

# **Crop Sequences and Rotations**

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# Crop Sequences

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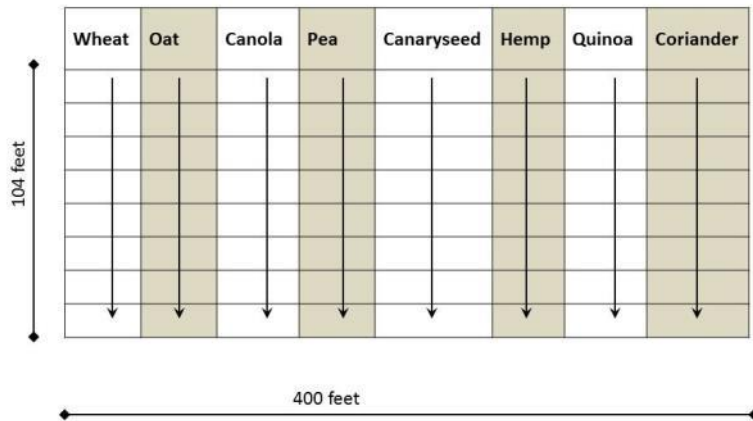
# Crop Sequencing of Large acreage crops and special crops

- **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

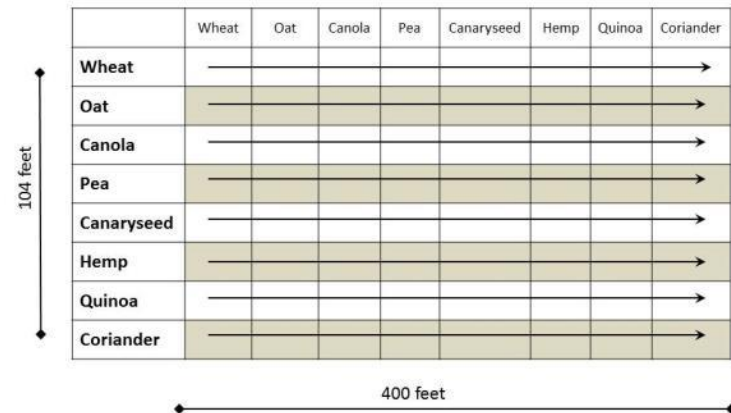


# Crop Sequencing of Large acreage crops and special crops

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

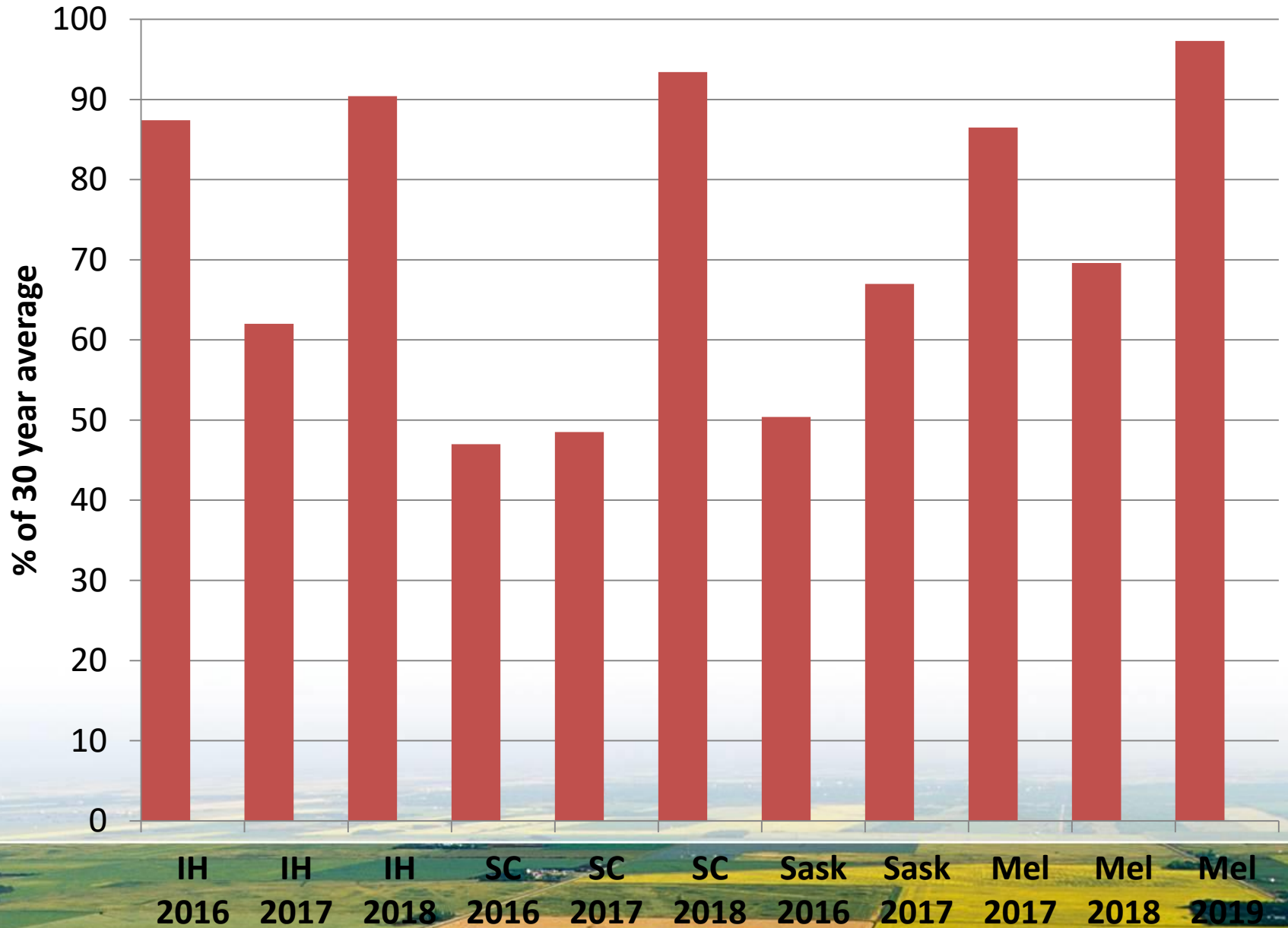


# Agronomics

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



# Growing Season Precipitation

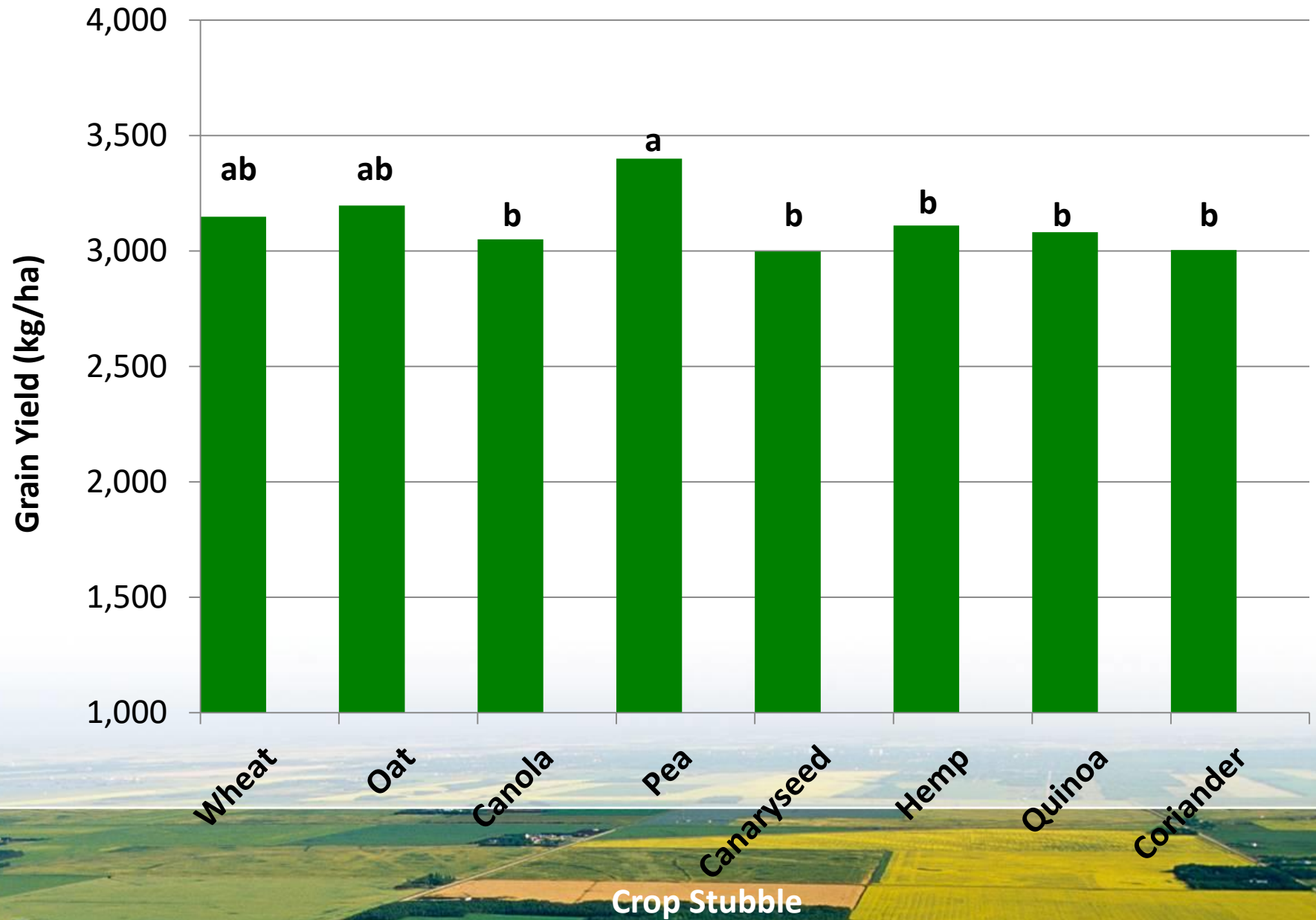


# Wheat

- Grain yield impacted at 4 out of 11 site years, Saskatoon in 2016 and 2018, Melfort in 2017 and 2018.
- There was a general trend for wheat biomass to be lower when grown on a cereal crop compared to a broadleaf crop



# Wheat



# Wheat

- 10-15% stubble effect on grain yield
- Wheat adaptable to most stubbles
- Pea was best broadleaf stubble – N boost?

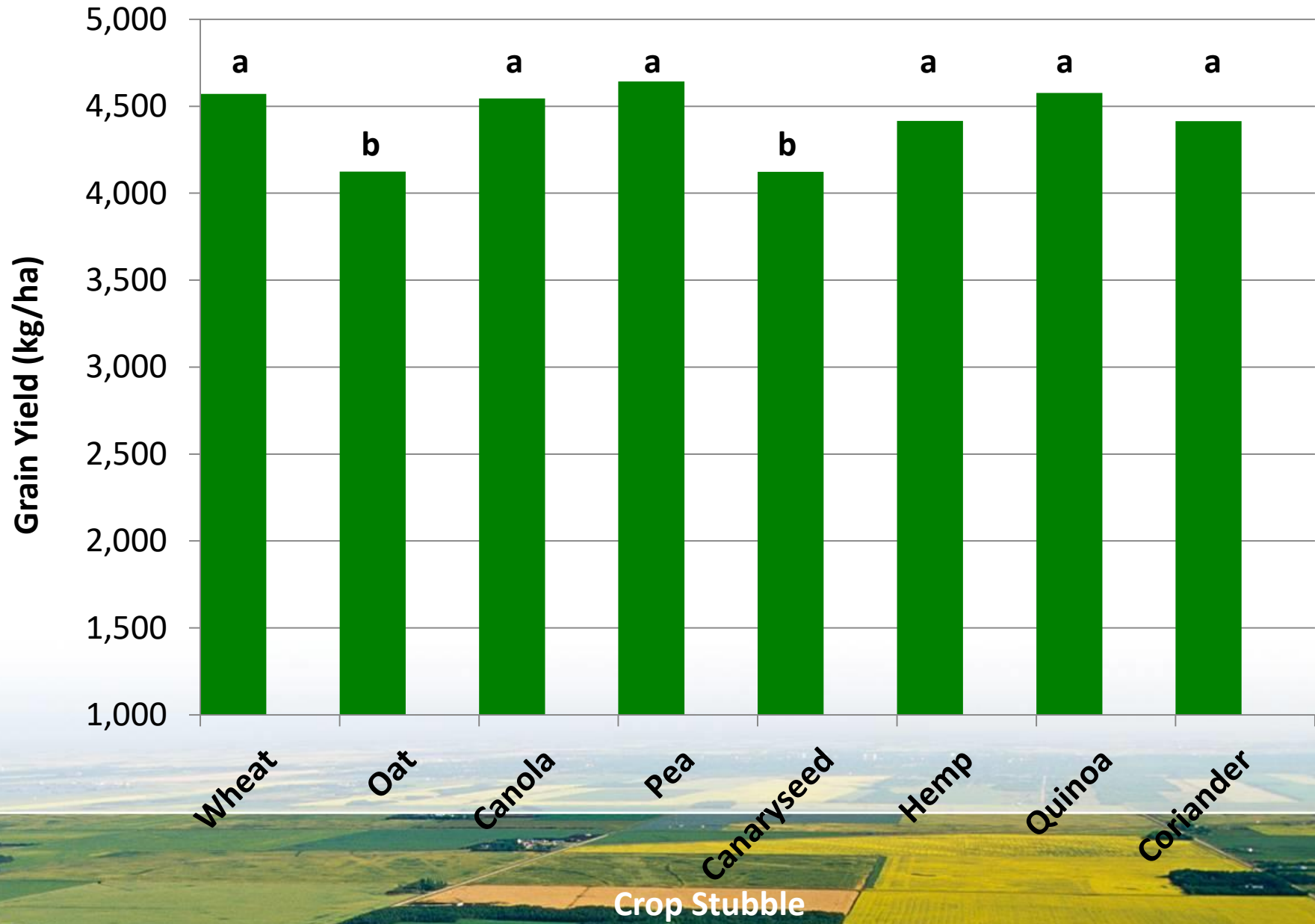


# Oat

- Grain yield impacted at 7 out of 11 site years
- Looking at the 7 site years no clear trend of the best stubble, lots of variability



# Oat





# Oat

- 13% stubble effect on grain yield
- Oat adaptable to wheat and broadleaf stubbles
- Oat and canaryseed not great stubbles for oat

