard system for berry production and normal annual cropping to intercropping the seabuckthorn and buffalo berry with an annual crop sequence or perennial legume in an alley cropping system



Experimental design

1) **Strip Plot: tree row width**

- a) 5 m (orchard style)
- b) 15 m
- c) 26 m)

2) **Tree Species**

- a) Seabuckthorn
- b) Buffaloberry

3) **Cropping System**

- a) Annual crops
- b) Perennial legume

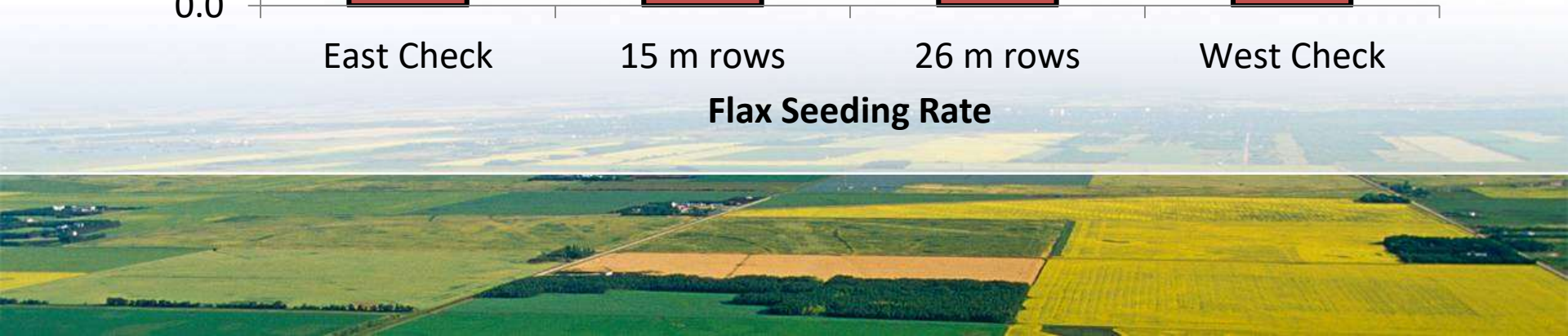
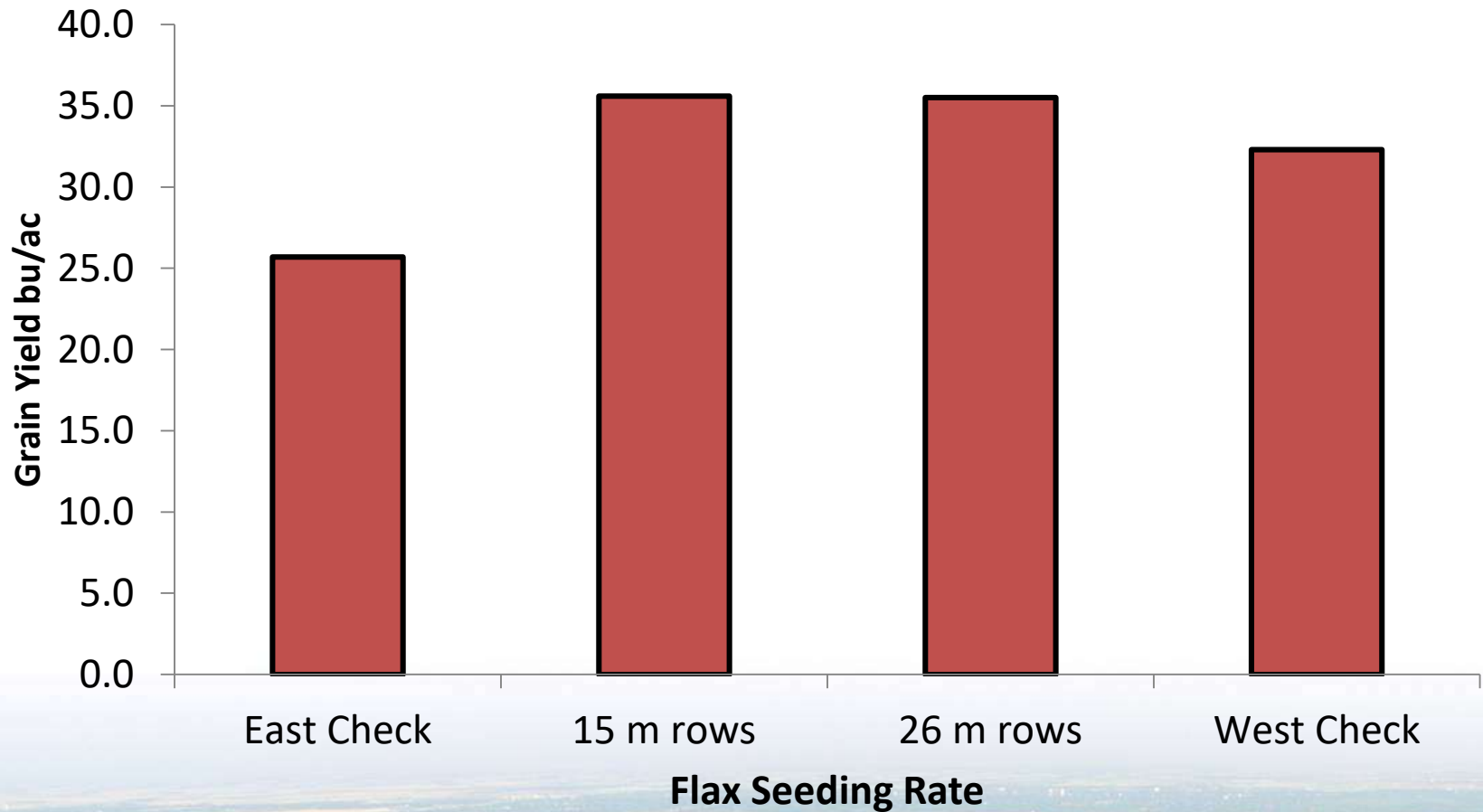


