Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Breeding barley in eastern Canada

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Canada

100 years of Barley Breeding

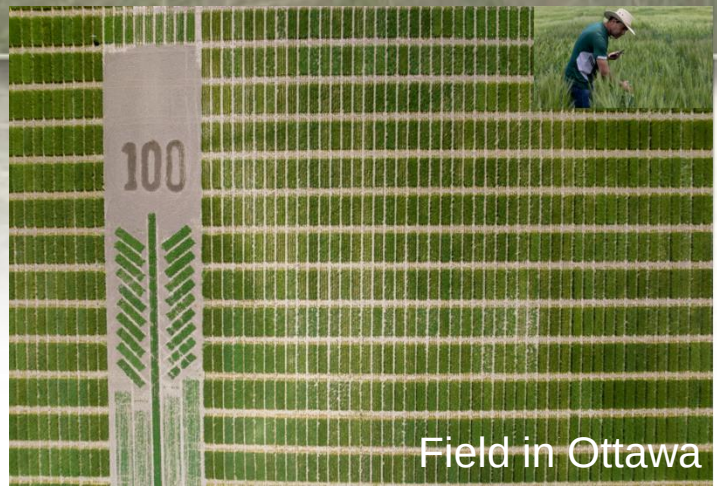
Barley Breeding Team

- Six full-time staffs
  - 1 Barley Breeder
  - 2 Breeding technicians -Charlottetown, PE
  - 2 Breeding technicians –Ottawa, ON
  - 1 assistant breeding technician –Ottawa, ON

- 2 summer students
- 1 casual help
- 1 graduate student

Breeding Facilities

- Two Breeding locations – Charlottetown PE and Ottawa ON
- >20 acres of field plots in Central experimental farm
- >5 acres of off-station field plots in Vernon, ON
- > 15 acres of field plots in Harrington, PE
- 1 FHB artificial nursery
- Machinery for planting, combine and seed cleaning
- Advanced material testing and evaluations >6 locations every year



Field in Ottawa


Field in Charlottetown, PE

Barley breeding focus

Two and Six-row Barley

- Feed (80%)
- Malting (18%)
- Hulless feed and food (2%)

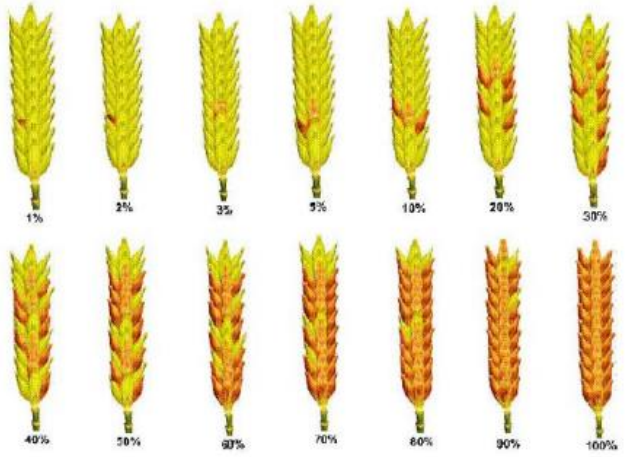
Two-row

Six-row

Black barley

Traits (Production and Quality traits)

- High yield
- Fusarium head blight resistance
- Improved lodging resistance
- Grain plumpness



