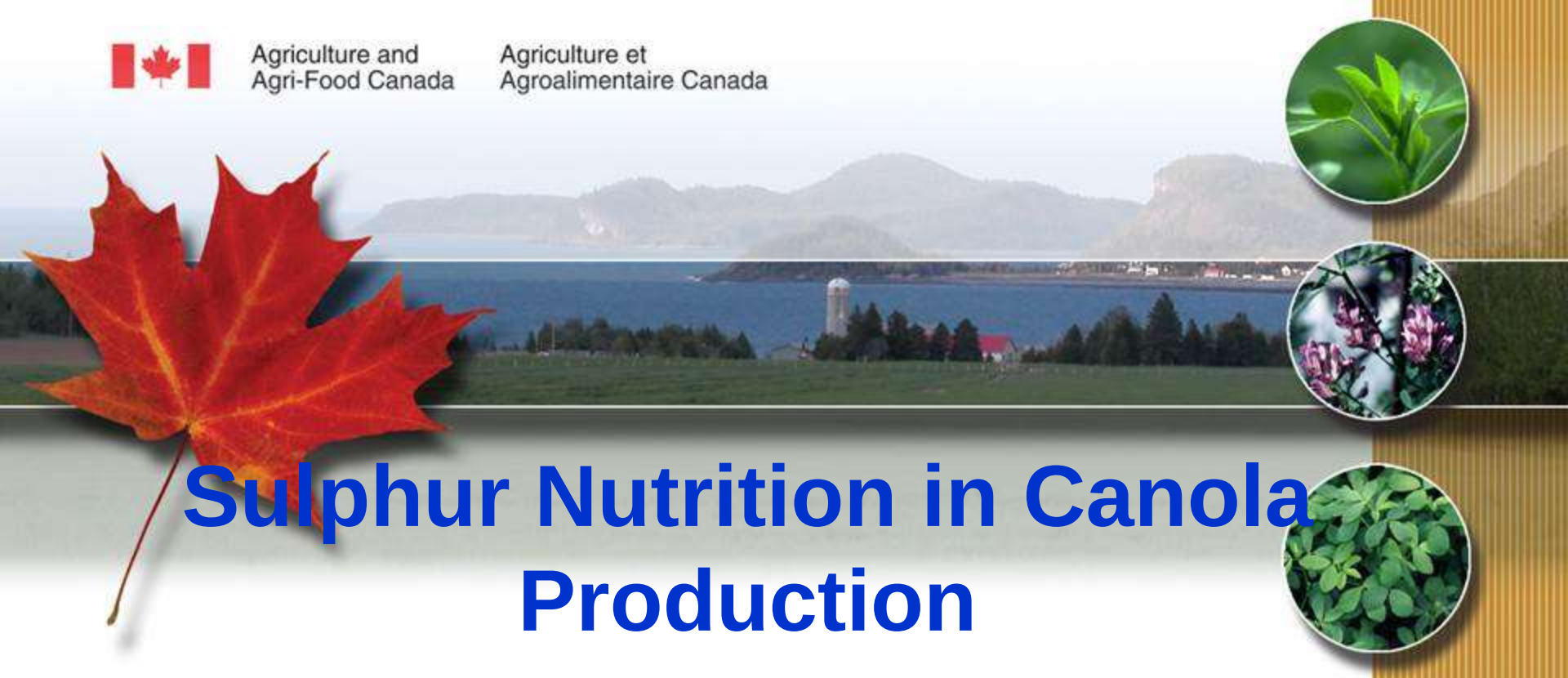

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Sulphur Nutrition in Canola Production

