Influence of preceding legumes and nitrogen management on malt barley yield and quality

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Canadian Barley Symposium 2020

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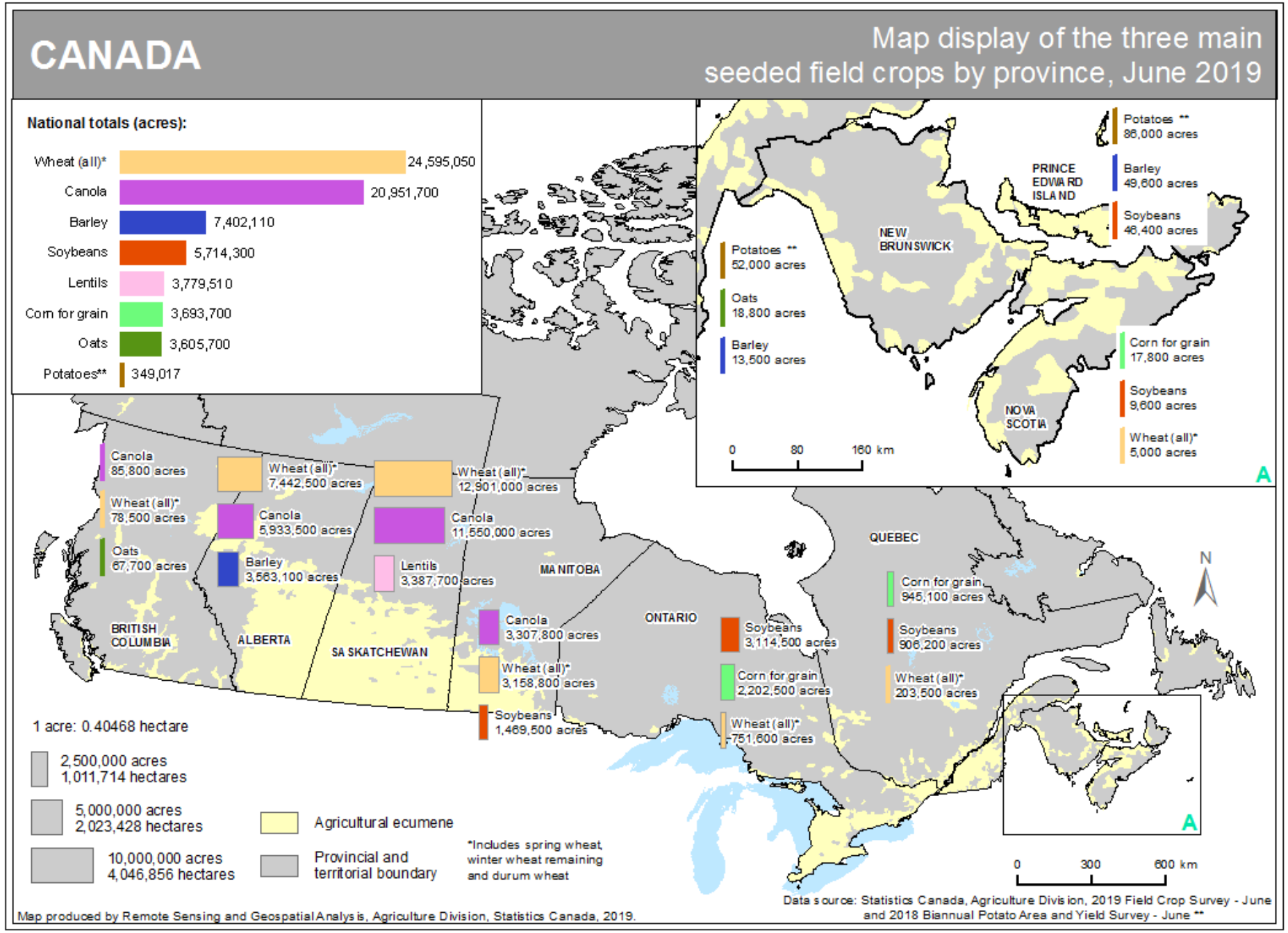
CANADA