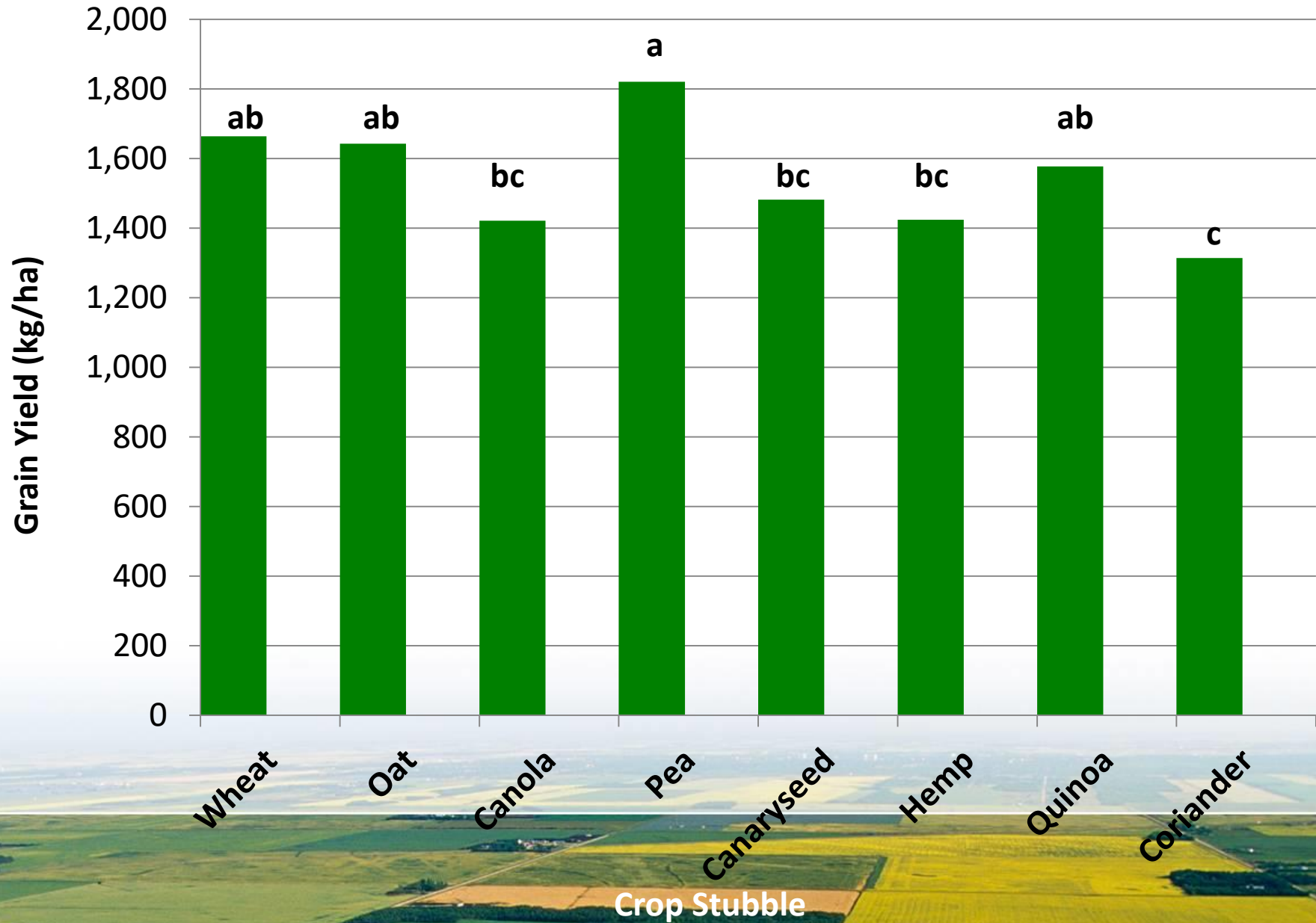


# Canola

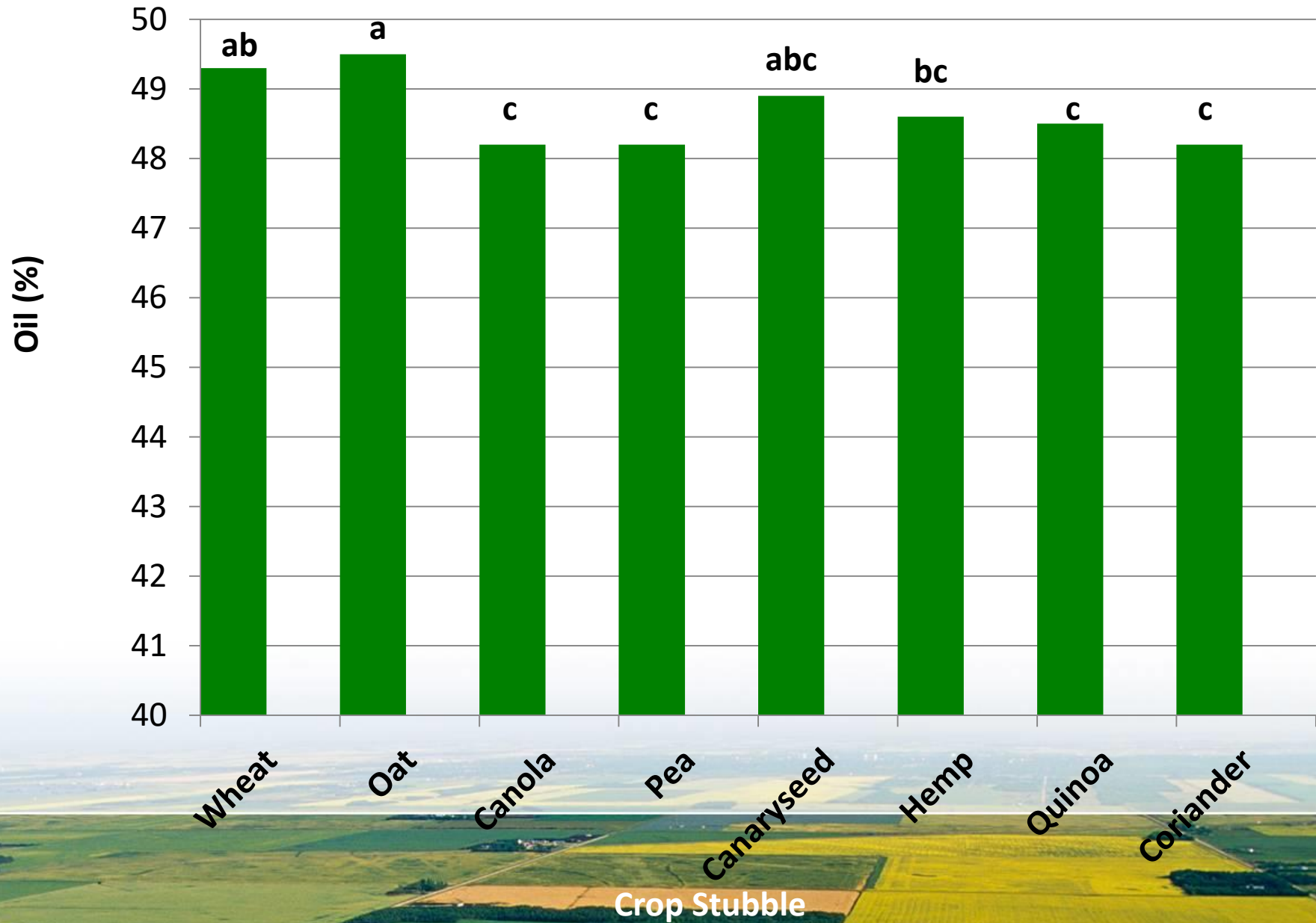
- Grain yield impacted at 3 out of 11 site years, Saskatoon in 2016, Melfort in 2017 and 2019.
- Strong decrease in biomass production when canola seeded into canola stubble.
- variation in canola biomass after seeded into canaryseed and coriander stubble.
- Oil content tended to be higher when seeded into oat and wheat



# Canola



# Canola



# Canola

- 38% stubble effect on grain yield
- Pea stubble had the highest yield
- Coriander stubble had the lowest yield
- Canola, canaryseed and hemp stubbles also lower than pea stubble