Dr. Bao-Luo Ma

Ottawa Research and Development Centre, AAFC,

Ottawa, ON, 613-759-1521, baoluo.ma@agr.gc.ca

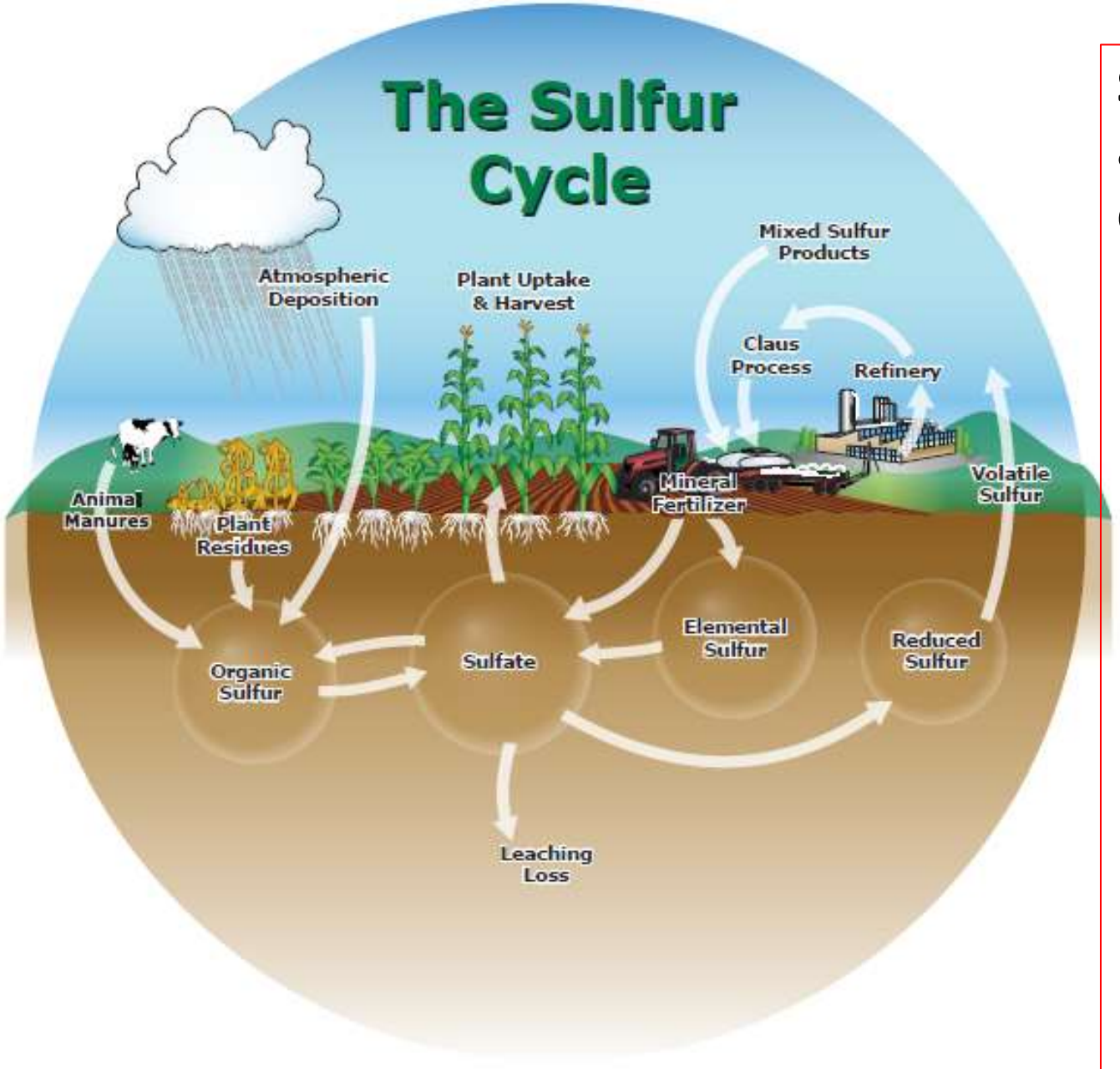
Canada

Outline

- Background
- Objectives
- Experimental design and data collection
- Results
- Conclusions
- Next steps

Background

- Sustainable canola production requires to simultaneously increase yield, NUE, profitability as well as minimize N loss
- The best way to improve NUE in canola is to adopt a nutrient balance approach
- Need to consider the synergistic and antagonistic interactions between macro- and micro-nutrients that occur in soils and plants
- Canola requires larger amounts of S than small grain cereal crops



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Shortage of soil available S, likely due to:

(i) reduction from atmospheric deposition with the effective control of air pollution,

(ii) reduction in S content in fertilizer; and

(iii) wide growth of high S demanding crops and/or larger S removal with increasing crop yields

Background

Table 1. Sulfur removal in the harvest portion[1] of some typical crops. Grain values are at 10% moisture content.