Map display of the three main seeded field crops by province, June 2019

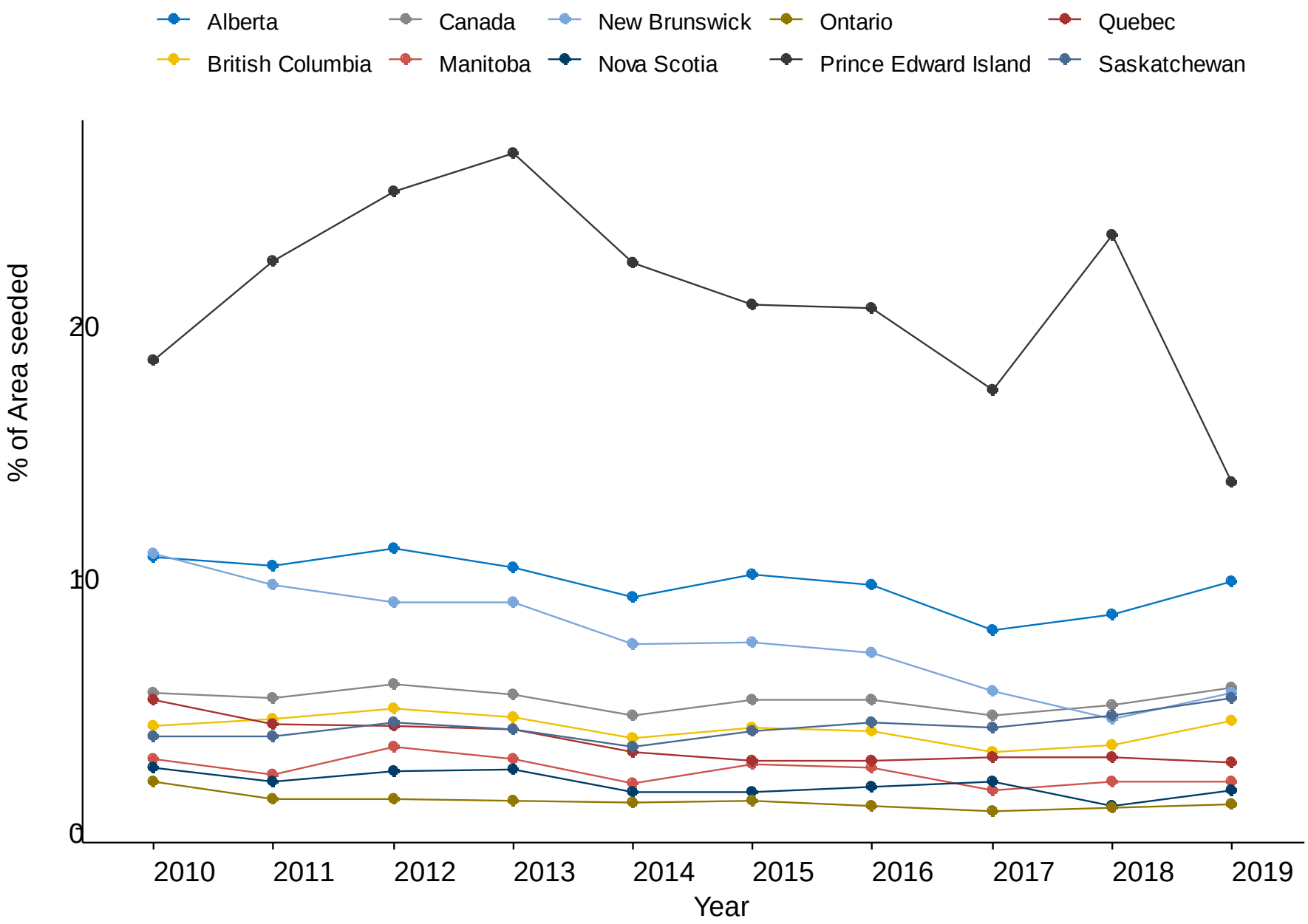


Data source: Statistics Canada, Agriculture Division, 2019 Field Crop Survey - June and 2018 Biannual Potato Area and Yield Survey - June **

Map produced by Remote Sensing and Geospatial Analysis, Agriculture Division, Statistics Canada, 2019.

Statistics Canada Statistique Canada

Canada


Alberta
British Columbia
Canada
Manitoba
New Brunswick
Nova Scotia
Ontario
Prince Edward Island
Quebec
Saskatchewan
% of Area seeded
20
10
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Year

Importance of barley

- Cropping system diversity
- Sustainability
- G x E x M

Seeding Rate, Nitrogen Rate, and Cultivar Effects on Malting Barley Production

J. T. O'Donovan,* T. K. Turkington, M. J. Edney, G. W. Clayton, R. H. McKenzie, P. E. Juskiw, G. P. Lafond, C. A. Grant, S. Brandt, K. N. Harker, E. N. Johnson, and W. E. May

ABSTRACT

The malting barley (*Hordeum vulgare* L.) industry is often challenged by the availability of sufficient volume and
demand. Our objective was to evaluate the effects of agronomic practices on grain uniformity, protein concentratio
components. Field experiments were conducted from 2005 to 2008 at eight rain-fed locations in western Canada.
seeding rates (200 and 400 seeds m^{-2}) and five N (0, 30, 60, 90, and 120 kg ha^{-1}) rates on two two-row barley cultiv
and 'CDC Copeland') were determined. Each experiment was conducted for 3 yr at each location (24 environments)
displayed some advantages over AC Metcalfe including higher grain yield, lower protein and more uniform kernel
vars, kernel weight, and plumpness were lower at the higher seeding rate; protein was also lower, maturity was earlie
more uniform. With increasing N rate, barley yield, kernel weight, and tillers $plant^{-1}$ increased, but days to seed mat
concentration also increased, and kernel plumpness and seed uniformity decreased. The increase in protein was less
CDC Copeland suggesting that there may be less risk with this cultivar of unacceptable protein levels at relatively high
environments barley plant stand decreased while lodging increased with increasing N rates. To improve the likelihoo
be acceptable for malting growers should select low-protein varieties, seed at relatively high rates and limit N applicat

THE NORTHERN GREAT Plains of North America, of which western Canada is a component, are one of the world's major producers and exporters of malting barley. Opportunities exist to increase the sale of malting barley but the industry is often challenged by the availability of barley that meets the quality requirements of the marketplace. Annu-

France, growers also have had difficulty achi
requirements for malting barley (Bail and M

Malting barley cultivars traditionally grow
ada have been mainly two-row (Canadian W
For many years, 'Harrington' (Harvey and R
the dominant cultivar. However, since its pro

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SHORT COM

Effect of seeding date and rate on malting b (*Hordeum vulgare* L.) quality

J.T. O'Donovan, M.J. Edney, M.S. Izydorczyk, T.K. Turkington, P.E. Jusk
C.A. Grant, K.N. Harker, W.E. May, E.N. Johnson, E.G. Smith, and G.W

Abstract: A western Canada field study investigated the effects of seeding date
Seeding date had little effect on quality. Increasing the seeding rate up to
germination and Kolbach indices, lower β-glucan, and better endosperm modification without compromising
malt extract.