Alley Crop drone shot July 2016 (IH)

5 acres



Grain Yield Canola 2017



Intercropping Chickpea and Flax

Objective

- To develop an agronomic system for intercropping chickpea with flax.

Chickpea needs stress in wet years

Flax dries out the soil and is not over competitive

Maybe growing them together we can provide stable yields and higher economic returns



Intercropping Chickpea and Flax

1) Crop Placement (special arrangement)

Intermixed (both crops in same row)

Single alternate rows

2) Flax seed density

(seeds m⁻²)

Approx. lbs/acre

a. 0	0
b. 75	5 (2018)
c. 150	10
d. 300	19
e. 600	38

3) Nitrogen Rate (kg ha⁻¹)

0

60

4) Flax Mono Crop (2018)



Funding

ADOPT

Saskatchewan Pulse Growers

Adopt a plot

Potential New funding

ADF

WGRF

Saskatchewan Flax Development Commission





Crops Interacted
Date: 19/07/2018
Location: 10/10/18

19/07/2018

I, 0 flax, 0 N



Crops Intermixed
Flax seed density: 9 per m²
Nitrogen Rate: 60 kg/ha

19/07/2018

I, 0 flax, 60 N



Crops: Adiantum Boreo
1000 1000
1000 1000

19/07/2018

A, 0 flax, 0 N



Crops Alternate Rows
Flax seed density 8 per m²
Nitrogen Rate 60 kg/ha

19/07/2018