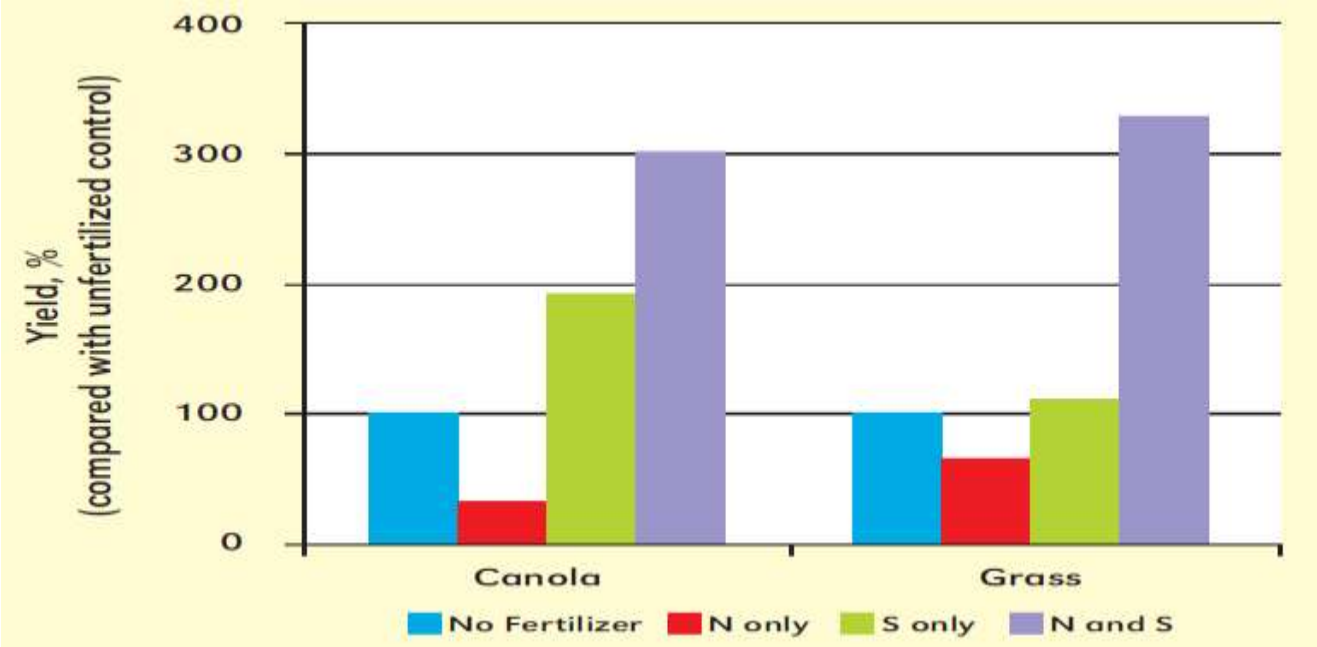
Cereals	kg S/t	lb S/unit[2]	Oilseed	kg S/t	lb S/unit
Wheat	1.4	0.084 (bu)	Canola	5.0	0.25 (bu)
Barley	1.2	0.058 (bu)	Sunflower	1.7	0.17 (cwt)
Corn	1.1	0.062 (bu)	Cottonseed	2.9	0.29 (cwt)
Rice	0.9	0.041 (bu)	Flaxseed	2.0	0.11 (bu)

[1]The unharvested portion of the plant may contain as much or more S than the harvested crop.