Key words: germination index, Kolbach index, β-glucan, α-amylase, endosperm modification.

Research Article

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ARTICLE

Effect of preceding crop and nitrogen application on malting barley quality

J.T. O'Donovan, M.S. Izydorczyk, B. Tidemann, M.J. Edney, T.K. Turkington, C.A. Grant, K.N. Harker, and Y. Gan

Abstract: As legume crops fix nitrogen (N) from the atmosphere, there is concern that soil residual N from legumes grown in rotation with malting barley may result in unacceptably high protein content and have negative effects on quality. However, little research has been conducted to investigate this. Field pea, lentil, faba bean [as seed or as a green manure (GM) crop], canola, and wheat were grown in 2009, canola in 2010, and malting barley in 2011. The objective was to determine the effects of crops grown in 2009 on the quality of barley grown in 2011. Crops were direct-seeded at Lacombe (Alberta), Swift Current (Saskatchewan), and Brandon (Manitoba). Fertilizer N (urea) was applied in 2010 and 2011 at 0, 30, 60, 90, and 120 kg ha^{-1}. The legumes had few negative effects on barley quality compared with canola or wheat. Exceptions occurred at Lacombe where the lentil and faba bean GM crops increased protein and decreased kernel plumpness. This was not evident at other locations. Increasing N fertilizer rate negatively affected almost all malt quality parameters at all locations. The results indicate that growing legume crops prior to malting barley is less likely to reduce malting barley quality than applying fertilizer N.

Key words: legumes in rotation, barley germination, β-glucan, α-amylase, endosperm modification.

Résumé : Les légumineuses fixent l'azote (N) présent dans l'atmosphère, mais on craint que le N résiduel dans le sol venant des légumineuses cultivées en assolement avec l'orge brassicole n'augmente de façon inacceptable la concentration de protéines dans le grain de cette céréale et en réduise la qualité. Peu de recherches ont toutefois

