

# Mixed Grain Intercrops: The Value Proposition



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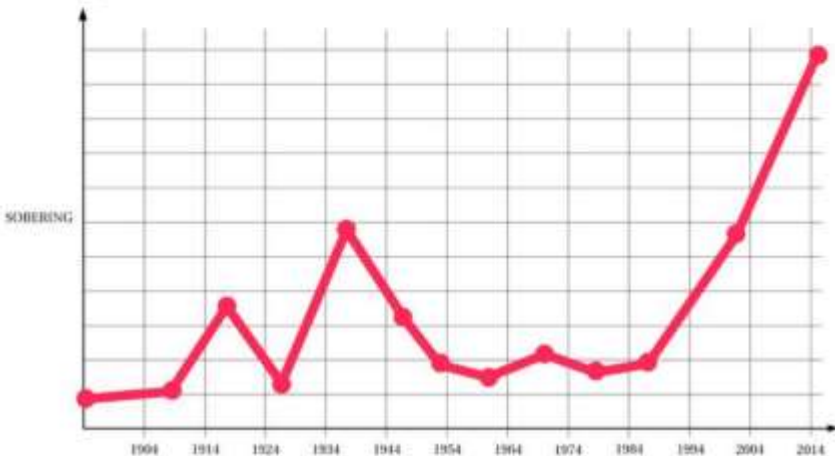
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## TWO YEAR CROP ROTATIONS



# FAQ: Why Mixed Grain Intercropping?



Photo: Kurt Myllymaki, Montana, 2018

- ◇ Why not?
- ◇ Obstacles are surmountable
- ◇ Multiple observed benefits
  - ◇ Productivity (yield)
  - ◇ Pest Reduction
  - ◇ Harvestability
  - ◇ Nutrient Efficiency
  - ◇ Risk Mitigation
  - ◇ Ecosystem services?



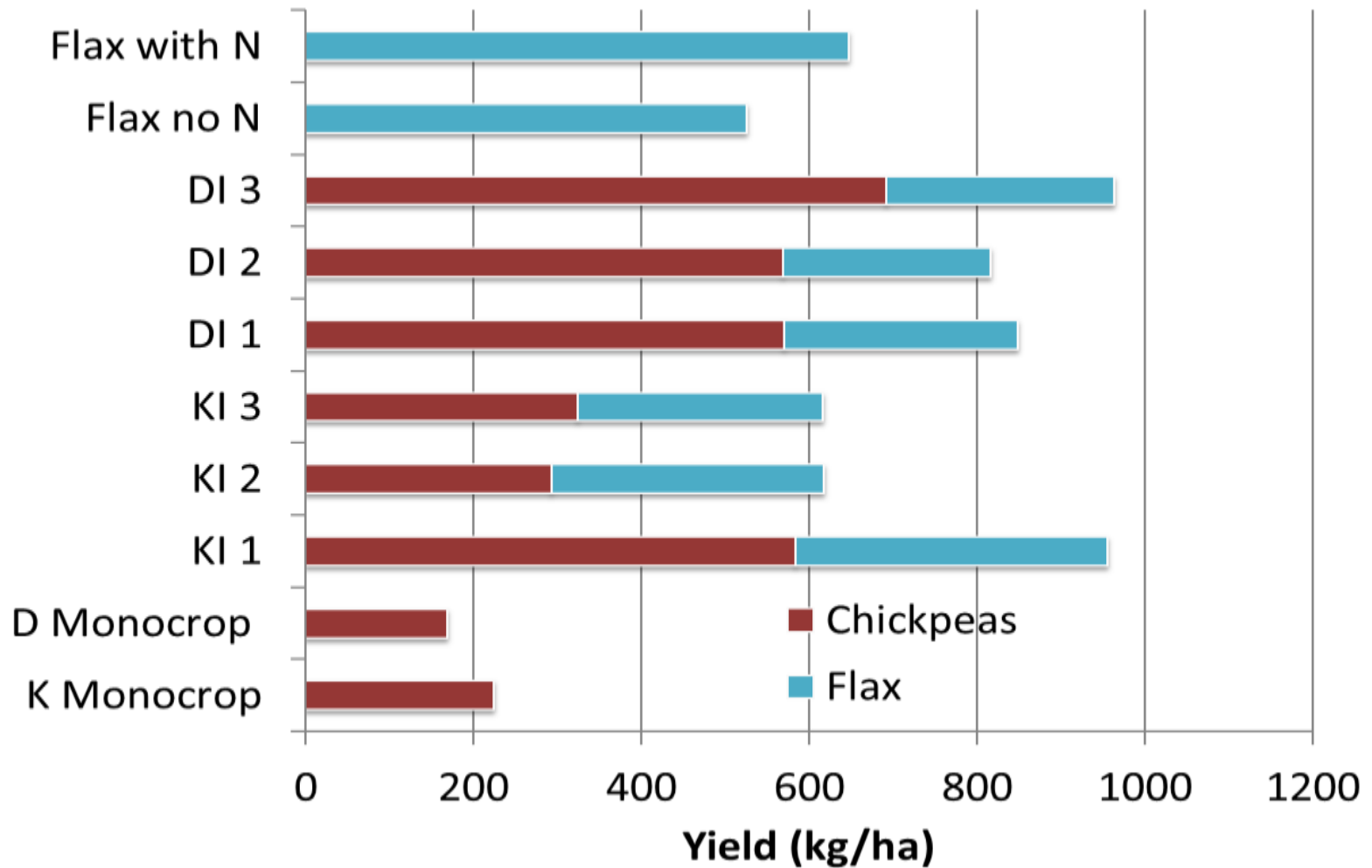
# Chickpea Flax Intercropping Trials



- Redvers (2012-2019)
- Indian Head (2015-2021)
- Swift Current, (2018-2021)
- Melfort (2019-2021)
- Saskatoon (2020-2022)