National Land and Water Resources Audit, 2001

Background

- Both S and N are important in protein synthesis, these nutrients are often considered to be co-limiting
- N:S = 16:1 in wheat while 6:1 in canola
- Recommend a N:S ratio of 5:1 to 7:1 in compound fertilizers in the Canadian Prairie



Aulakh and Malhi, 2004. cited from IPNI: Sulphur for plant nutrition

Objectives

- Determine the effects of N and S fertilization on canola nutrient uptake, nutrient stoichiometry, and their relationship to canola yields

Materials and Methods:

- **Experimental design:**
  - Combinations (26-28) of timing (PP vs. SP) and rates of N fertilizer with vs. without S application
  - RCB design with 4 replication
  - Two yr in 6 sites

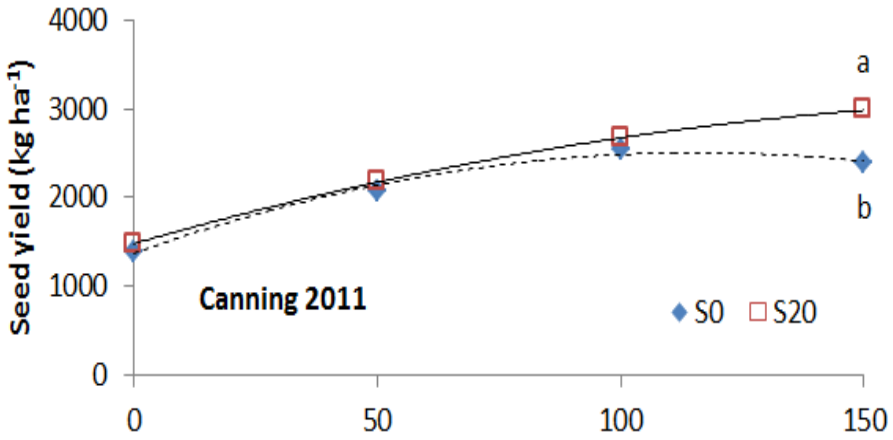
- **Sites:**
  - Ottawa, ON
  - Elora, ON
  - Ste Anne de Bellevue, QC
  - St-Augustin-de-Desmaures, QC
  - Fredericton, NB
  - Canning, NS