he direct
tilisation

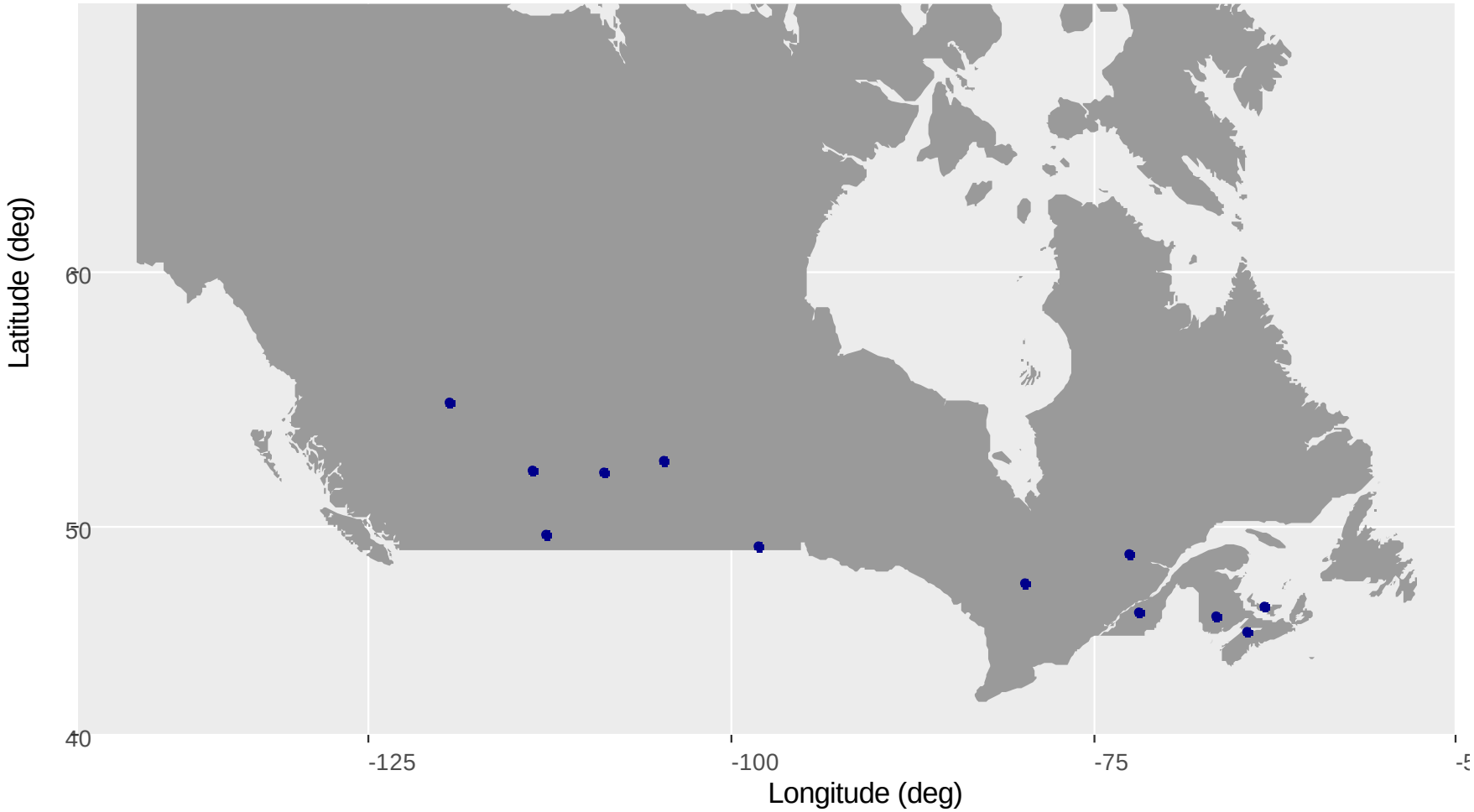
he small,
han malt
h limited

Experimental Design

- 12 sites across Canada
- 18 treatments (3 crops x 6 fertility)
- Barley (AAC Synergy) following:
  - A brassica (canola, brown mustard, Camelina)
  - Legume 1 (pea)
  - Legume 2 (Faba, lentil, soybean)
- Nitrogen management
  - 0 kg/ha control
  - 30, 70 or 100 % of recommended amount (or 70 kg/ha – EAST only)
  - 70/30 or 50/50 % split

12 sites

- West
  - Beaverlodge, AB
  - Lacombe, AB
  - Lethbridge, AB
  - Melfort, SK
  - Scott, SK
  - Morden, MB
- East
  - New Liskeard, ON
  - Normandin, PQ
  - Princeville, PQ
  - Fredericton, NB
  - Canning, NS
  - Harrington, PE