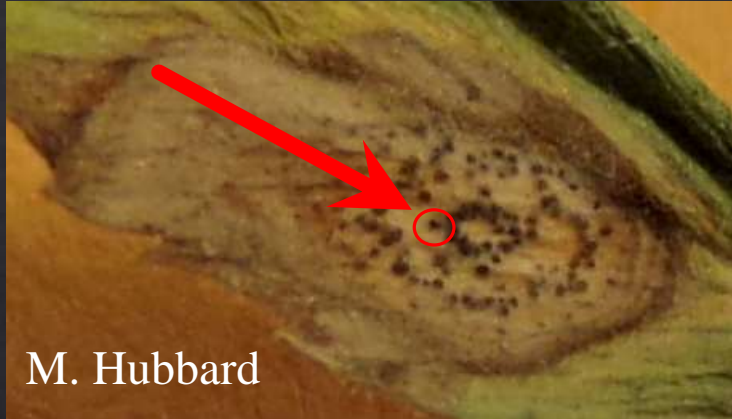
Funders:  
Government of SK  
WGRF  
Sask Pulse Growers  
Sask Flax

# 2014 Redvers Chickpea Flax (ADOPT)



# Asochyta Symptoms

- ◇ Leaves
- ◇ Stems
- ◇ Pods



# Current management

- Crop rotation
- Planting clean seed
- Seed treatments
- Genetic resistance
  - Can be overcome

◆ Fungicides (Gan et al. 2006;  
Gossen et al. 2014)

- ◆ Financial cost
- ◆ Time consuming
- ◆ Risk of fungicide resistance
  - ◆ Especially to strobilurins