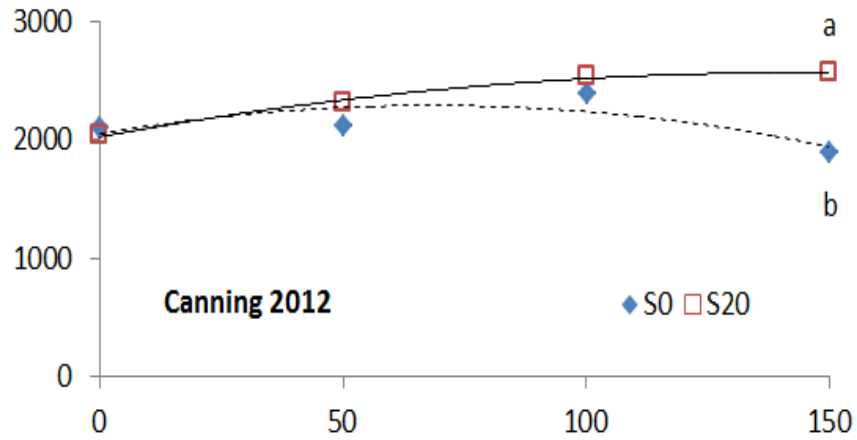
Measurements

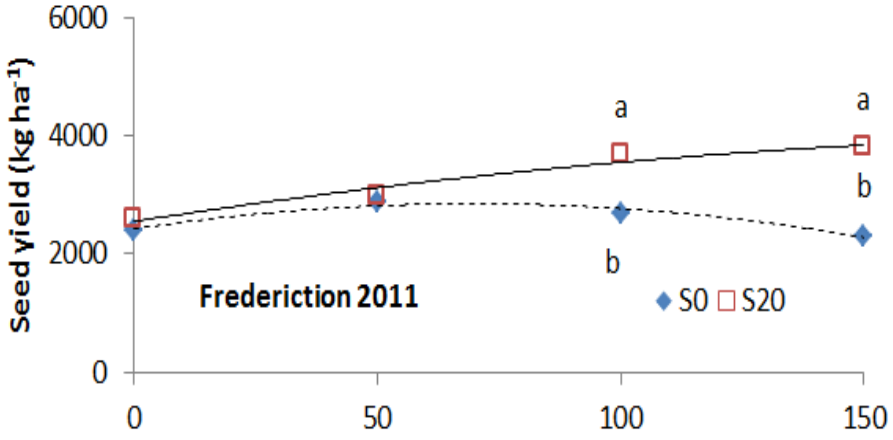
- Soil basic information
- Phenology
- Yield, yield components
- Plant samples at early flowering, and straw and seed samples at harvest for the determination of N and S concentrations
- Agronomic NUE with and without S addition was calculated and compared