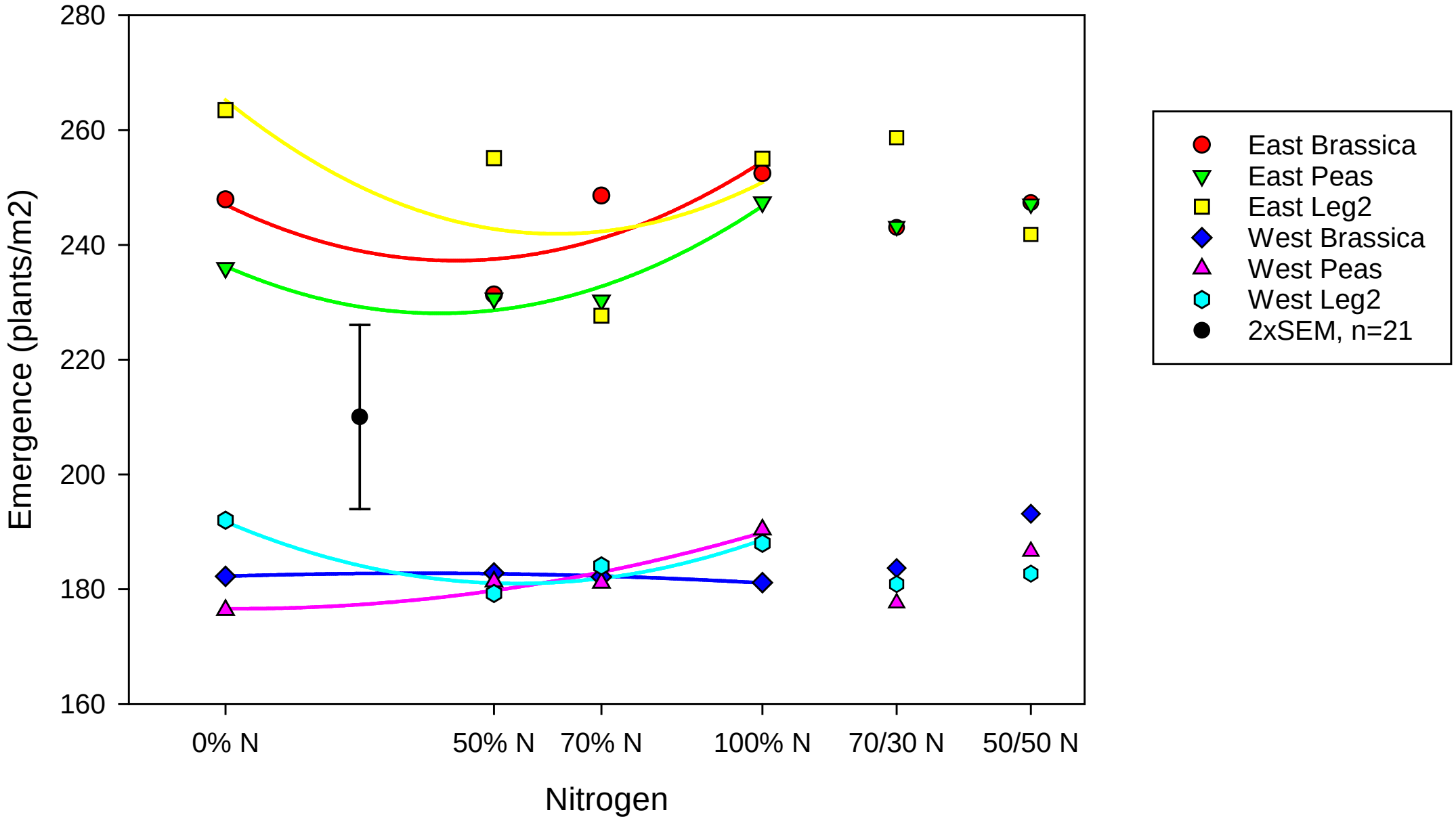


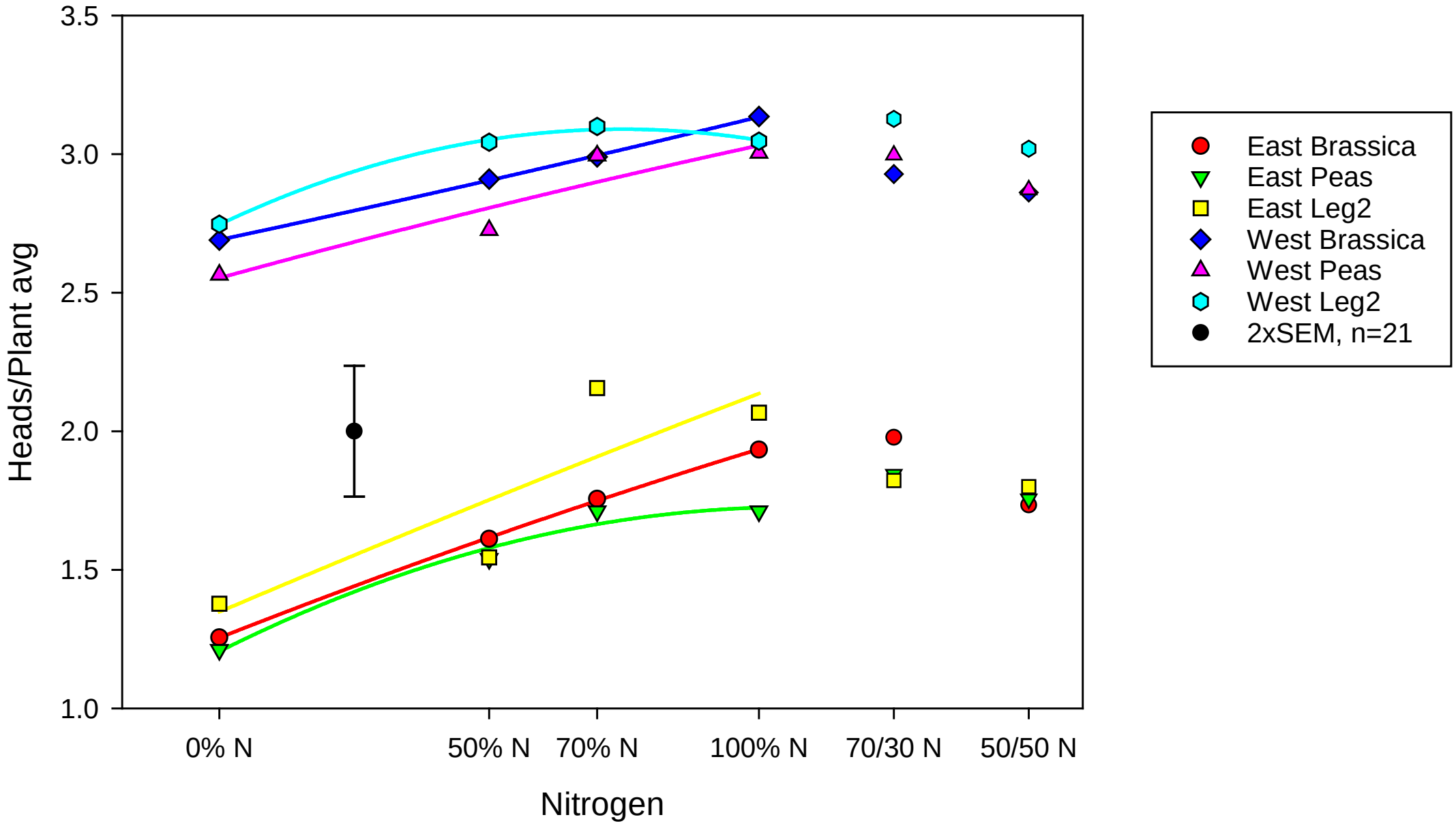
Measurements