Gan et al. 2006. Field Crops Res. 97:121-134

Gossen et al. 2014. Can. J. Plant Path. 36: 327-340

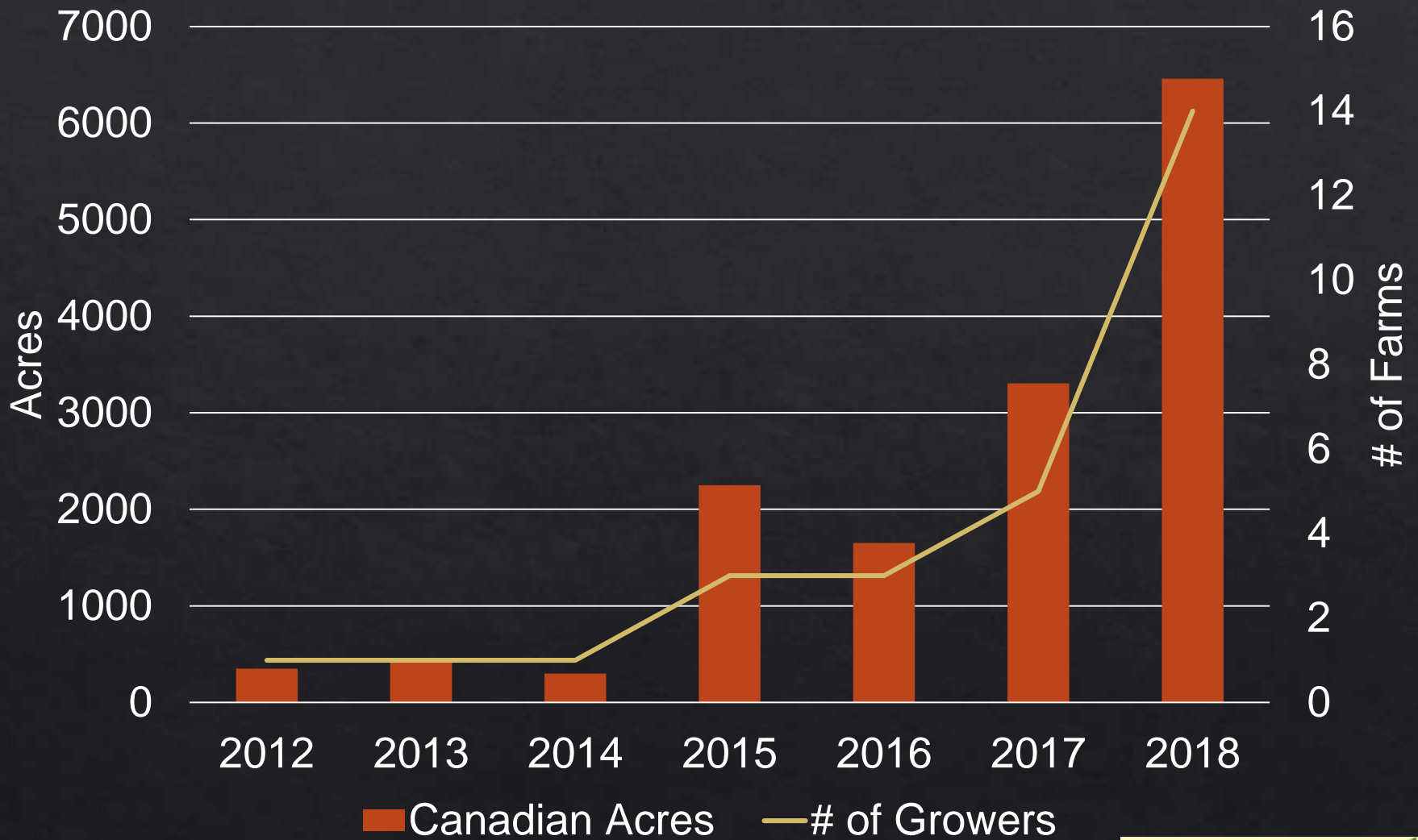


Never underestimate the ingenuity of farmers

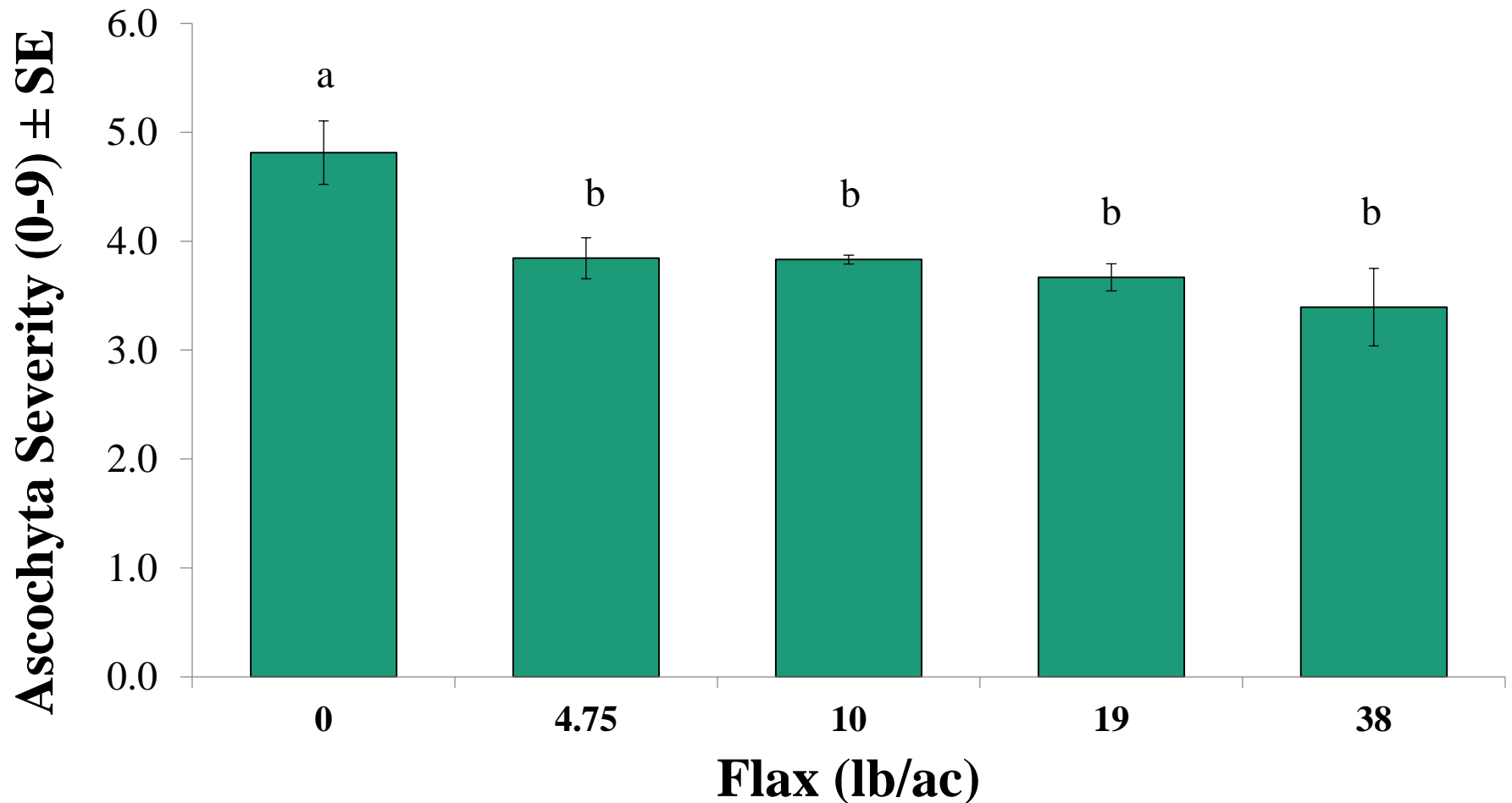