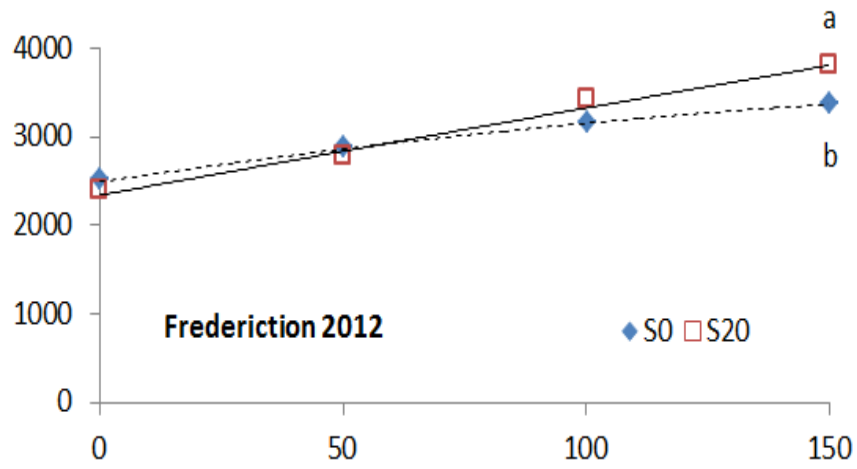
Results

Yield response

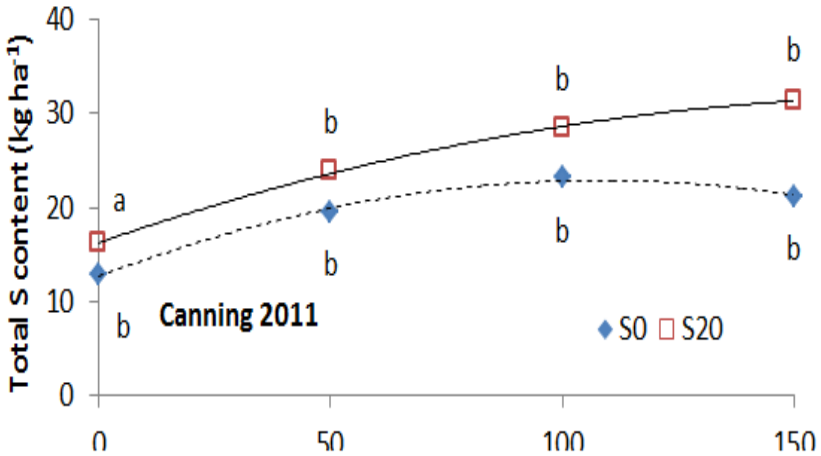


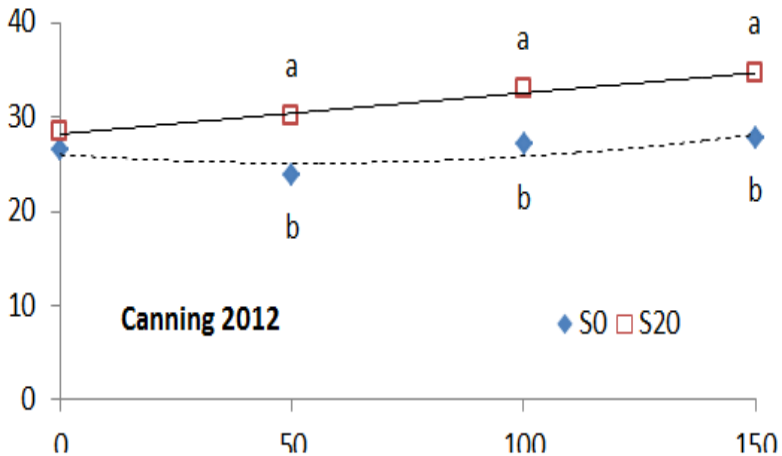






S uptake


Total S content (kg ha-1)
Canning 2011
S0 S20


Canning 2012
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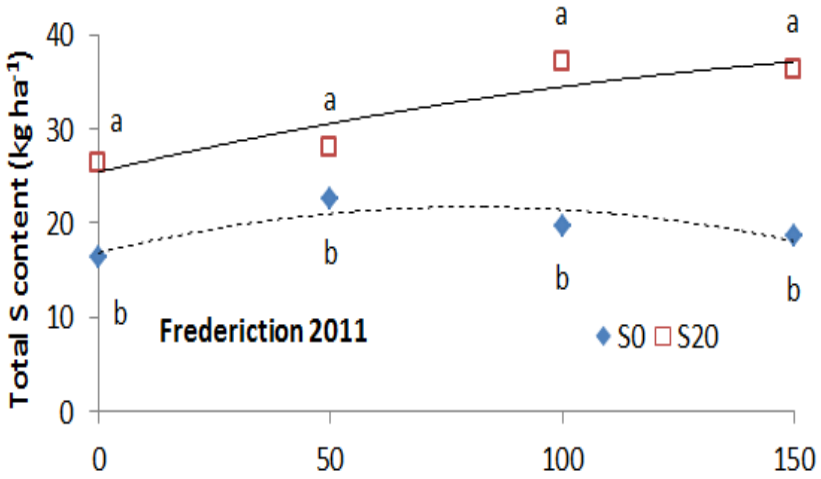
Total S content (kg ha-1)
Fredericton 2011
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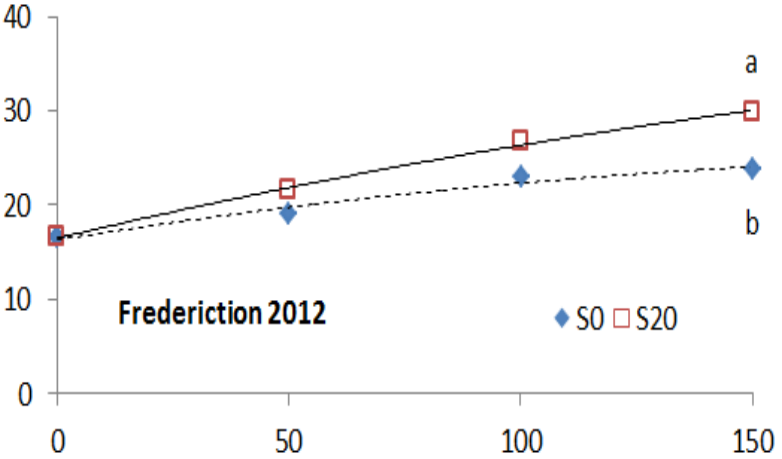
Fredericton 2012
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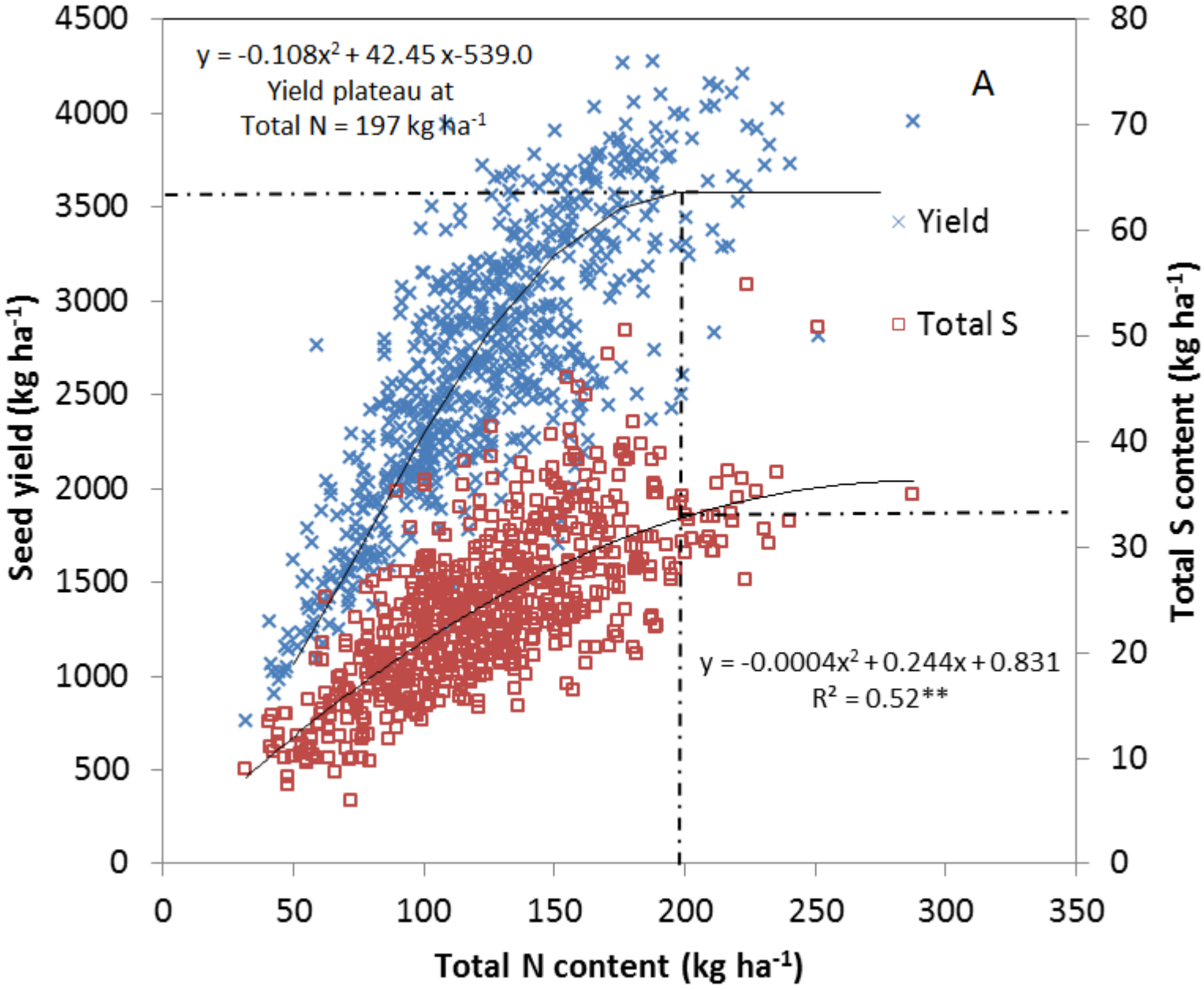