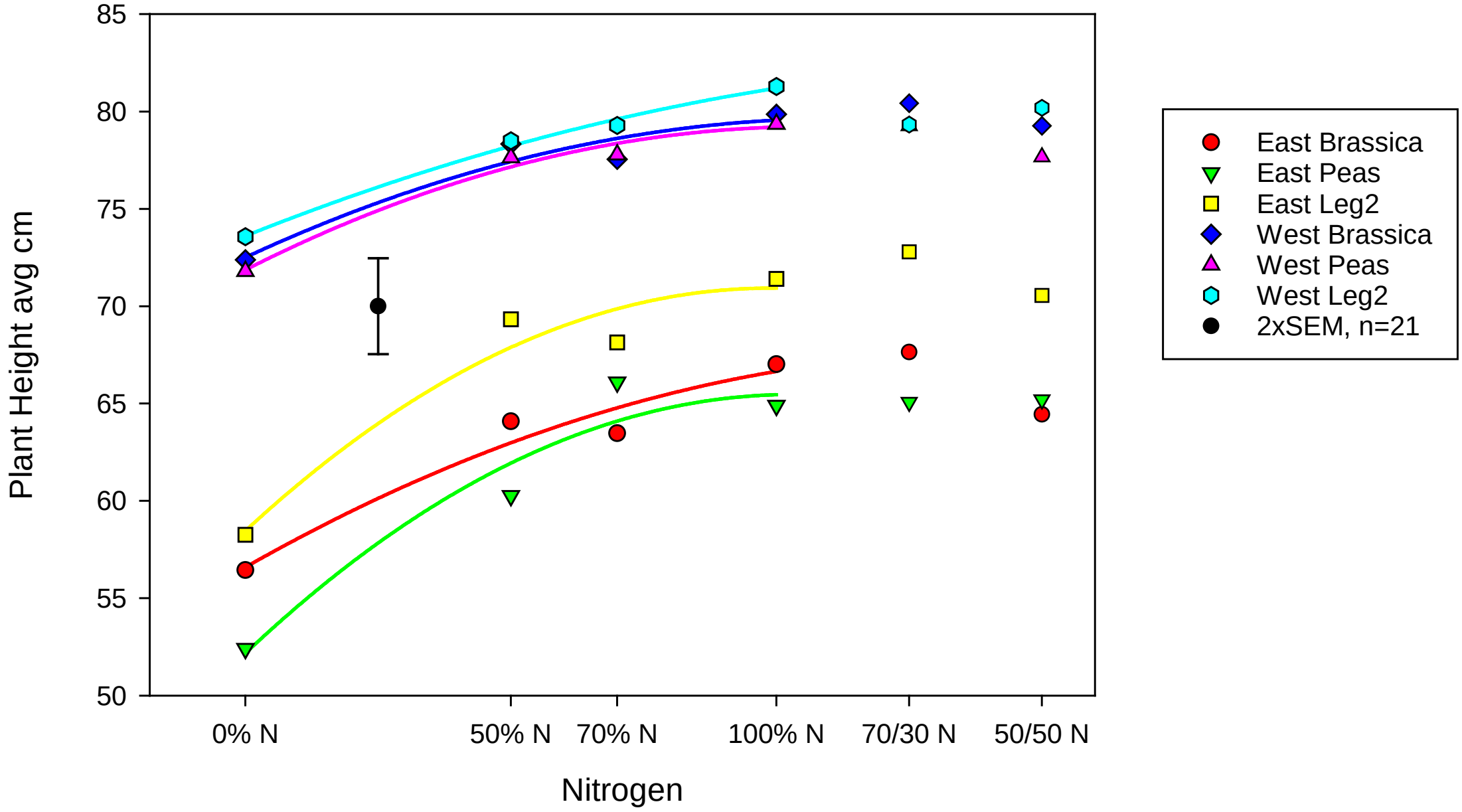
- Soil and tissue N
- Agronomics
- Malt quality
  - Full suite of malt chemical analysis