# Commercial Chickpea Flax

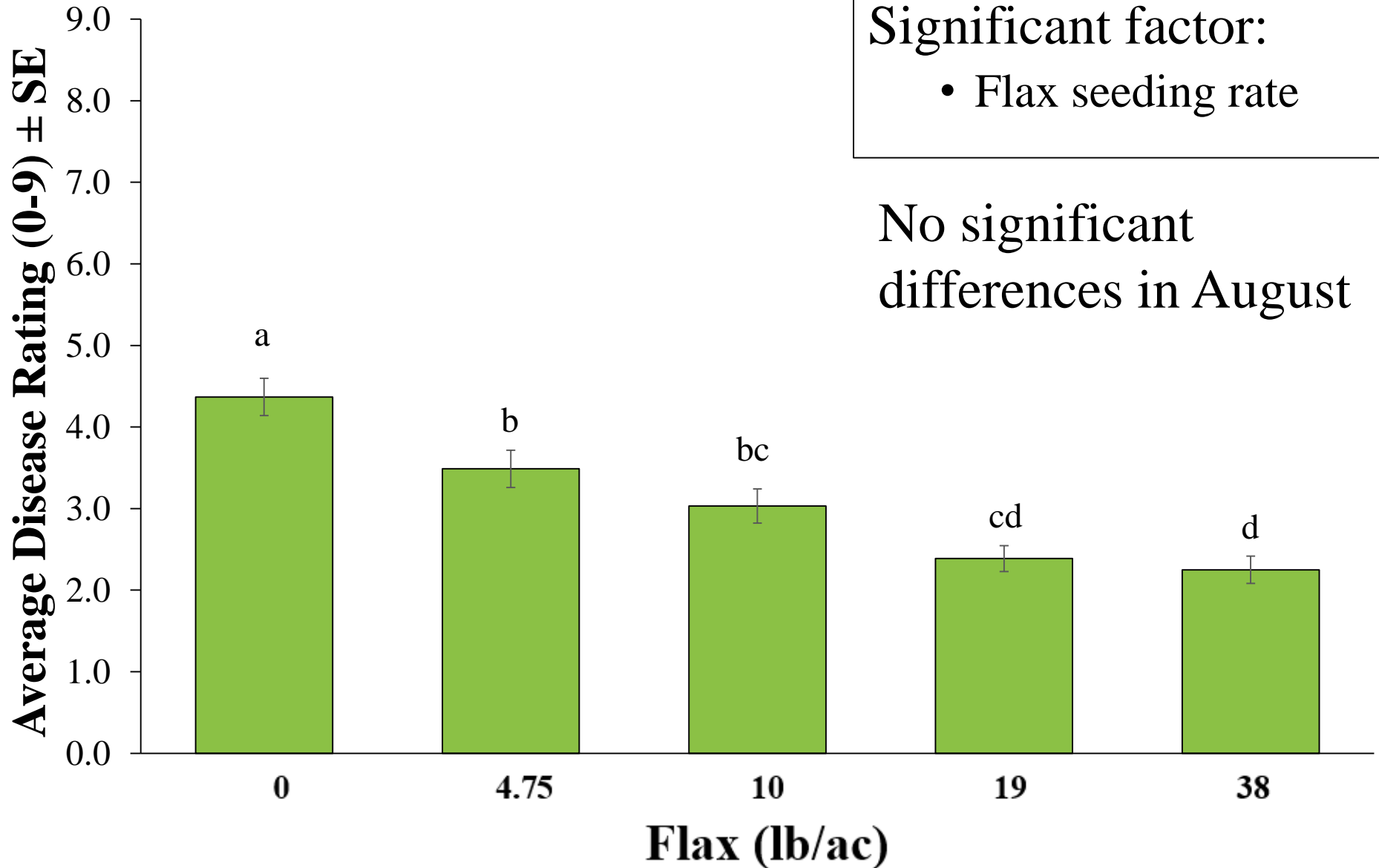


# Disease Severity in Redvers 2018



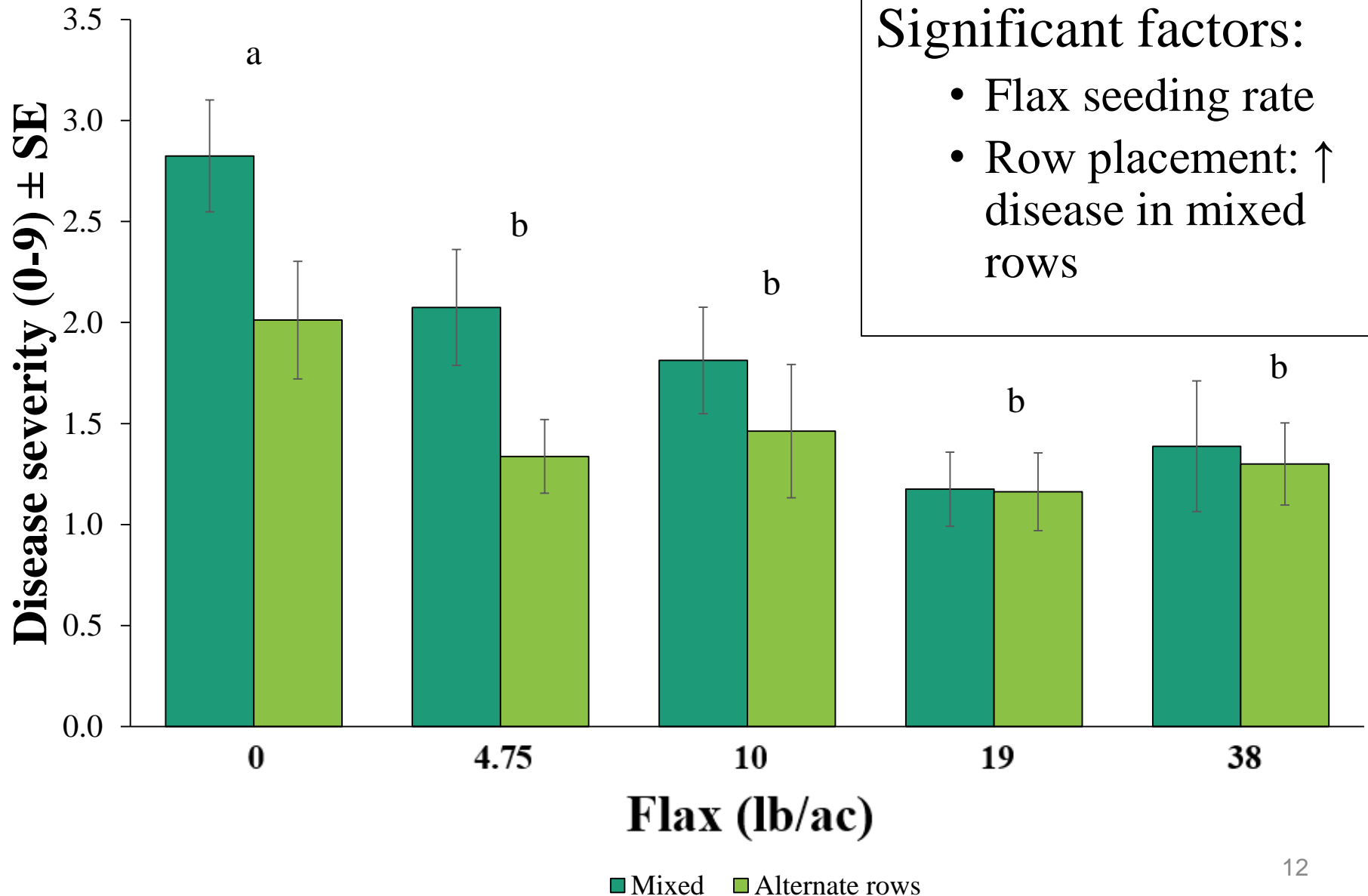
- Higher in monocrop chickpeas than any intercrop treatment