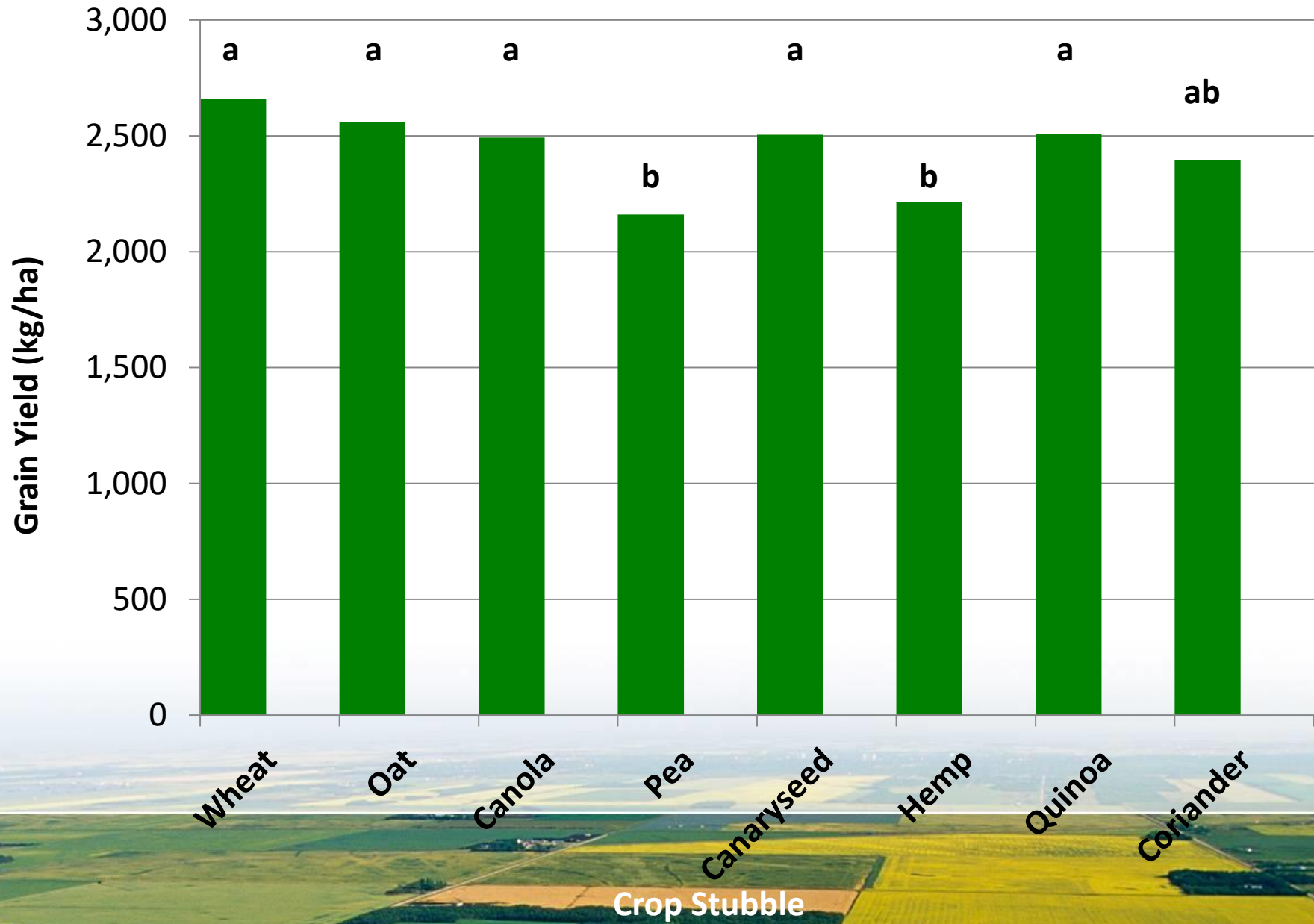


# Pea

- Grain yield of pea was impacted by the previous crop at six out of eleven site years, including Indian Head in 2016, Saskatoon 2016 and 2017, and Melfort in 2017, 2018 and 2019.
- The plant density of pea was not affected by stubble at any site year
- In the low precipitation environment of this study soil borne disease did not have a large impact on pea yield.



# Pea



# Pea

- 23% stubble effect on grain yield
- Pea and hemp stubble had the lowest yield
- Cereal stubbles and canola stubble supported high grain yield of pea



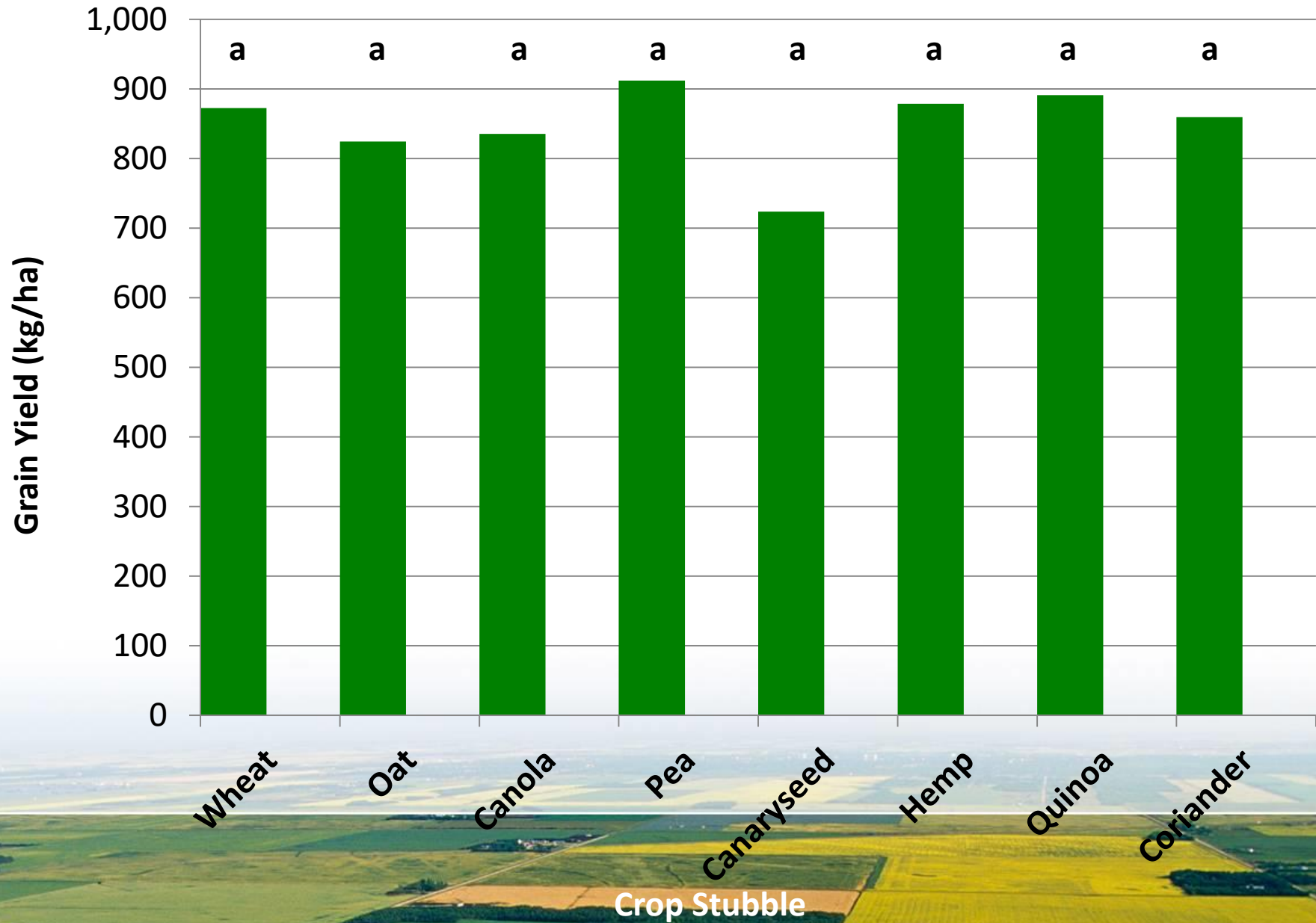


# Canaryseed

- The grain yield of canaryseed was impacted by the previous crop at one out of eleven site years, Melfort in 2018.
- Canaryseed biomass did not thrive when canaryseed was seeded into oat and canaryseed stubble



# Canaryseed



# Canaryseed

- No statistical differences
- Canaryseed stubble had the lowest numerical grain yield
- Pea and hemp stubble had the lowest yield
- It appears that other factors have a larger impact on grain yield than the effect of a previous crop on grain yield.