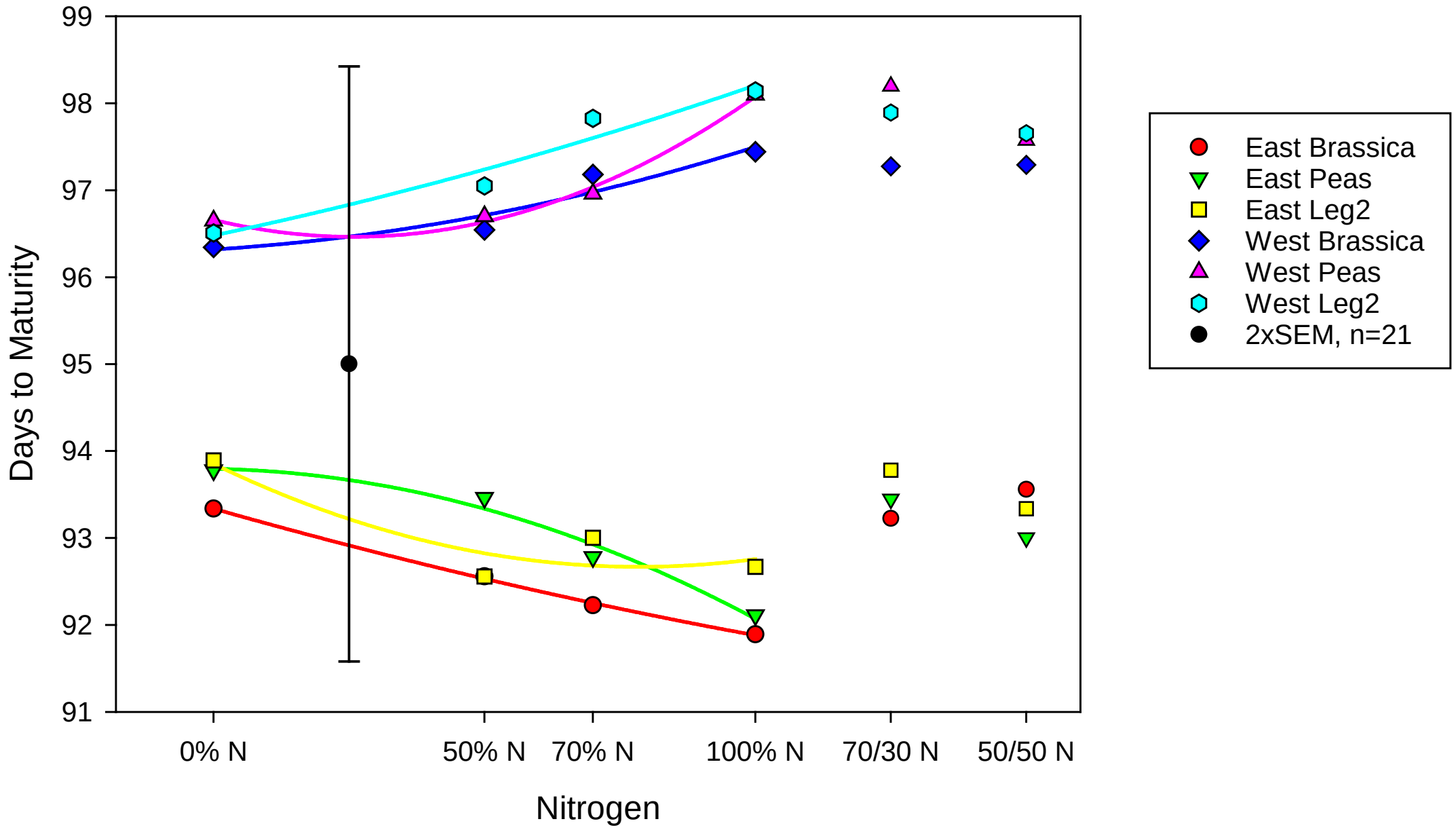
Preliminary agronomic results

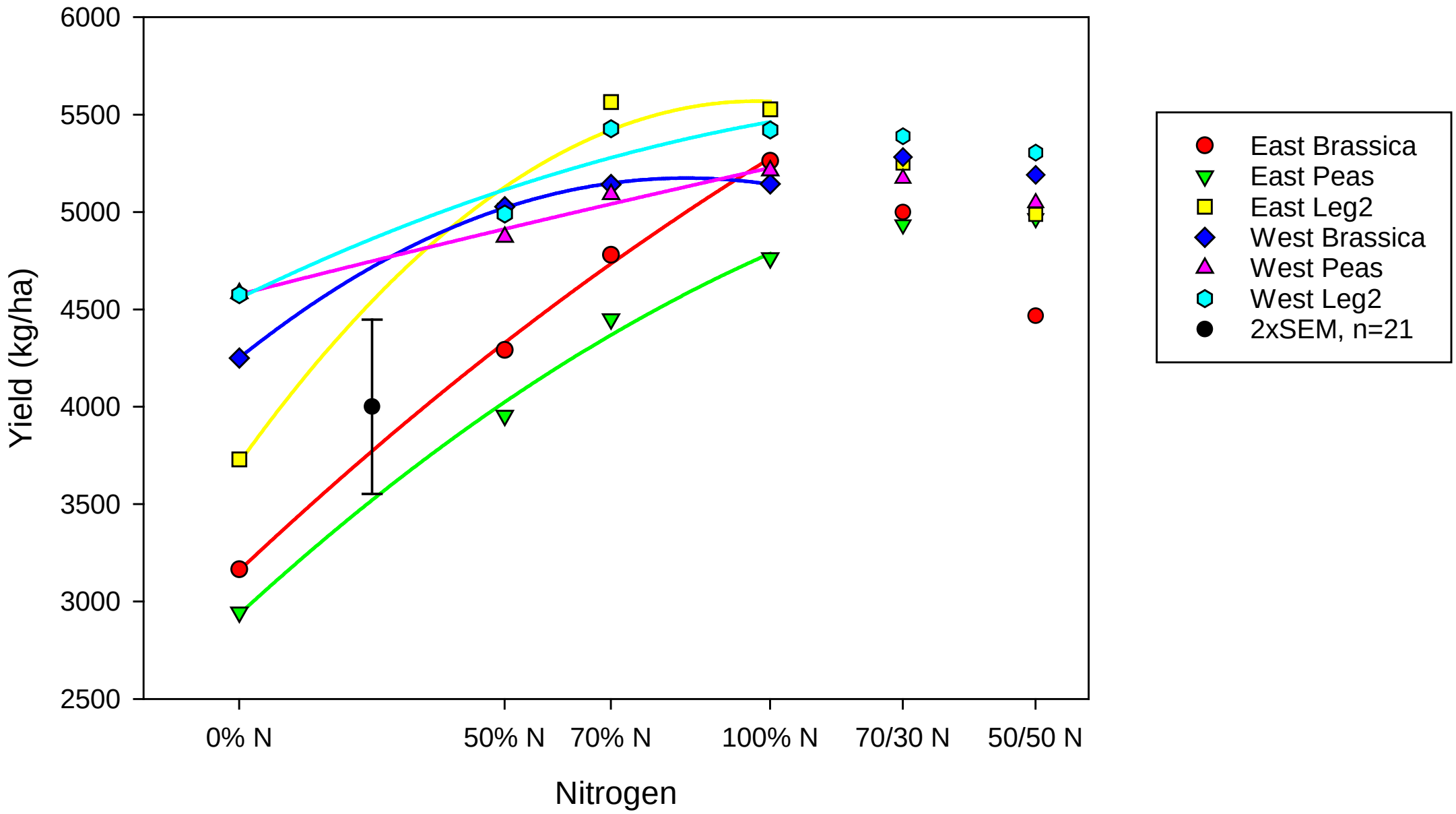
- East vs. West effects
- Nitrogen effects
- Previous crop effects


280
260
240
220
200
180
160
Emergence (plants/m2)
0% N
50% N
70% N
100% N
70/30 N
50/50 N
Nitrogen
East Brassica
East Peas
East Leg2
West Brassica
West Peas
West Leg2
2xSEM, n=21