# Redvers, July 2019

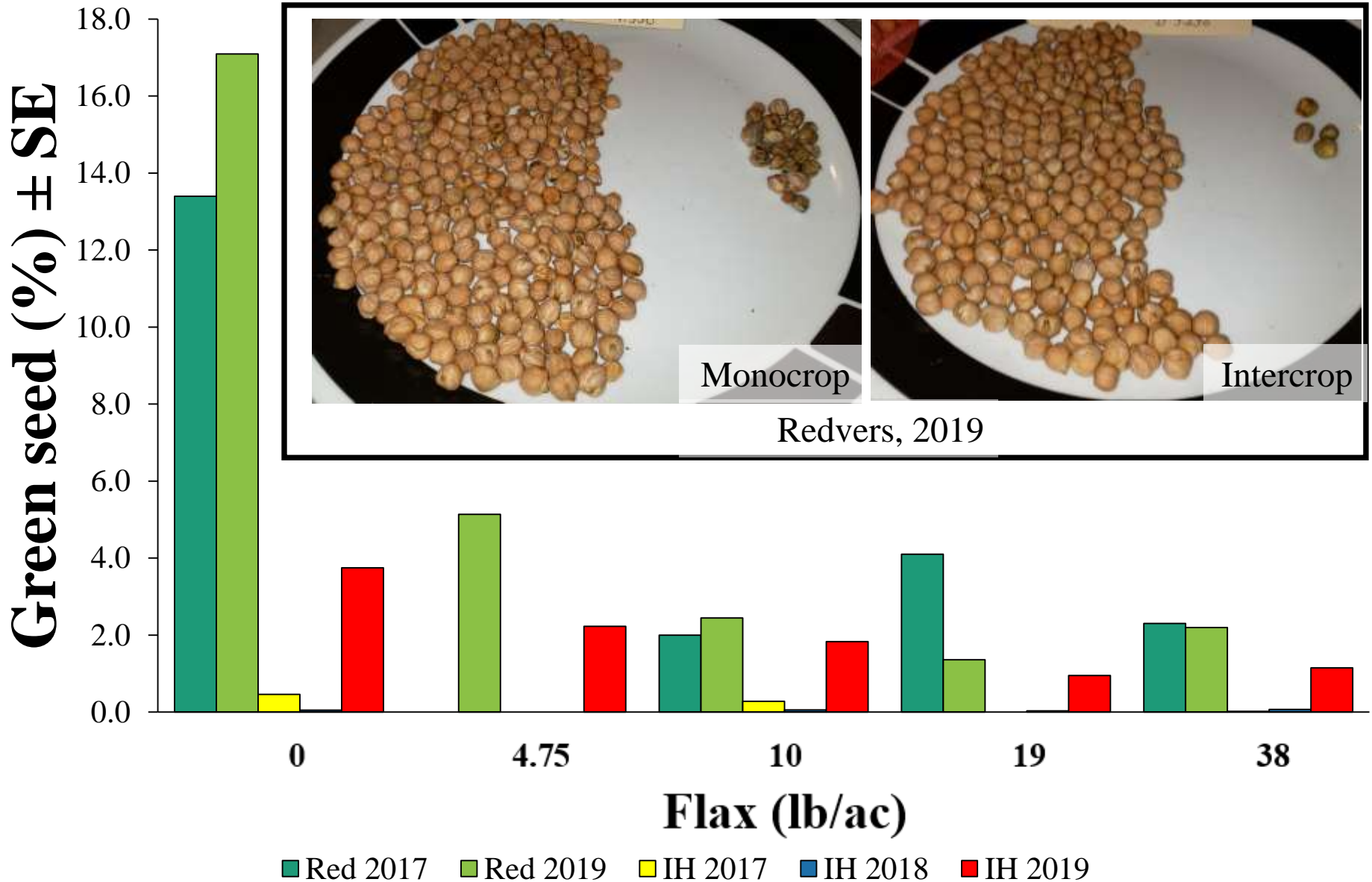




# Melfort, Aug 2019

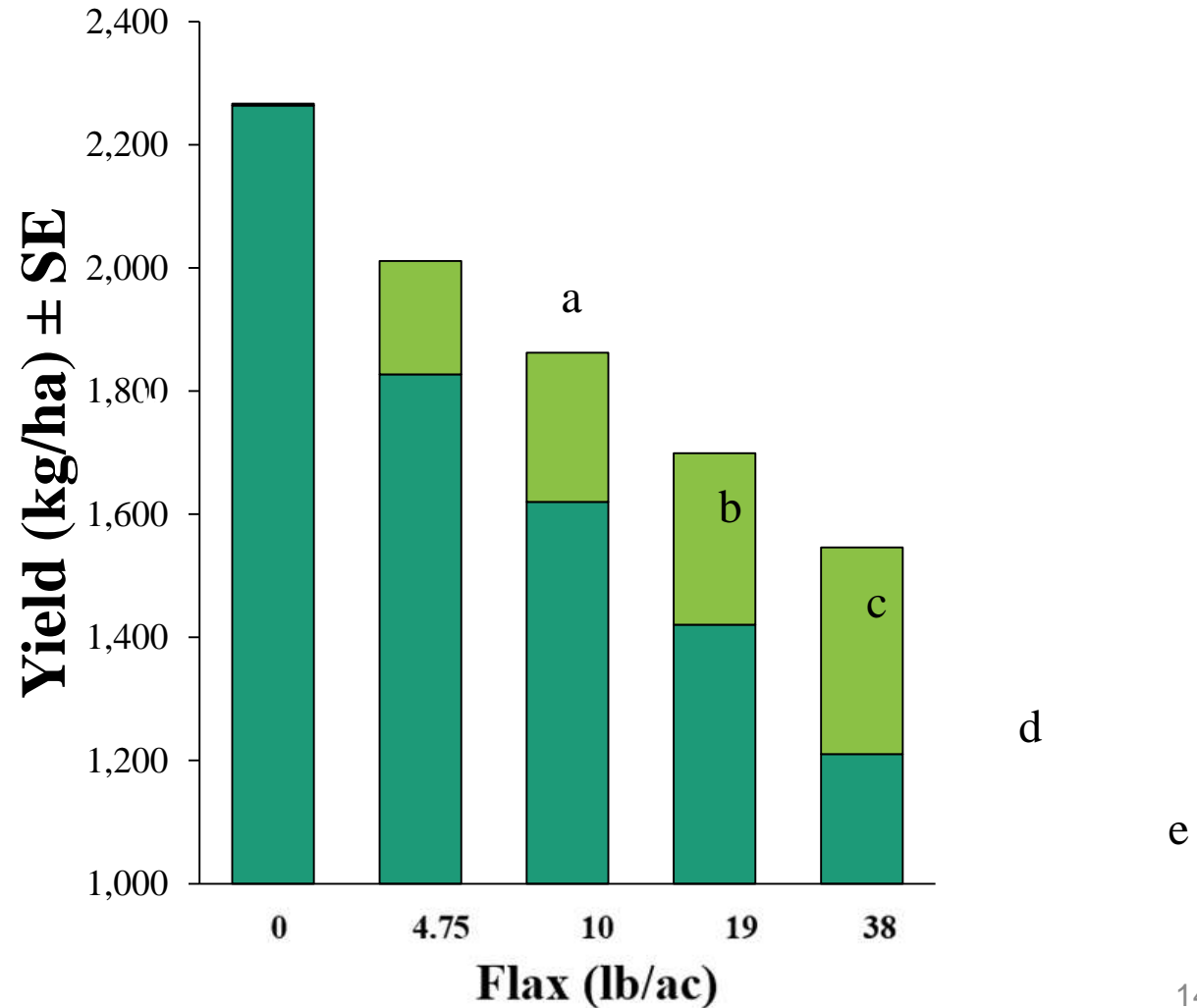


# Chickpea seed quality



# What about Yield?

Indian Head 2019 (no disease pressure)

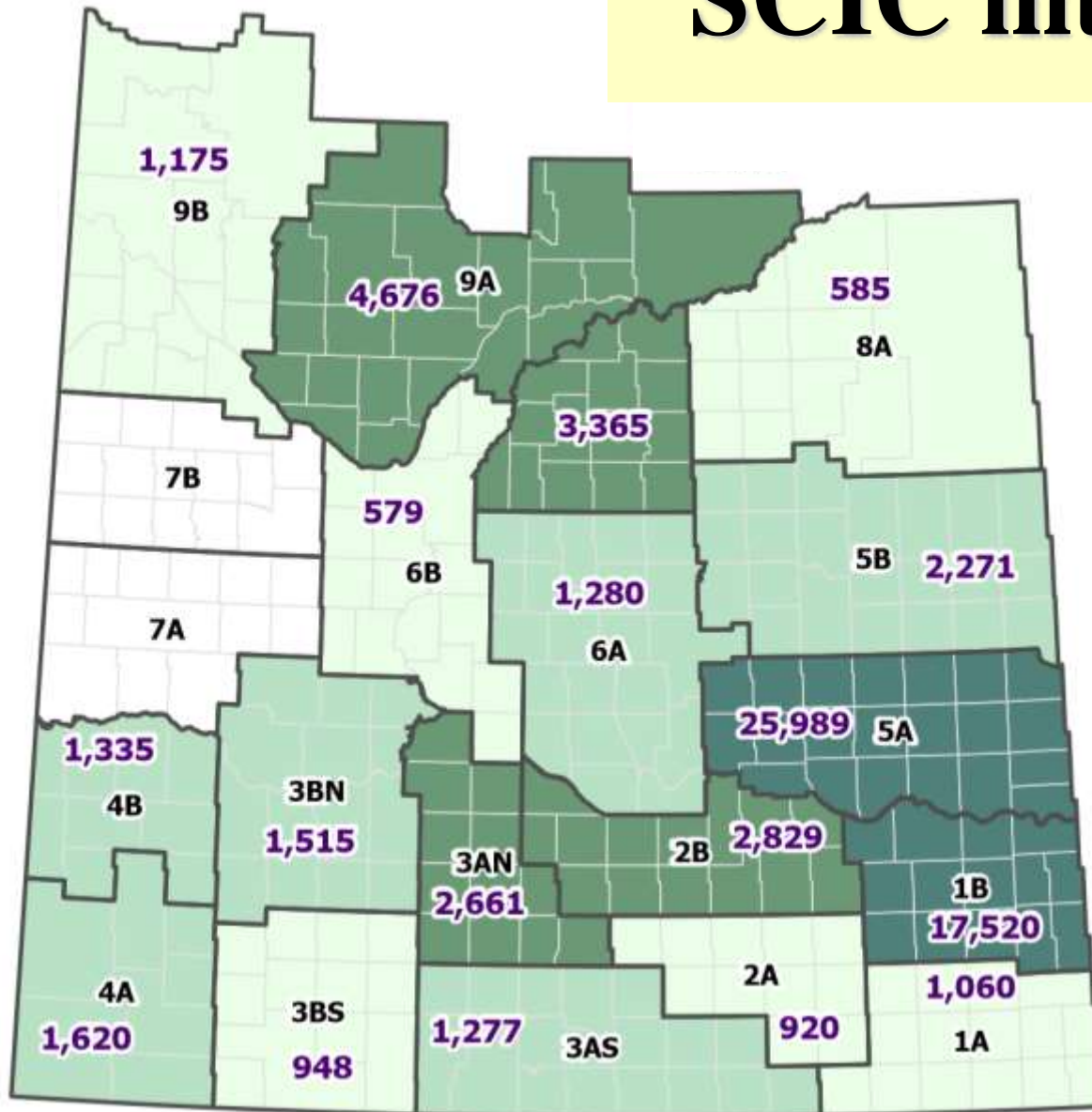




# Results of 2013-2019 intercrop trials

- Manage Ascochyta blight in chickpea
- Reduce costs
- Improve chickpea seed quality – Reduce green seed
- Expands areas where growing chickpea is an option
- Does not usually hurt overall yield (LER) and sometimes helps