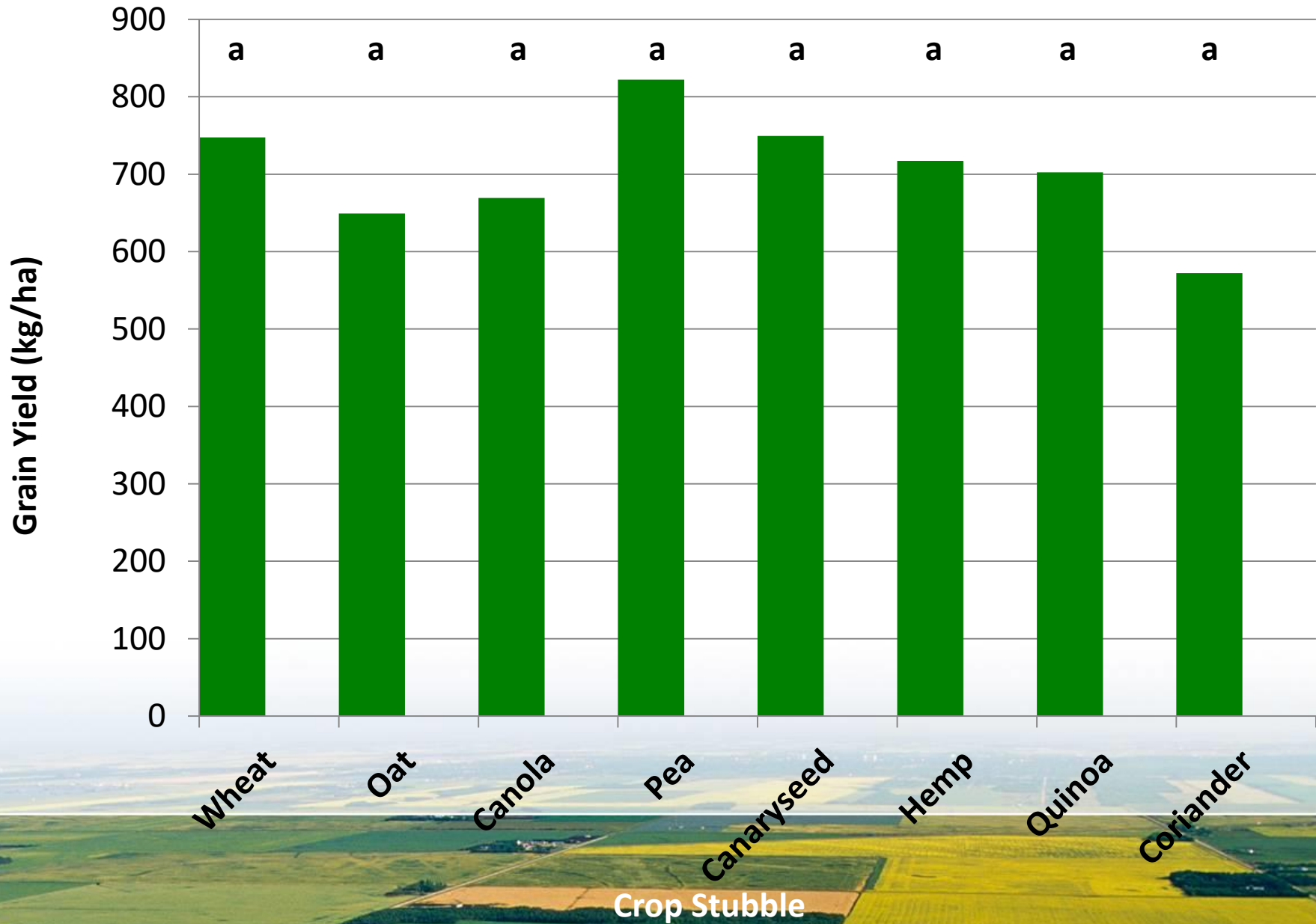


# Hemp

- The grain yield of hemp was impacted by the previous crop at one out of eleven site years, Saskatoon in 2016.
- The plant density of hemp was not impacted by stubble type.



# Hemp



# Hemp

- No statistical differences
- Hemp has a wide tolerance to being seeded into different crop stubbles.
- It appears that other factors have a larger impact on grain yield than the effect of a previous crop on grain yield.

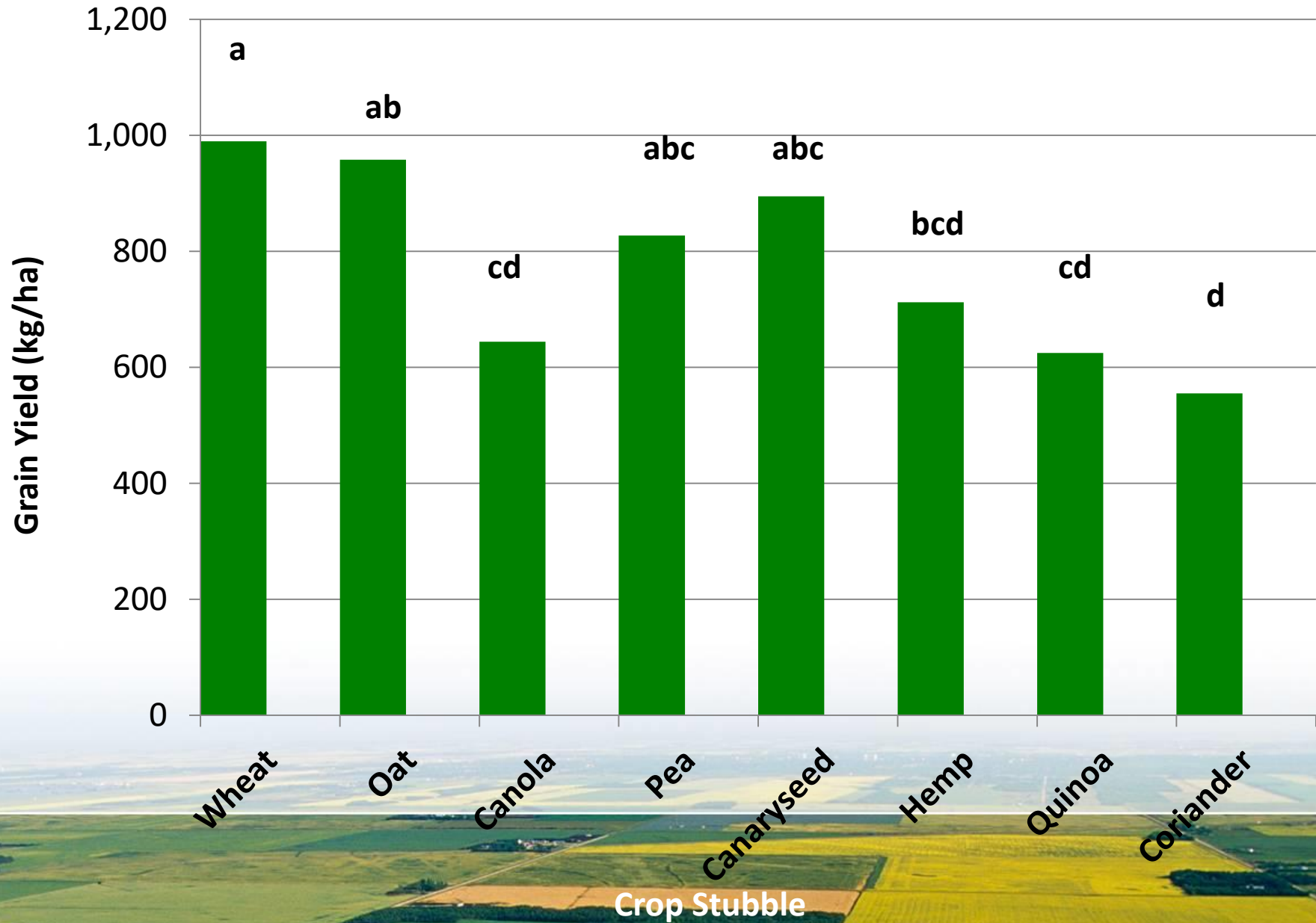


# Coriander

- The grain yield of coriander was impacted by the previous crop at three out of eleven site years including, Swift Current in 2017, Saskatoon in 2017, and Melfort in 2018.
- Coriander was able to establish in all eight crop stubbles
- Coriander biomass production appear to be the most consistent on wheat, oat and pea stubble during this trial.



# Coriander





# Coriander

- 78% stubble effect on grain yield
- Grain yield of coriander was higher on wheat stubble than canola, hemp quinoa and coriander stubbles
- Of all the broadleaf crops coriander showed the clearest preference for being seeded into a cereal crop verses being seeded into a broad leaf crop.



# Indian Head 2017 Broadleaf stubble



19/07/2017

# Indian Head 2017 Cereal stubble



19/07/2017

# Volunteer Crop as a Weed

- A producer has to have a clear plan on how to control volunteers when seeding into oat, canola and coriander stubbles
- The plan can be quite simple but it is needed



# Conclusions

- Results reflect dry to normal precipitation
- Usually a penalty for growing a crop on its own stubble
- Pea stubble was beneficial to both cereal and broadleaf crops
- Only 80 kg N ha<sup>-1</sup> applied so separating N benefits from other benefits not possible



# Conclusions

- Cereals appear to be less sensitive to crop stubble than broadleaf crops
- Wheat had a broad adaptability to crop stubble even into its own stubble
- All crops did well on wheat stubble
- Coriander showed the clearest preference for being seeded into a cereal crop verses being seeded into a broad leaf crop.