3.5
3.0
2.5
2.0
1.5
1.0
Heads/Plant avg
0% N
50% N
70% N
100% N
70/30 N
50/50 N
Nitrogen
East Brassica
East Peas
East Leg2
West Brassica
West Peas
West Leg2
2xSEM, n=21

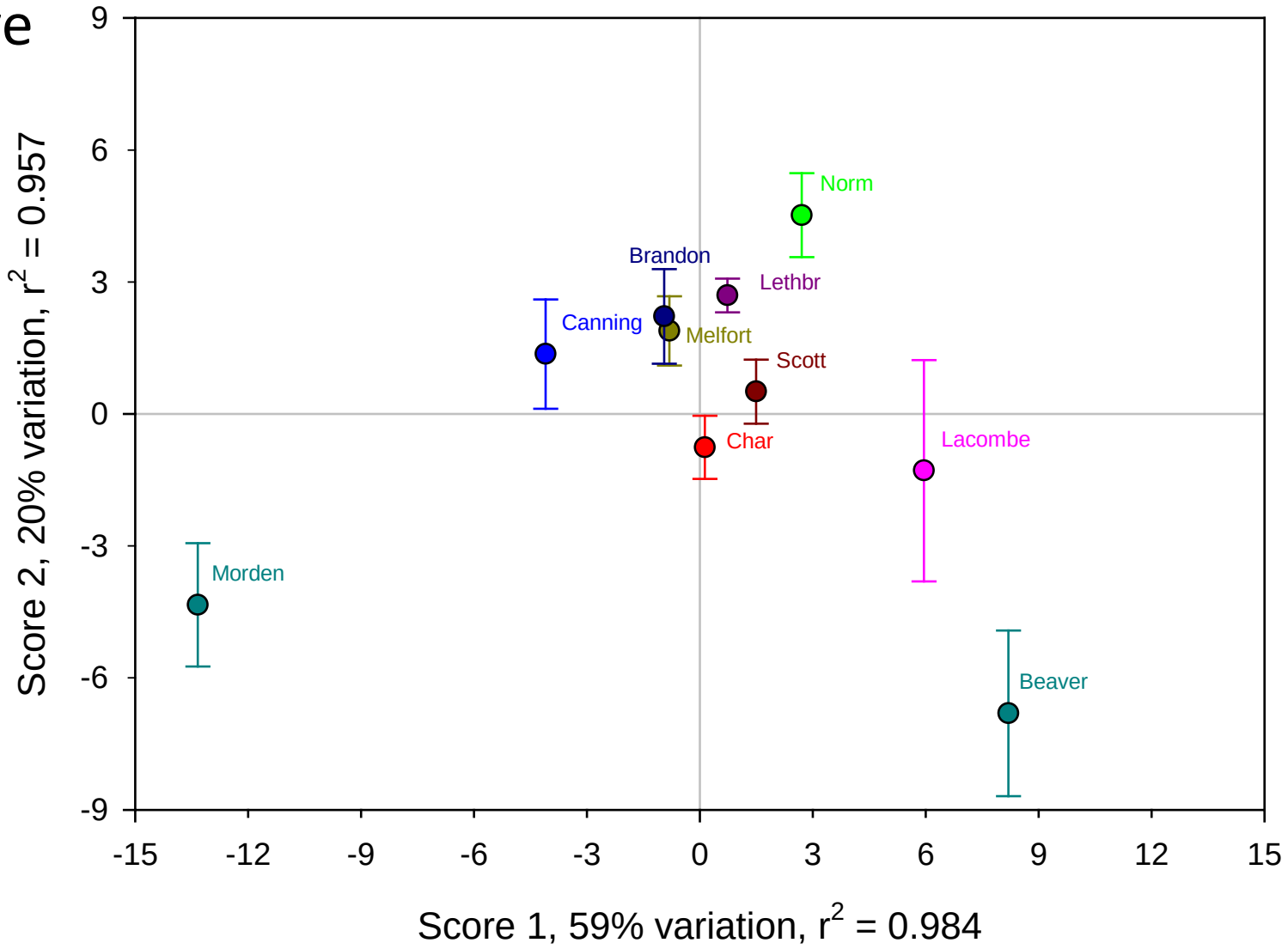

Plant Height avg cm
85
80
75
70
65
60
55
50
0% N
50% N
70% N
100% N
70/30 N
50/50 N
Nitrogen
East Brassica
East Peas
East Leg2
West Brassica
West Peas
West Leg2
2xSEM, n=21


99
98
97
96
95
94
93
92
91
Days to Maturity
0% N
50% N
70% N
100% N
70/30 N
50/50 N
Nitrogen
East Brassica
East Peas
East Leg2
West Brassica
West Peas
West Leg2
2xSEM, n=21


6000
5500
5000
4500
4000
3500
3000
2500
Yield (kg/ha)
0% N
50% N
70% N
100% N
70/30 N
50/50 N
Nitrogen
East Brassica
East Peas
East Leg2
West Brassica
West Peas
West Leg2
2xSEM, n=21

Discriminant analysis

- Sites in close proximity have similar responses



Conclusions

- Differences in Eastern and Western responses
- Malt quality and soil data will provide further insights
- Barley grown 2020 with wrap-up in 2021-22

CANADIAN AGRICULTURAL PARTNERSHIP

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