A, 0 flax, 60 N



Crops Interacted
Flax seed density 75 plants/m²
Nitrogen rate 0 kg/ha

19/07/2018

I, 75 flax, 0 N



Crops International
Project Name: 2 years
Project No: 001/18

19/07/2018

I, 75 flax, 60 N



Crop Alternate Rows
Flax
0 N

19/07/2018

A, 75 flax, 0 N



Crops Alternate Rows
Flax with Barley
Barley with Flax

19/07/2018

A, 75 flax, 60 N



Flax (Linum catharticum)
19/07/2018

19/07/2018

I, 300 flax, 0 N



Flax
60 N

19/07/2018

I, 300 flax, 60 N



300 flax, 0 N

19/07/2018

A, 300 flax, 0 N



19/07/2018

A, 300 flax, 60 N



Crops Harvested
19/07/2018

19/07/2018

I, 600 flax, 60 N



19/07/2018

A, 600 flax, 60 N

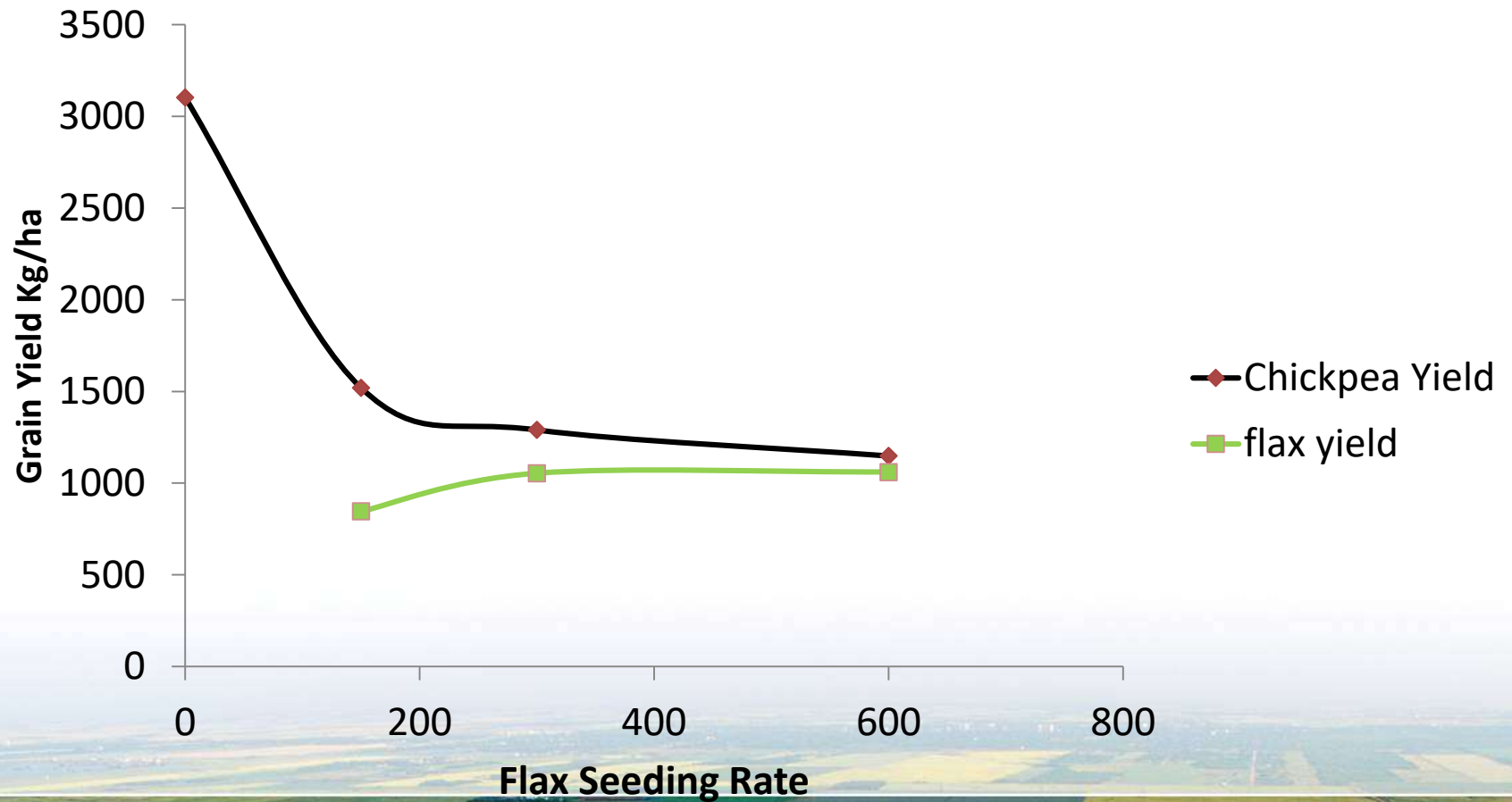


The flax
60 N
600 flax

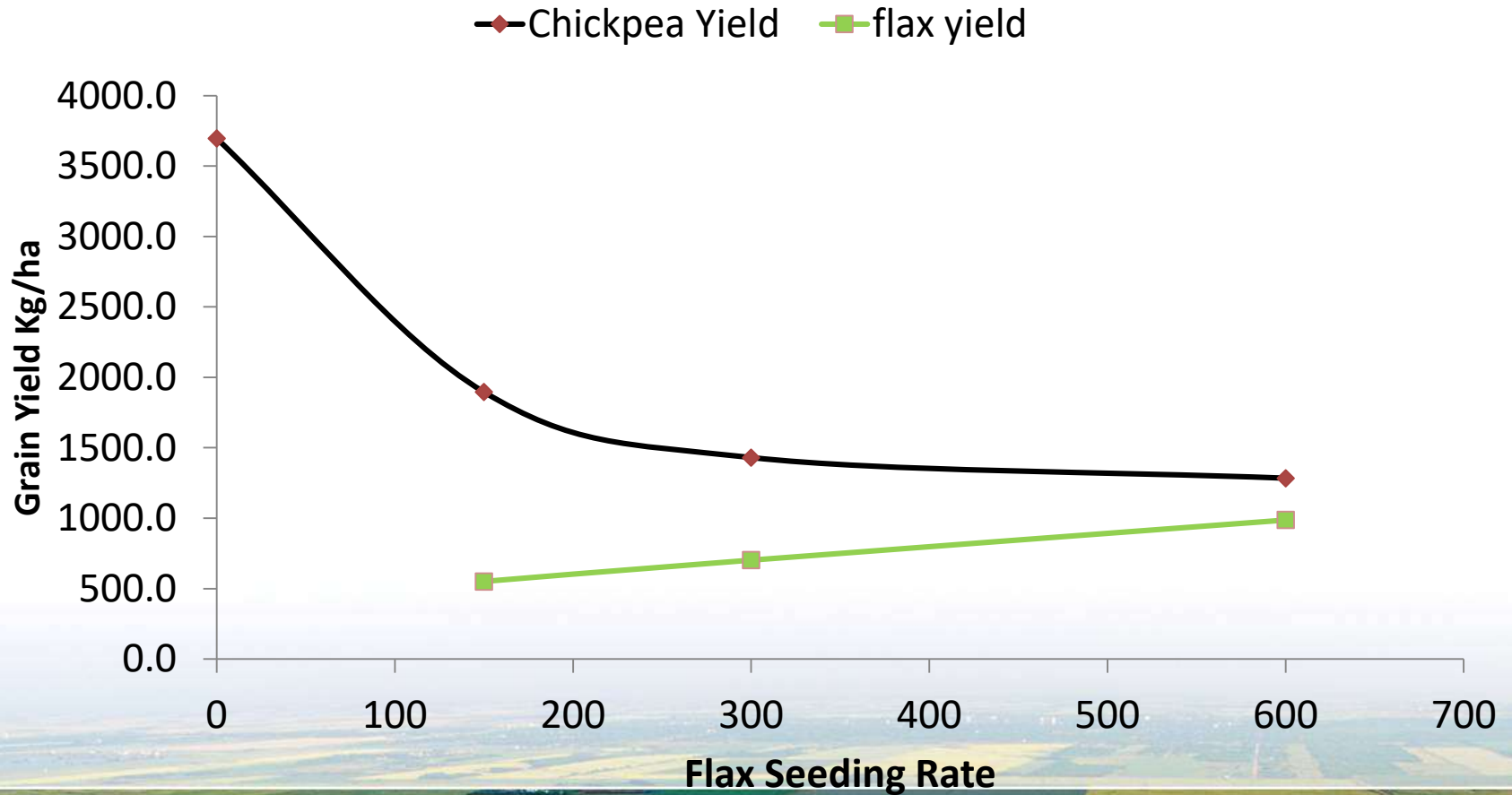
19/07/2018