# Frequency of Pulses in the Rotations

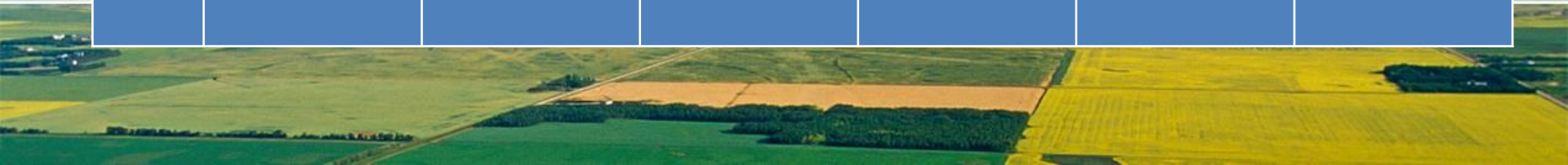
Dr. Guy Lafond had a pea frequency study that just wheat. He ran for approx. 9 years with no major problems and then the whole system collapsed

Started a new study with Dr. Gan looking at pulse frequency in more diverse rotations



# Pulse Intensity in Rotation

Rotations						
All phases of the rotation are grown in each year 24 treatments 4 reps						
	1	2	3	4	5	6
A	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat
B	Canola	Pea	Pea	Pea	Lentil	Canola
C	oat	oat	Canola	Lentil	oat	Pea
D	Pea	Pea	Pea	Pea	Pea	Canola
Justification	Cereal-oilseed-pulse in a rotation	Intensified pea-based rotation with cereal as a break crop	Intensified broadleaf crop with 1 cereal as a break crop	Intensified pulse-based rotation, 2 species with 1 cereal as a break crop	Intensified pulse-based rotation, 2 species with cereal as a break crop	Intensified canola-based rotation with cereal and pulse between