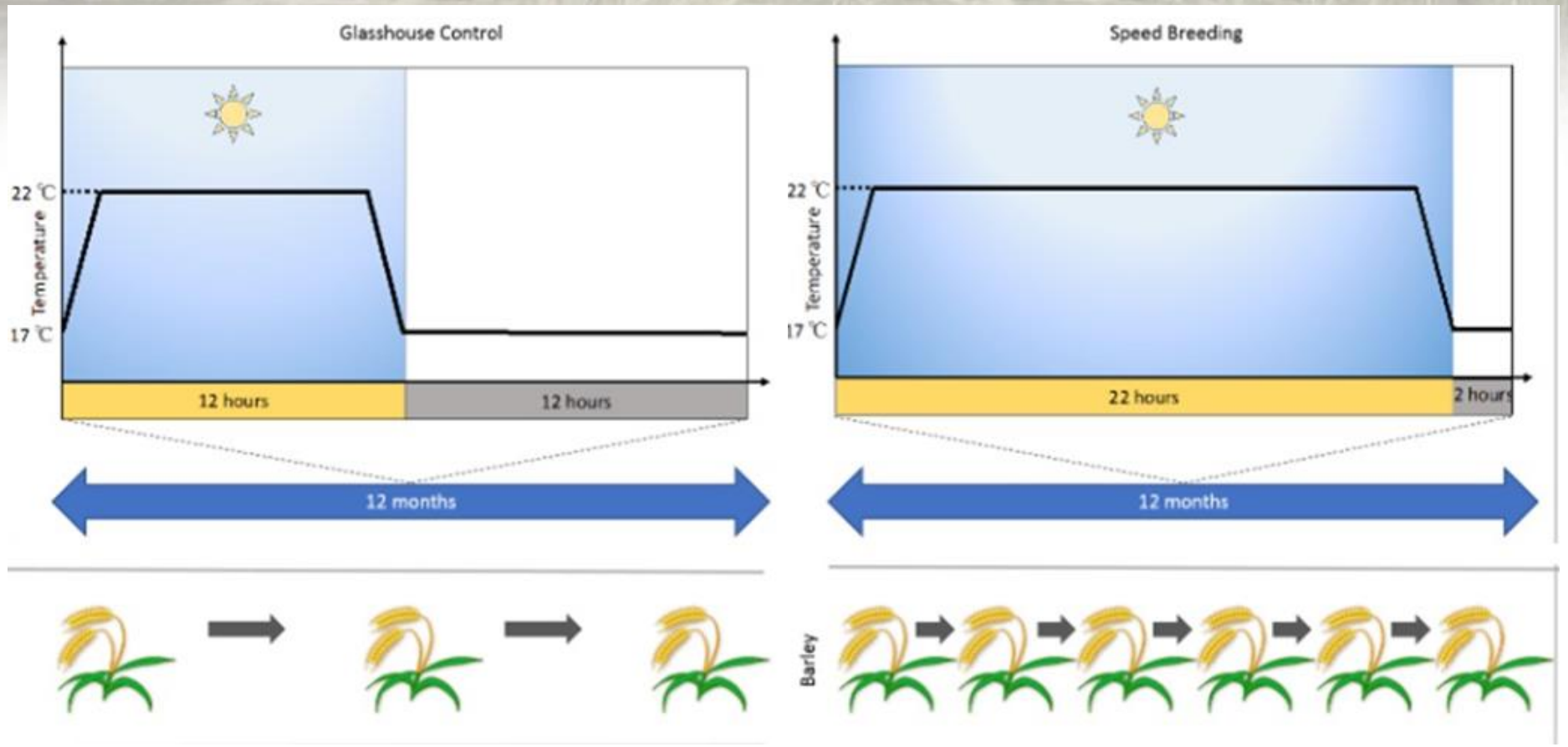
- Protein
- Malt extract
- Wort viscosity

Variety Development

Conventional breeding approach

Activities	Year	
Parent1 x Parent2	2018 Year 1	
F1 (Greenhouse)	2018 Year 1	Inbreeding
F2 (Field)	2019 Year 2	
F3 (Field)	2020 Year 3	
F4 (Field – HS)	2021 Year 4	Selection
F5 (Field- single rows)	2022 Year 5	
F6 (Field- mini-plot)	2023 Year 6	
F7 (Field - PYT)	2024 Year 7	Evaluation
F8 (Field - AYT)	2025 Year 8	
F9-11 (MLYT)	2026 Year 9	
Commercialization	2029 Year 12	

Accelerate Variety Development



Accelerate Variety Development

Speed Breeding Approach

Activities	Year	
Parent1 x Parent2	2017	Year 1
F1 (Greenhouse)	2018	Year 2
F2 (Greenhouse)	2018	Year 2
F3 (Greenhouse)	2018	Year 2
F4 (Greenhouse)	2019	Year 2
F5 (Field-Single row)	2019	Year 2
F6 (Field-NZ)	2019	Year 2
F7 (un-replicated YT)	2020	Year 3
F8 (Prelim. YT)	2021	Year 4
F9 (Advanced YT)	2022	Year 5
F8-10 (MLYT)	2023-25	Year 6-8
Commercialization	2026	Year 9

New released varieties (2018 to date)

Two-row varieties

1. AAC Ling (2018)
2. AAC Bell (2018)
3. AAC Madawaska (2019)
4. AAC Sorel (2021)
5. CH1209-1 (2023)

Six-row varieties

1. OB2930-35 (2021)
2. OB2705n-11 (2021)

Current projects

Optimal seeding rates for hulless barley

R. Khanal, A. Mills, T.M. Choo, S. Fillmore, D. Pageau, N. Mountain

Demand for hulless barley

- Feed, food and malt uses
- Higher digestibility, higher protein and energy contents, and lower fibre than hulled barley
- Contains health-related compounds adding to its appeal in the health-food

Hulless black barley

AAC Starbuck

CH2909-162-95

Hulless barley does not tolerate handling as hulled barley because of the exposure germ