# SCIC intercrop acres



CD  
 RM

2019 Seeded Acres

Intercrop 313 Acres = 72,410

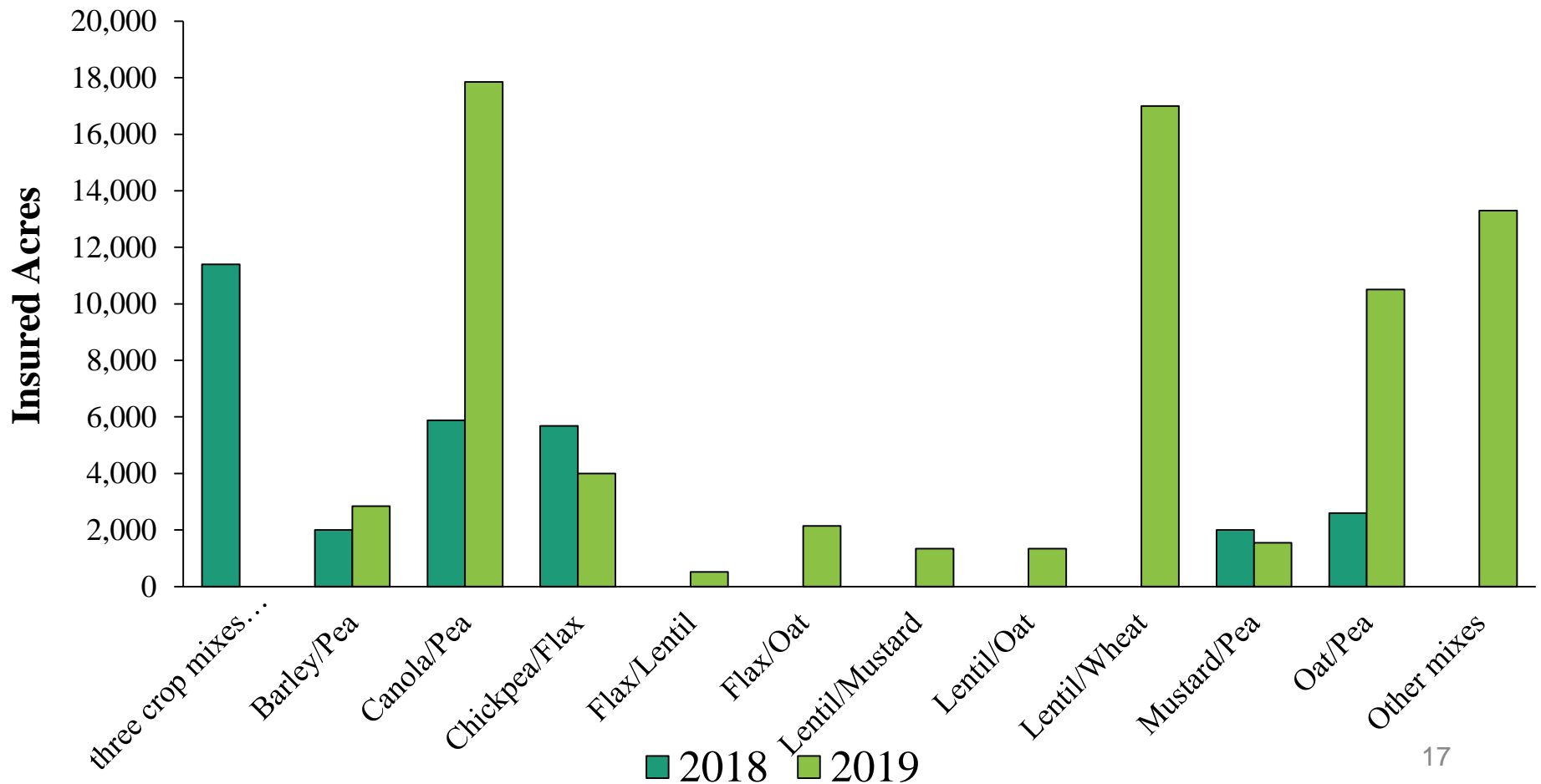
InterCrop313

- ≤1,200
- ≤2,500
- ≤5,000
- ≤25,989

2019 SCIC Acres  
 seeded to intercrops as  
 reported on seeded  
 acreage reports  
 Min. 2 customers & 400  
 acres required per CD  
 Aug 8, 2019

# SCIC Reported Acres in SK

- Total acres ~ doubled from 2018 to 2019
- Many uninsured acres





# Chickpea Flax Intercrop

## Best Advice So Far

- ◆ Start with small acreage
- ◆ Target monocrop chickpea density
- ◆ Flax rate 10-20 lb/ac (preliminary), do strip trials for local verification
- ◆ Chickpeas thresh the flax bolls
- ◆ Intercrop compensates, lowers risk (esp. in wet areas)

# Trial Details –

Sask Pulse Intercrop Trial 2017 – Redvers, SK

- ◇ Yellow and brown mustard intercrop
  - ◇ 3.1 lb/ac intercrop
  - ◇ 5.5 lb/ac monocrop
- ◇ Accidentally double seeded peas and lentils
- ◇ Intercrop – 40 lb/ac N
- ◇ Monocrop mustard – 60 lb/ac N