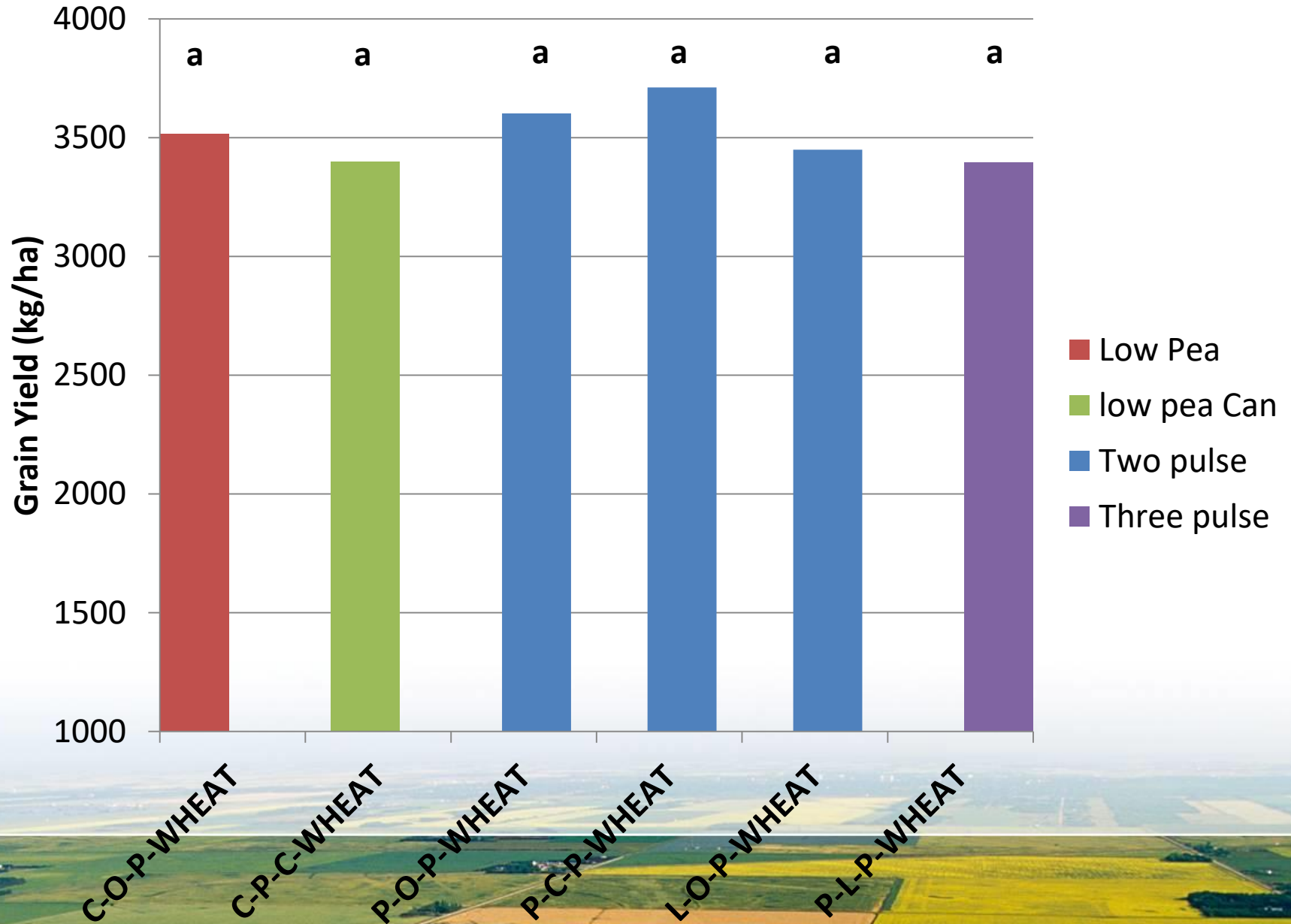


# Funding

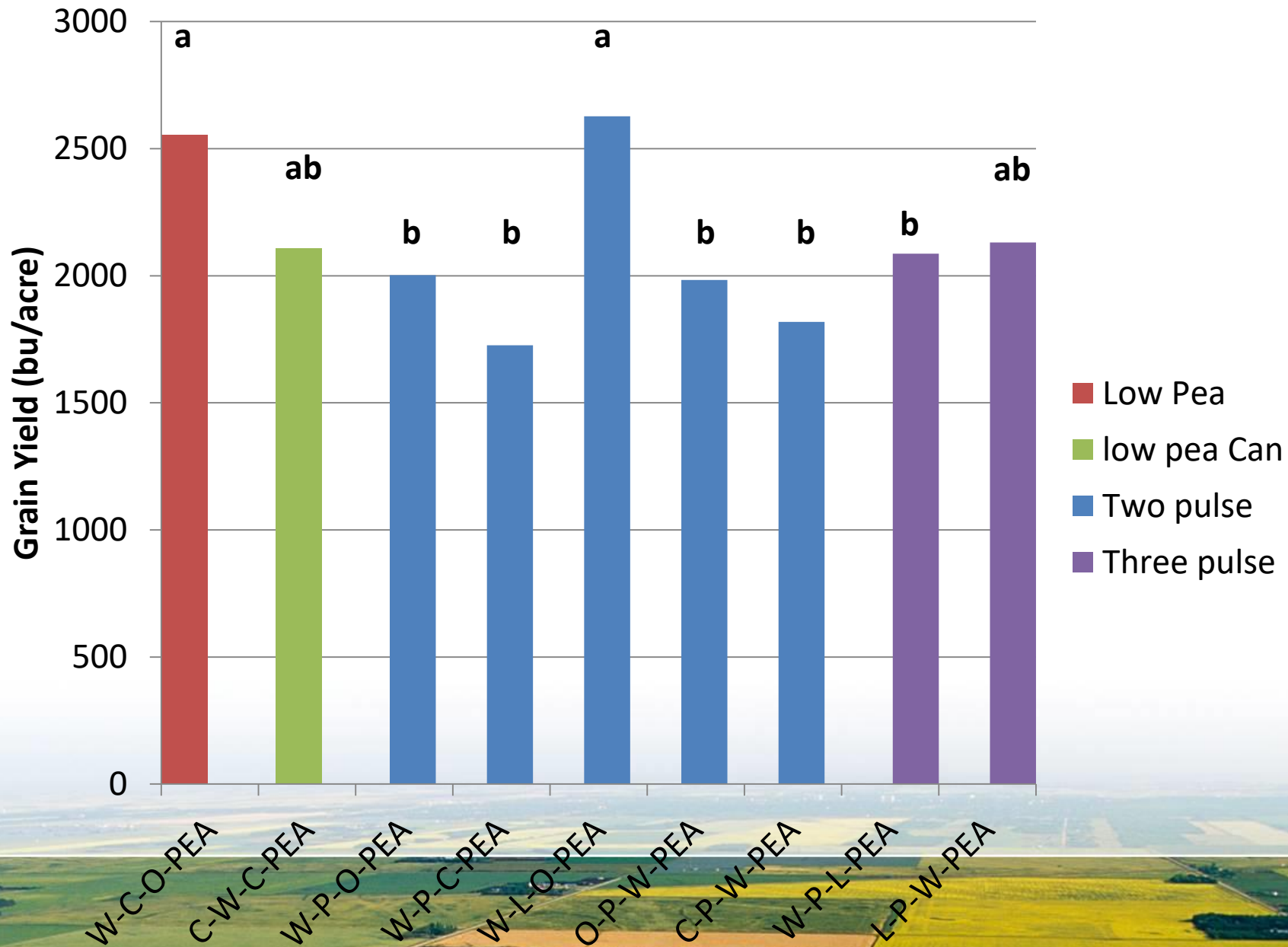
## Saskatchewan Pulse Growers