Recommended seeding rate is 300 seeds per m^2 in eastern Canada

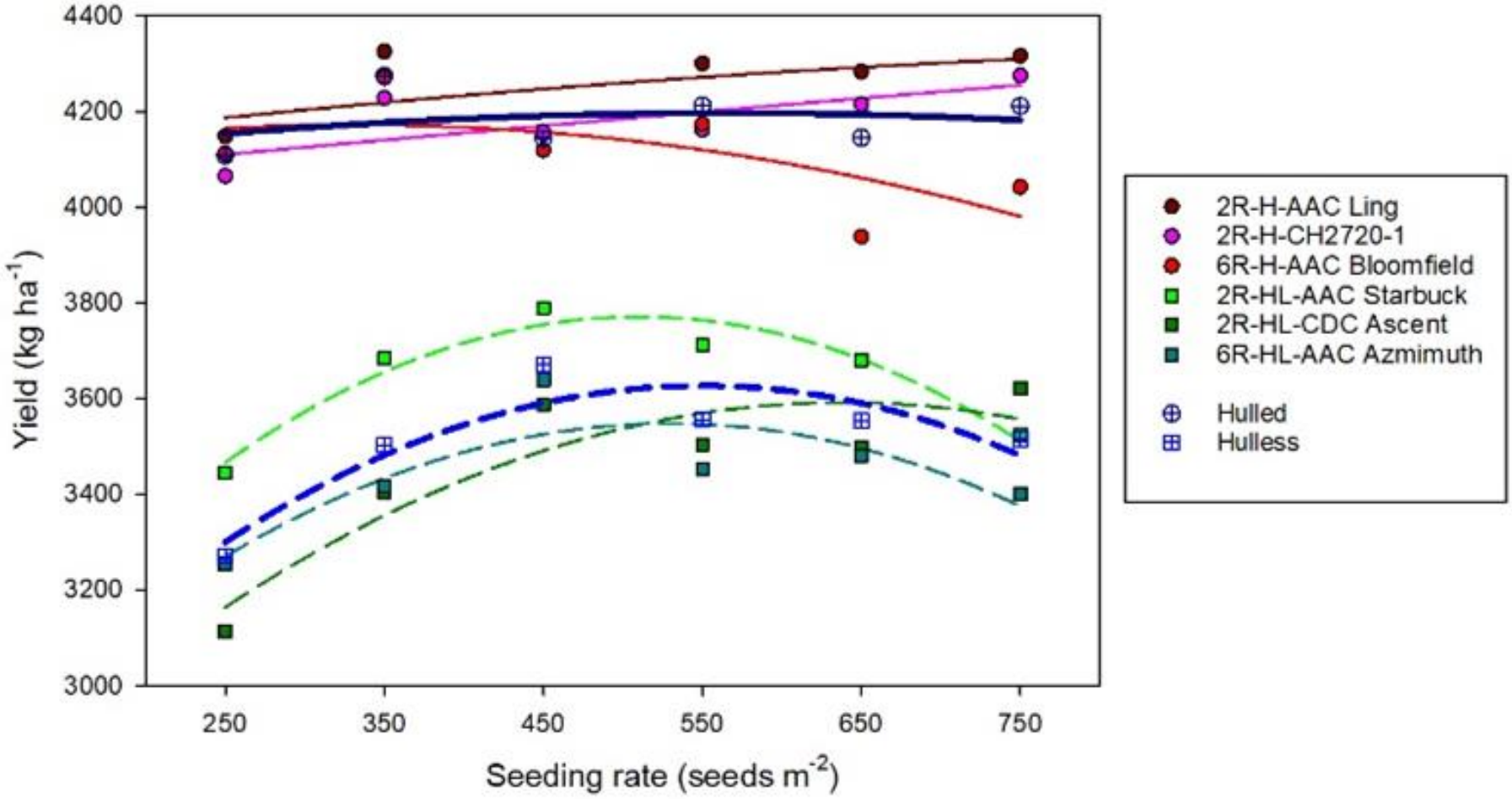
Hulled barley

Hulless barley

Justification of the study

- There are no recommended guidelines for hulless barley
- Agronomic practices that generate maximum yield potential are necessary to make it a successful crop