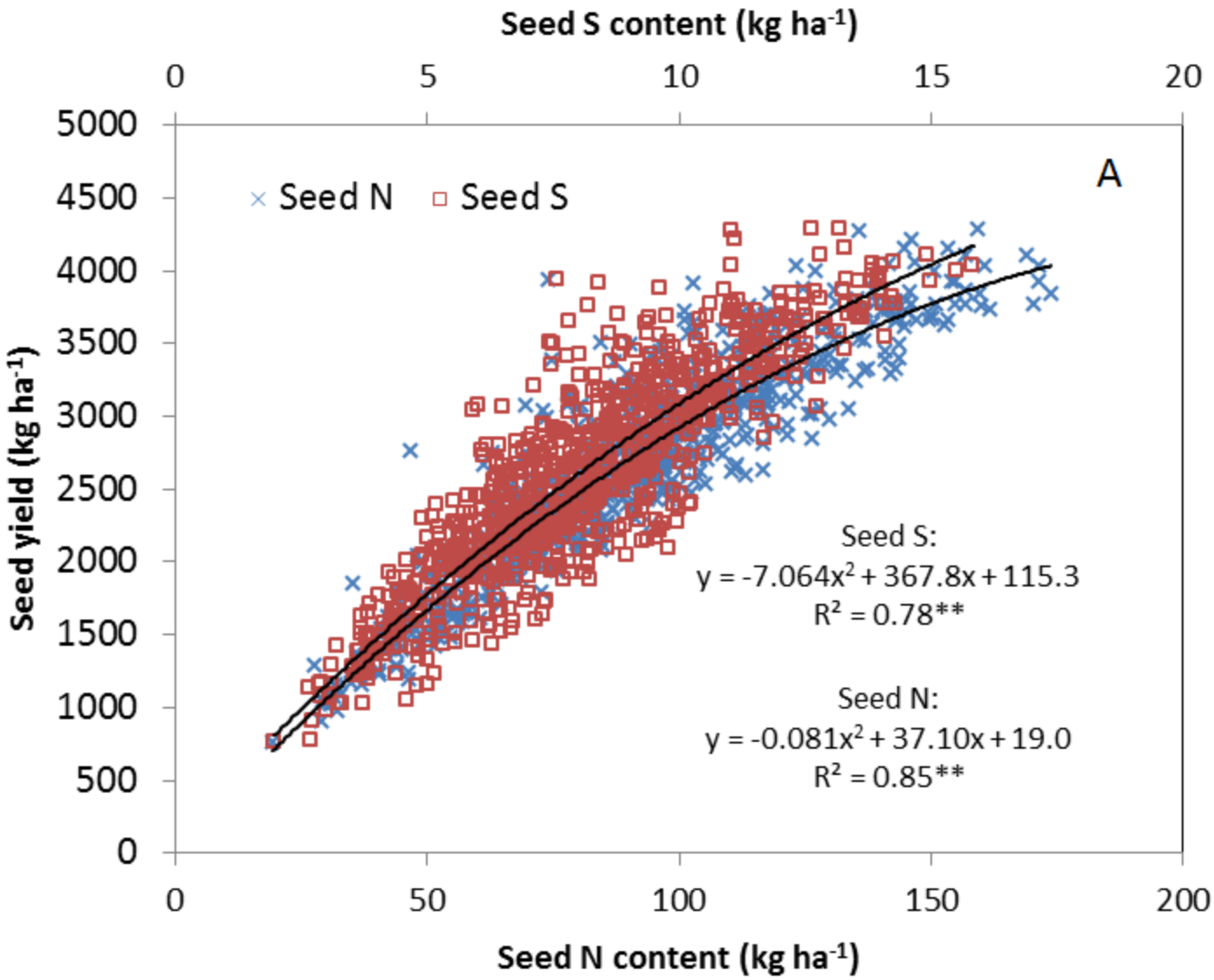


Relationships among seed yield, plant total N and total S contents. Solid curved lines are nonlinear regression for all data (N = 672)



Relationships between canola seed yields and seed N, S and B contents. Solid curved lines are nonlinear regression for all data (n = 672) from all site-years

Key conclusions

- The maximum seed yield of 3580 kg ha^{-1} was attainable at plant N uptake of 197 kg ha^{-1}, plant S uptake at 33 kg ha^{-1} or N:S = 5.9;
- Fertilizer S application at a rate of 20 kg ha^{-1} greatly enhanced seed yields of canola and improved NUE at six of nine site-years, especially at the N150+S20 combination;
- S supplement at high-N application is important for canola production in eastern Canada

Next steps

- Identify the ranges of canola plant S concentrations and N:S ratios at early stages and at maturity;
- Determine the critical S concentration and N:S ratio at early growth stages in relation to canola yield;
- Develop a site-specific S recommendation rate for enhanced nutrient use efficiency and canola yield

Acknowledgements

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THANK YOU

ANY QUESTIONS ?