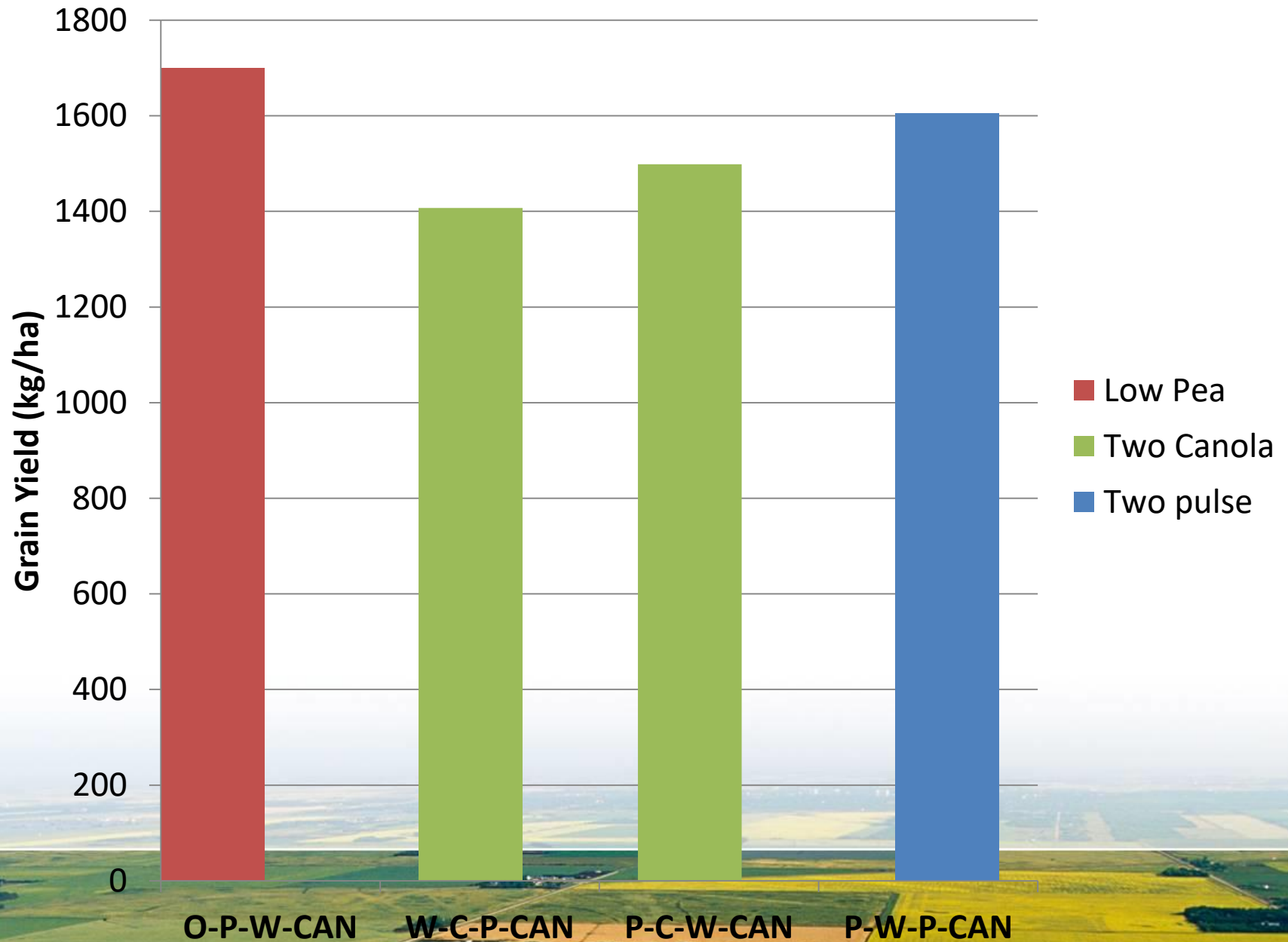
# Gain Yield of Wheat (2016-19)



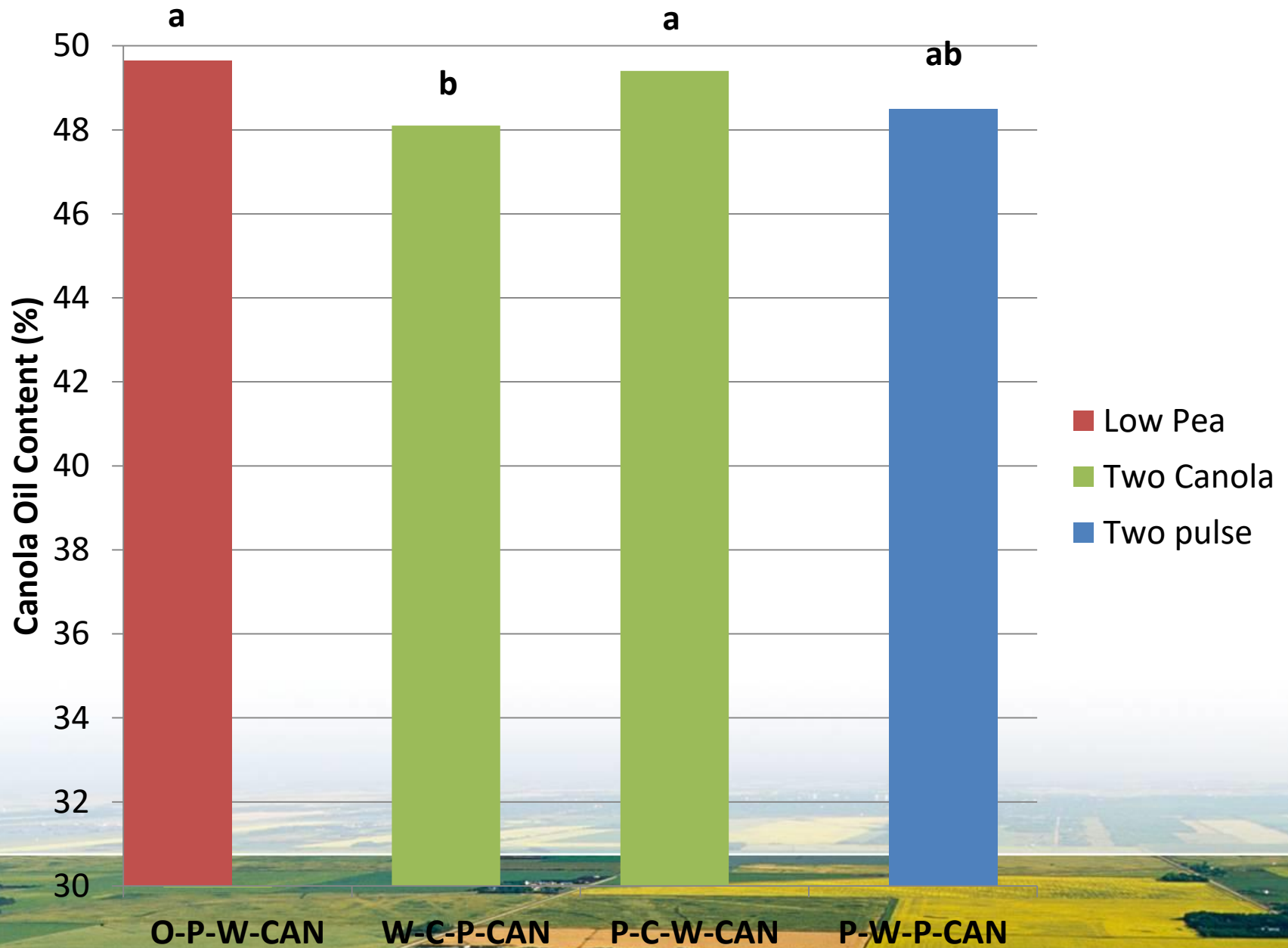
# Gain Yield of Pea (2016-19)