600 flax, 60 N

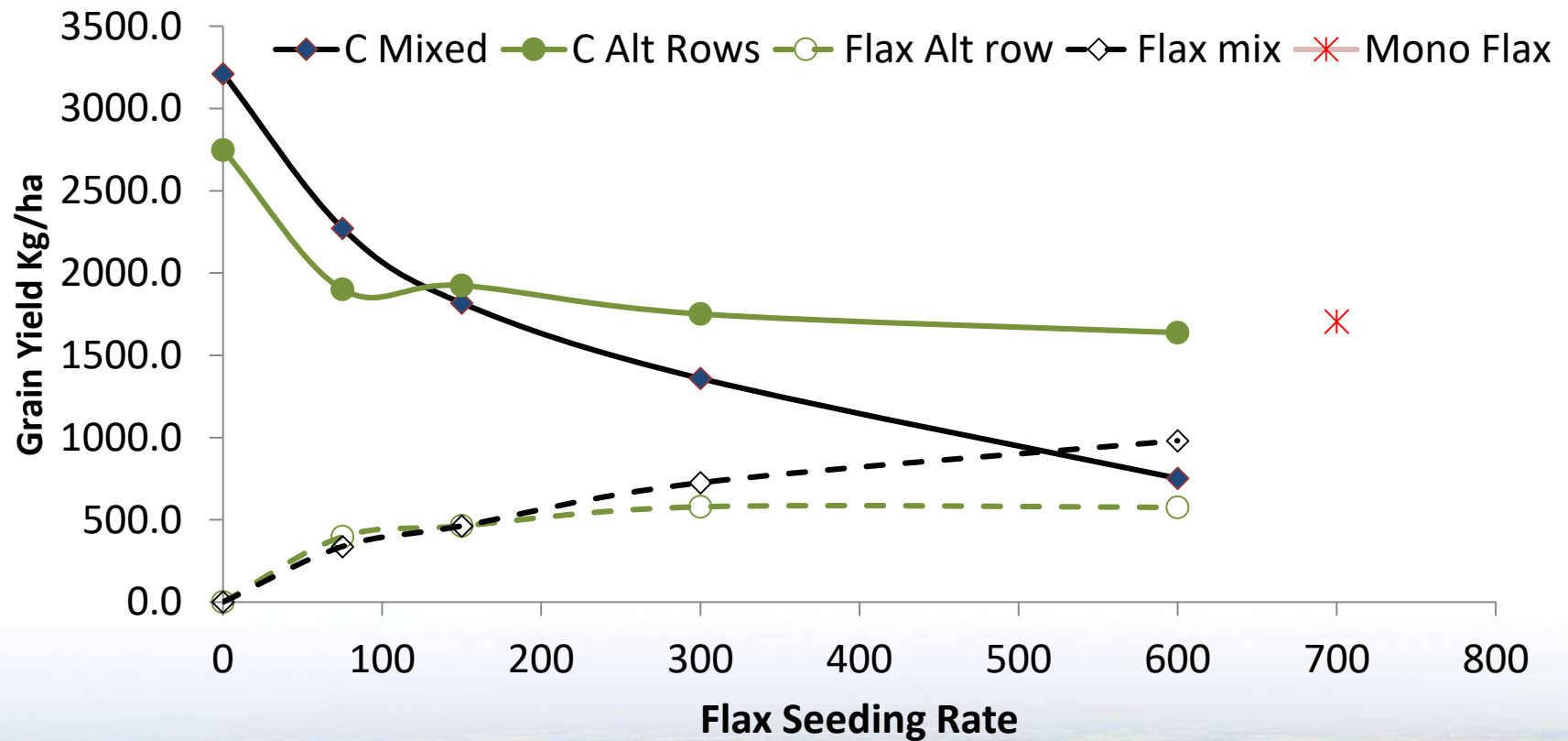
Grain Yield Indian Head 2017



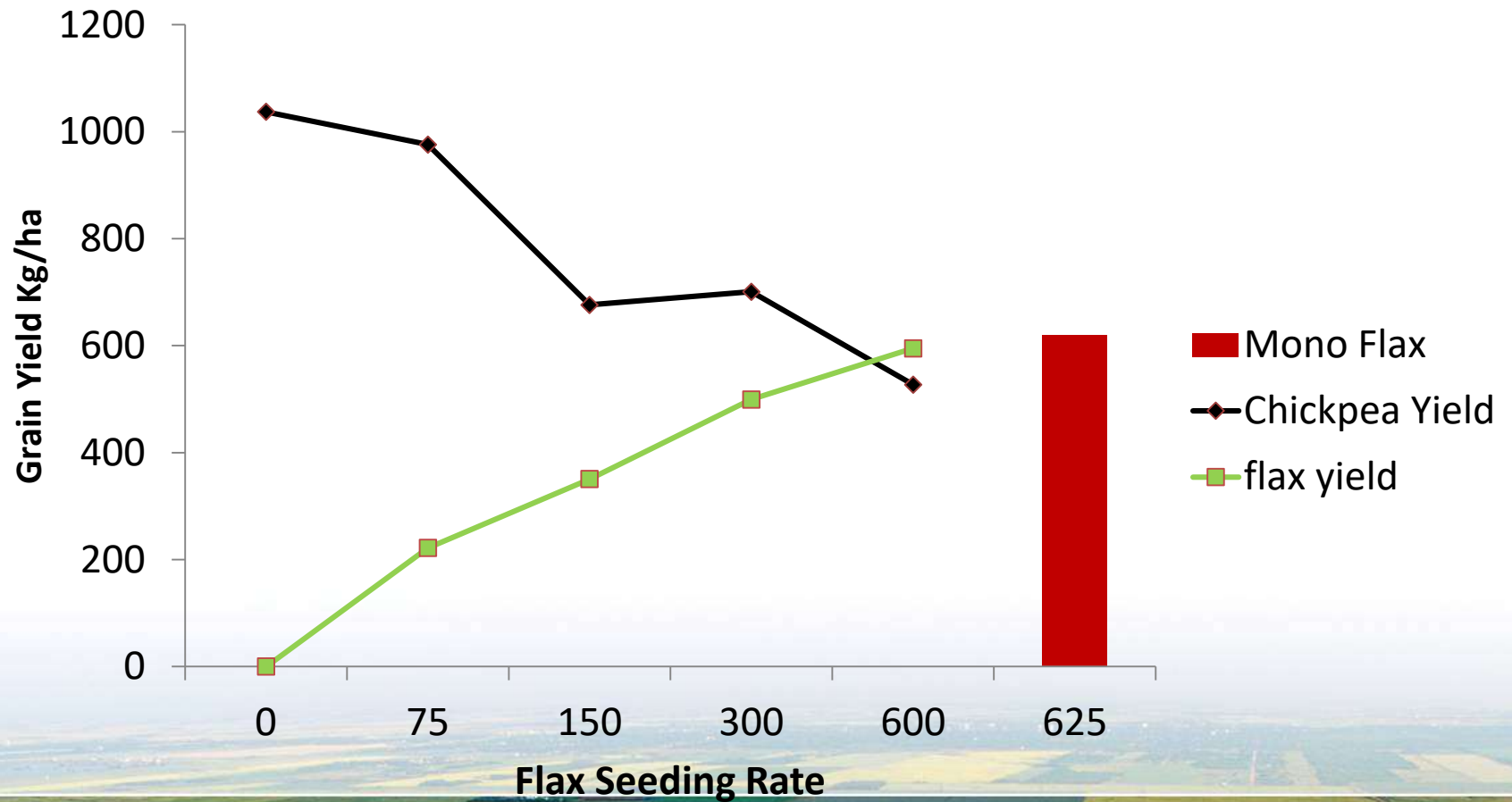
Grain Yield Redvers 2017



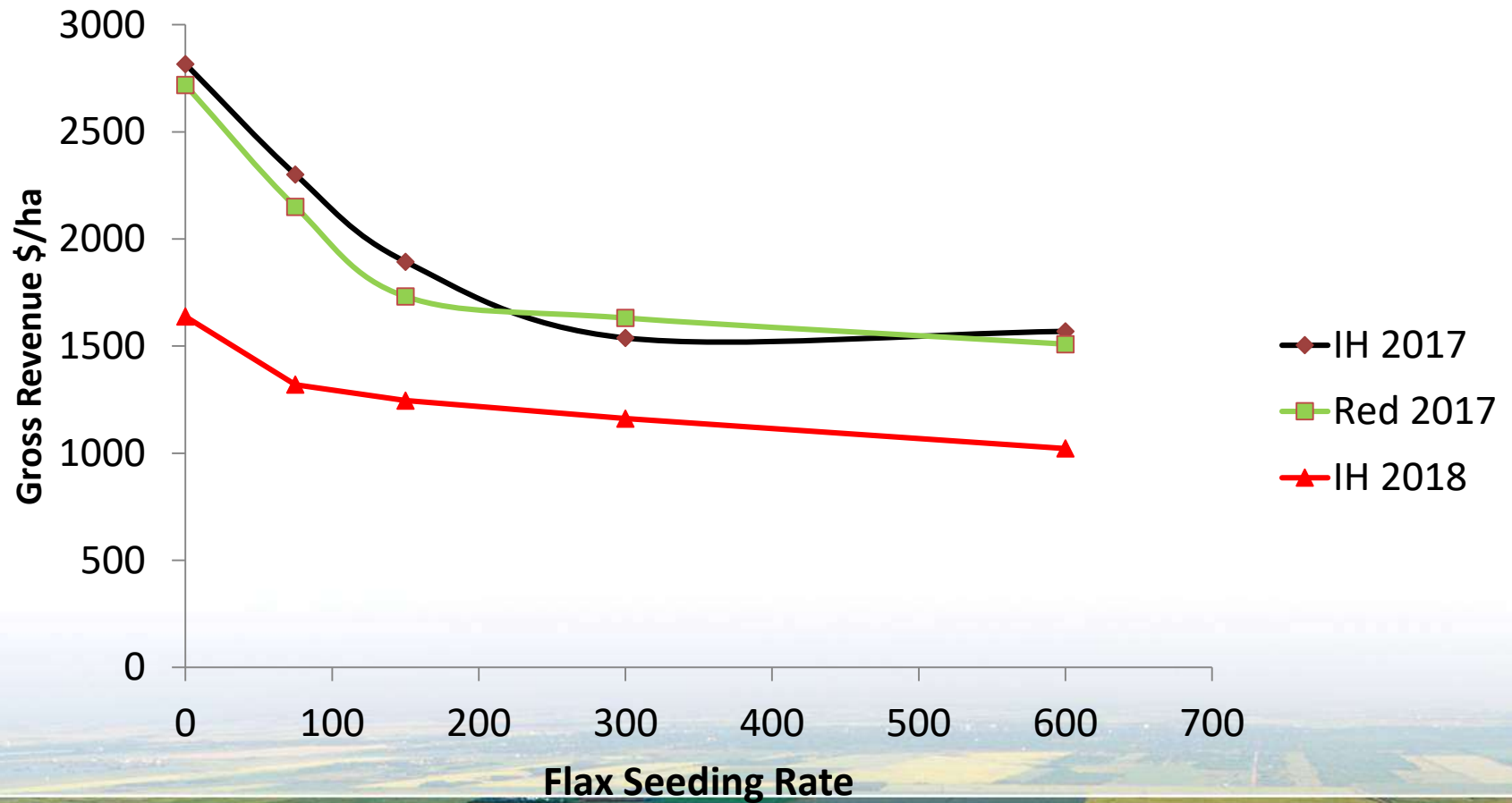
Grain Yield Indian Head 2018



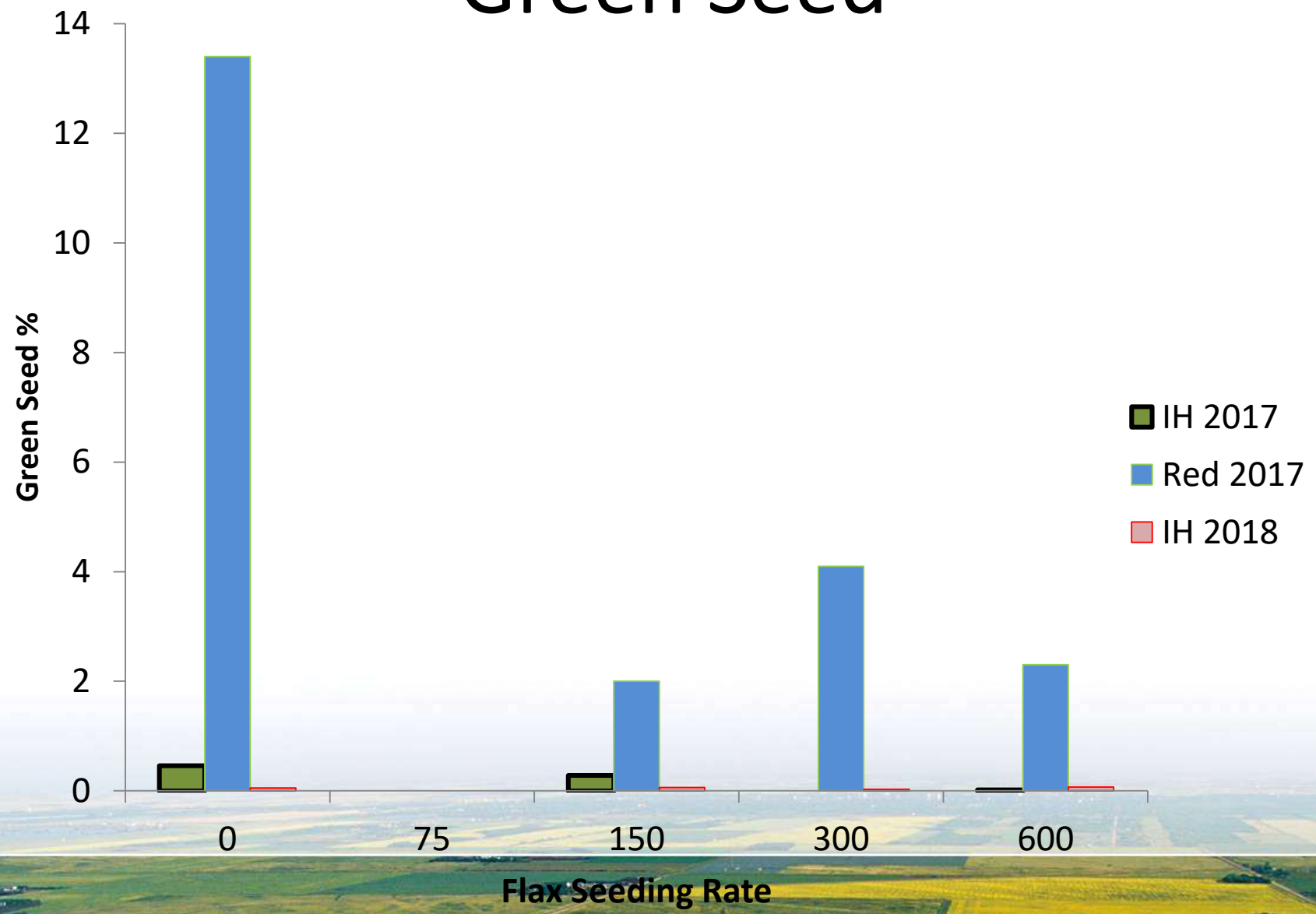
Grain Yield Redvers 2018



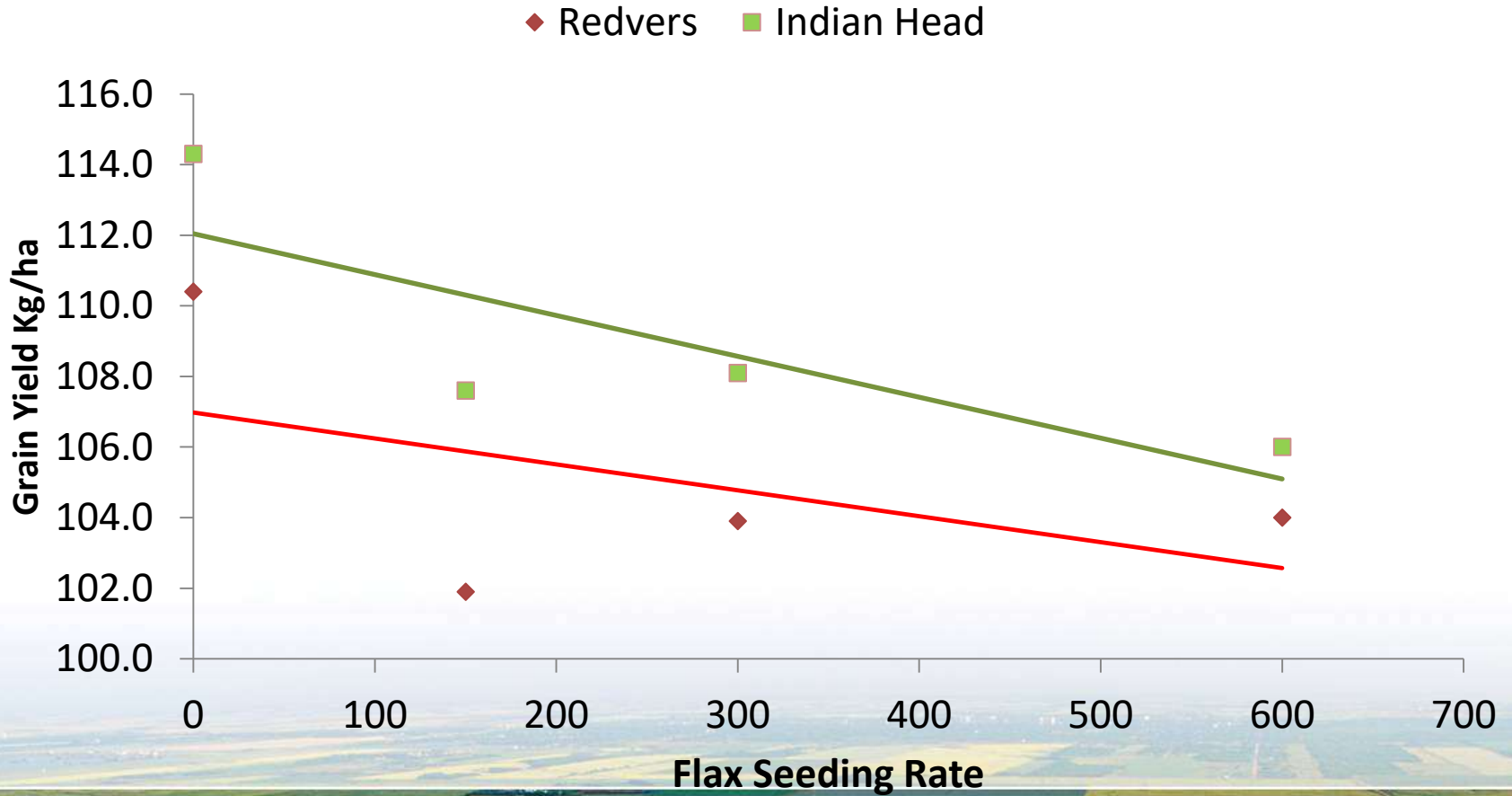
Gross Income



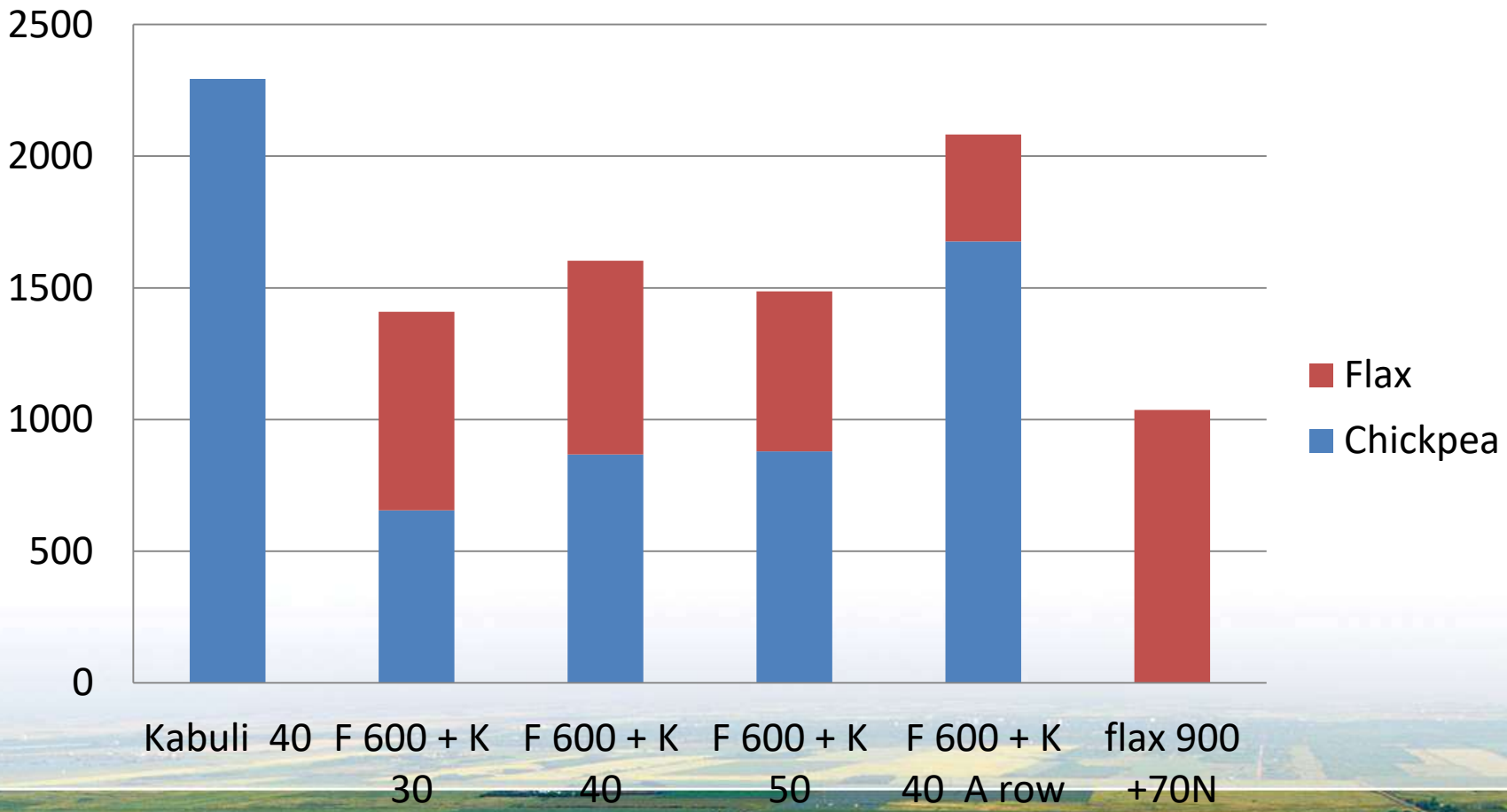
Green Seed



Maturity 2017



Indian Head 2015, Grain Yield



Conclusions - Bill

- **Just getting started**
- **Focus**
 - Chickpea Yield, Maturity, Green Seed
 - Flax Yield
- **Flax Seeding Rate is the Driver**



Acknowledgments

Technicians:

Rebecca Davies, Orla Willoughby, Randy Shiplack, Chris Omoth

Kevin Willoughby, Kathy Ringdal, Joanne MacKay, Kyle Stewart