# Mustard Pea Intercrop Data – SPG 2017

Treatment	Pea Yield		Mustard Yield	Pea Yield		Total Yield	
	(bu/ac)		(lb/ha)	Partial LER		Full LER	
YPea Monocrop	55.7	B	0	<b>1</b>	B	<b>1</b>	C
YPea YMust	56.4	B	119	<b>1.01</b>	B	<b>1.18</b>	BC
YPea BMust	68.9	A	96	<b>1.23</b>	A	<b>1.33</b>	BC
GPea Mono	67.8	A	0	<b>1</b>	B	<b>1</b>	C
GPea YMust	59.4	B	175	<b>0.88</b>	C	<b>1.12</b>	B
GPea Bmust	63.2	AB	138	<b>0.93</b>	BC	<b>1.08</b>	A
P	<0.05		Ns	<0.01		<0.05	
LSD	8.2		--	0.10		0.14	
<b>Oilseed Used</b>							
None	62.2	AB	0	1	A	1	B
Ymust	58.3	B	148	0.9453	A	1.1484	A
BMust	66.5	A	117	1.0833	B	1.205	A
LSD	5.8		--	0.07		0.102	
P	<0.05		Ns	<0.01		<0.01	

Intercropping also reduced lodging in yellow and green peas.



# Pea Oat Intercrop Results- - 2019

## \$/ac

Crop Value per acre		Swift Current			Indian Head			Outlook (Irrigated)			Redvers		
		Oat	Pea	Total	Oat	Pea	Total	Oat	Pea	Total	Oat	Pea	Total
	Intercrop 25	89	94	183	880	306	386	247	91	339	24	348	372
	Intercrop 50	131	59	190	133	278	411	373	33	405	43	296	339
	Intercrop 75	164	49	214	174	229	404	407	25	432	78	234	313
	Intercrop 100	167	50	217	192	191	383	467	16	484	108	191	300
	Intercrop 125	175	45	220	204	177	381	523	15	537	137	164	301
	Mono Oats	232		232	403		403	537		537	349		349
	Pea (weeded)		216	216		388	388		138	138		435	435
	Pea		191	191		396	396		151	151		410	410

\*Assuming \$7/bu pea and \$2.85/bu oat  
 No Yield data from Melfort or Prince Albert sites

# Pea oat intercrop - economics

- ◇ Estimated cost of basic separation using rotary screens based on \$0.25/bu (industry source) is \$15-25/acre depending on yield.
- ◇ Half the normal rate of N was applied to the intercrops, resulting in a cost savings of about \$18/ac compared to monocrop oats.
- ◇ The cost of the intercrop pea seed is estimated at \$22/ac and ranged from \$1 to \$5 per acre for intercrop oat seed.

	<b>Intercrop</b>
<b>Seed cost</b>	\$9 higher
<b>N fertilizer</b>	\$17.50 lower
<b>Separation</b>	\$18 higher
<b>Pesticides</b>	??? likely higher in oats
<b>Total Cost</b>	\$9.50 higher (minus differential in pesticide use)

# Pea Oat Intercrop - 2019

- ◆ LERS very close to 1
- ◆ Cost effective separation is very important for pea-oat
- ◆ Various production problems in 2019 resulted in not great results on the intercropping
- ◆ Lodging in peas was minimal for most sites
  - ◆ (except on irrigation where peas struggled generally)
- ◆ Another year of trials is needed
- ◆ Sask Oat has a preliminary report on trials

# Pea canola intercrop

## Redvers 2019

		Pea	Canola	N rate
<u>TRT#</u>	<u>Variety</u>	<u>lb/ac</u>	<u>lb/ac</u>	<u>lb/ac</u>
1	Inca (yellow)	172	0	0
2	Raezer (green)	211	0	0
3	CDC Dakota (Dun)	175	0	0
4	Maple Pea	157	0	0
5	Marrowfat Pea	304	0	0
6	Canola	0	4.5	80
7	Inca (yellow) + Canola	172	2.7	25
8	Raezer (green) + Canola	211	2.7	25
9	CDC Dakota (Dun) + Canola	175	2.7	25
10	Maple Pea + Canola	157	2.7	25
11	Marrowfat Pea + Canola	304	2.7	25



# Yield – Pea Canola ADOPT Demonstration

Variety	Yield bu/ac			
	canola	pea	LER	mono pea
Inca (yellow)	10.6	43	0.98	59
Raezer (green)	9.8	41	0.97	56
CDC Dakota (Dun)	8.4	47	1.06	58
Maple Pea	3.9	42	1.10	40
Marrowfat Pea	8.0	35	0.94	47
Mono Canola	42			

# What is the Value Proposition?

- ◆ Depends on the crop combination
- ◆ Look at all benefits to risk, workload, production cost
- ◆ Higher yield is only part of the story
- ◆ Effects on lodging, harvestability, maturity, disease pressure

# Challenge to Farmers and Industry

- ◆ Steep learning curve for farmers
- ◆ VR seeding and fertilizer application mapping
- ◆ Plant count and pod counts in strip trials
- ◆ Yield mapping for strip trials (seed rates, fertilizers, inoculants)
- ◆ More boots on the ground!



# Acknowledgments for Trial Funding

SK Ministry of Agriculture:

- Agriculture Development Fund (ADF): 2019-2022
- Agriculture Demonstration of Practices & Technologies (ADOPT) (2012-2015)

Sask Pulse Growers (2016-2017)

Sask Flax (2019-2022)

Western Grains Research Foundation (2019-2022)

# Acknowledgments

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## **Redvers:**

Technician: Elijah Leatherdale

## **Indian Head:**

Technicians: Rebecca Davies, Orla Willoughby, Randy Shiplack





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#IntercropInnovators

# What do you want to grow? What can you sell? Separate?

## ○ Oilseeds

- Canola
- Flax
- Mustards
- Camelina
- Sunflower

## ○ N-fixers

- Peas (various)
- Lentils (various)
- Chickpea
- Cowpea

## Cereals etc

- Wheat
- Barley
- Rye
- Oats
- Canaryseed
- Corn
- Sorghum