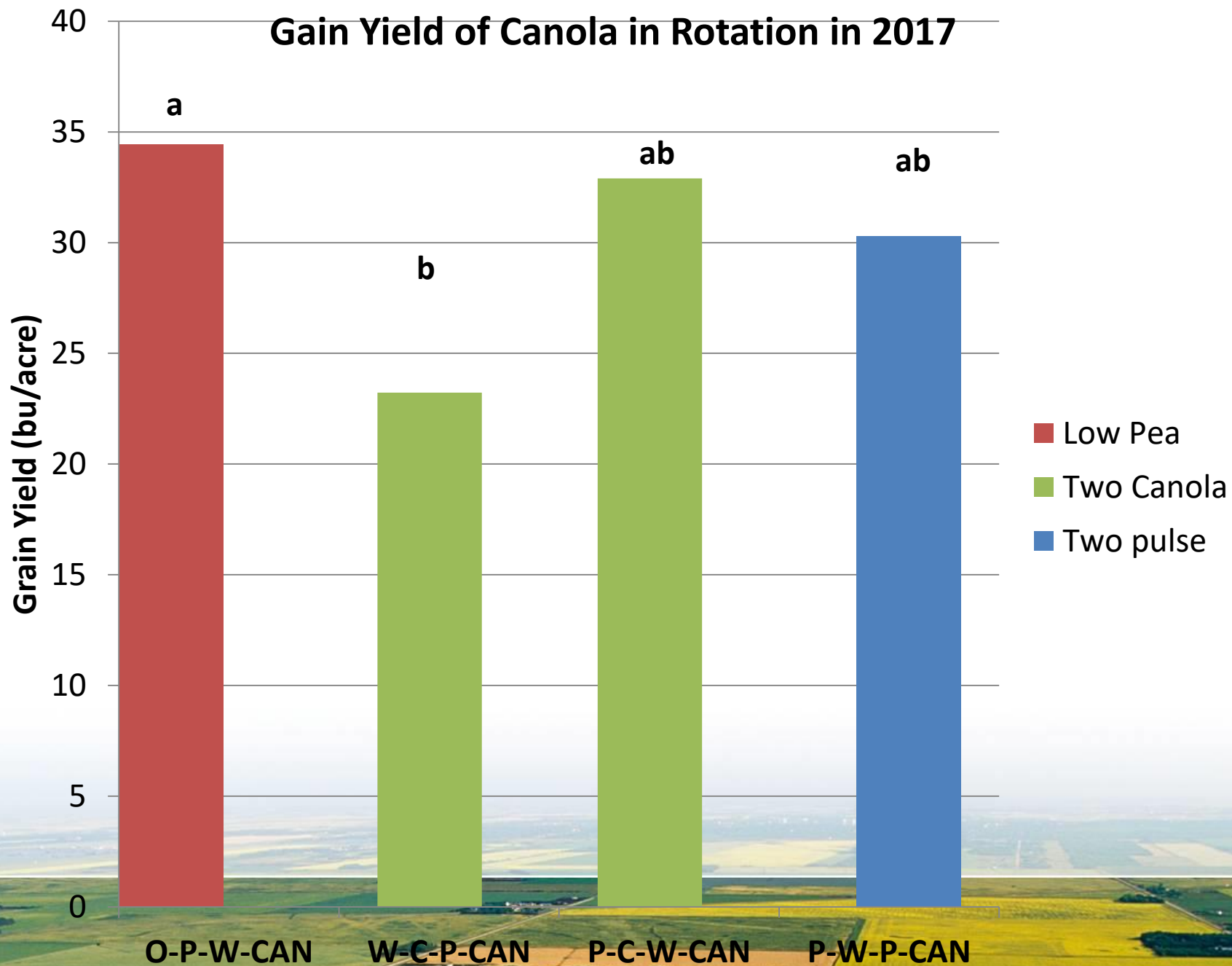
## Gain Yield of Canola (2016-19)



# Oil Content of Canola in Rotation in 2015



# Gain Yield of Canola in Rotation in 2017



# Conclusions

- Dry years beneficial in maintaining pea yield
- W-C-O-P and W-L-O-P rotations are the most consistent
- W-C-O-P expected to be good
- W-L-O-P rotation what is going on?
- Wheat and canola yield not impacted
- Canola oil (%) higher on cereal stubble



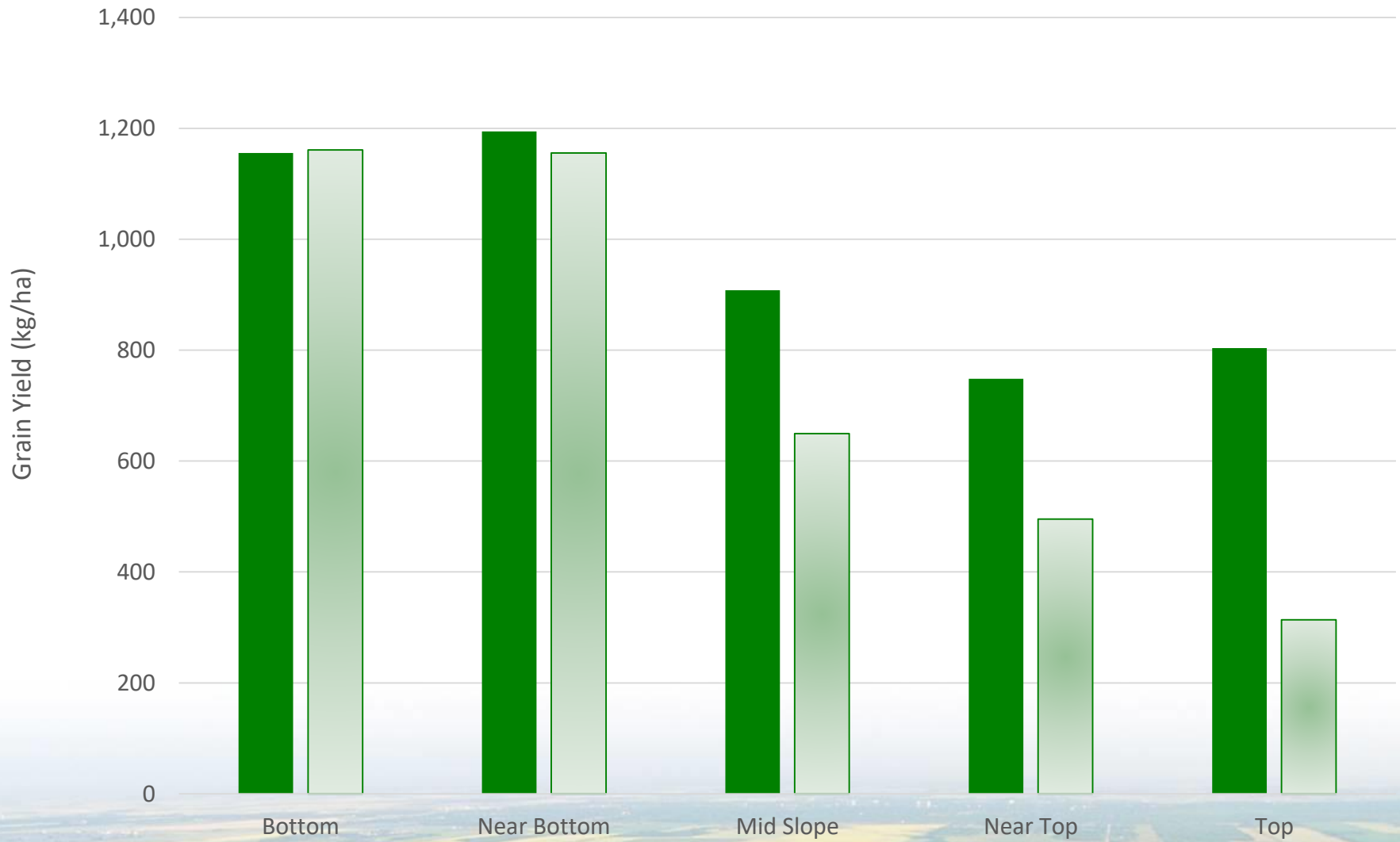
# Canaryseed: Chloride and Slope

- We know Cl has a big impact on Canaryseed yield especially on loam soils
- Cl moves in the soil
- How does Cl application requirements change on a slope?
- Started preliminary research with tissue samples, soil samples and grain yield





# Canaryseed Yield



**Slope Position**