Seeding rate vs grain yield

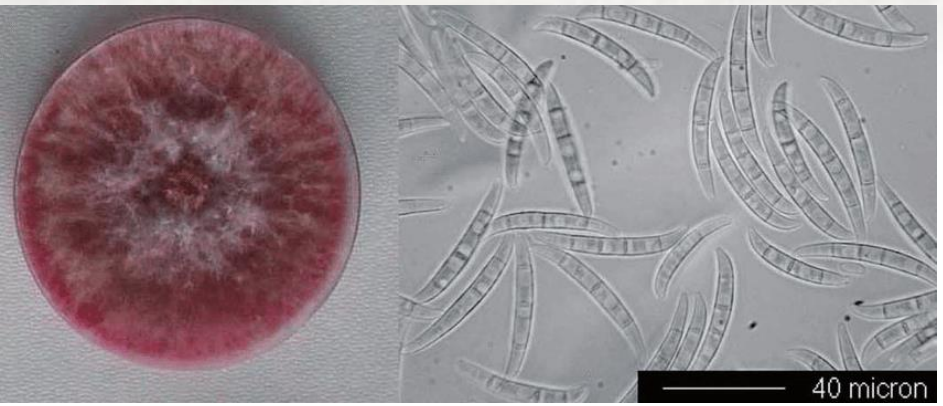


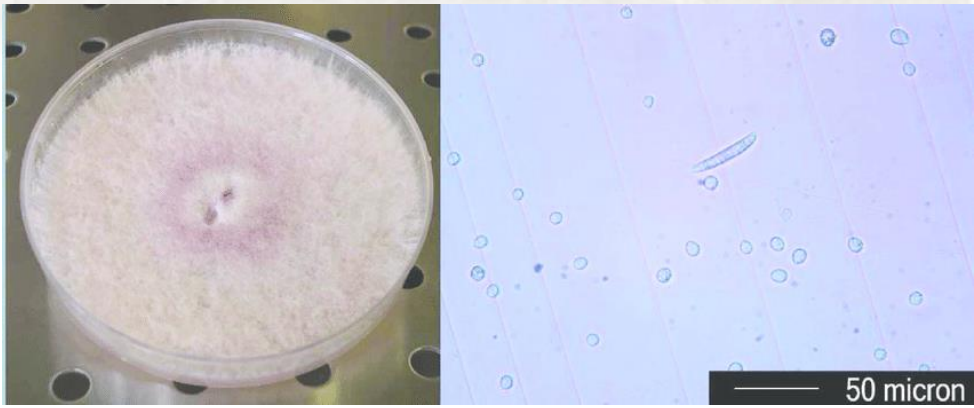
Current projects

Pathogenicity of *Fusarium graminearum* and *F. poae* causing Fusarium head blight in barley under controlled conditions

R. Khanal, K. Hudson, A. Foster, X. Wang, L. J. Harris, E. Brauer, and D. P. Overy

FUSARIUM SPP. IN EASTERN CANADA





Fusarium graminearum (Fg)

- Predominant cause of FHB epidemics in North America
- Toxin of concern = DON

Fusarium poae (Fp)

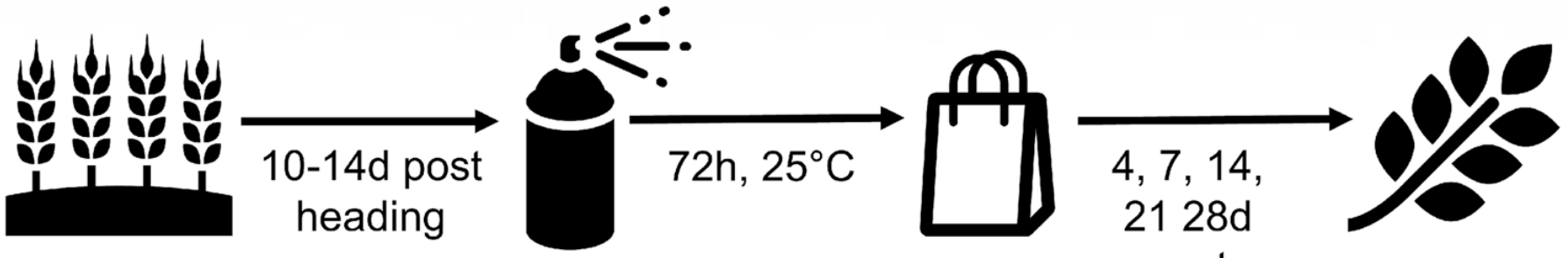
- 'Weak' pathogen
- Higher detection frequency
- Toxin of concern = T-2, HT-2

FUSARIUM SURVEY (Xue et al. 2018)

- Surveyed wheat, barley, and oats from 2001-2017
- **FHB epidemic vs. non-epidemic years**
  - *F. graminearum* (*Fg*) = most detected in **epidemic** years
  - *F. poae* (*Fp*) = most detected in **non-epidemic** years
- **Wheat vs. oat vs. barley**
  - Wheat – *Fg* dominated
  - Oat – *Fp* dominated
  - **Barley – *Fg* and *Fp* equally dominant**

METHODS

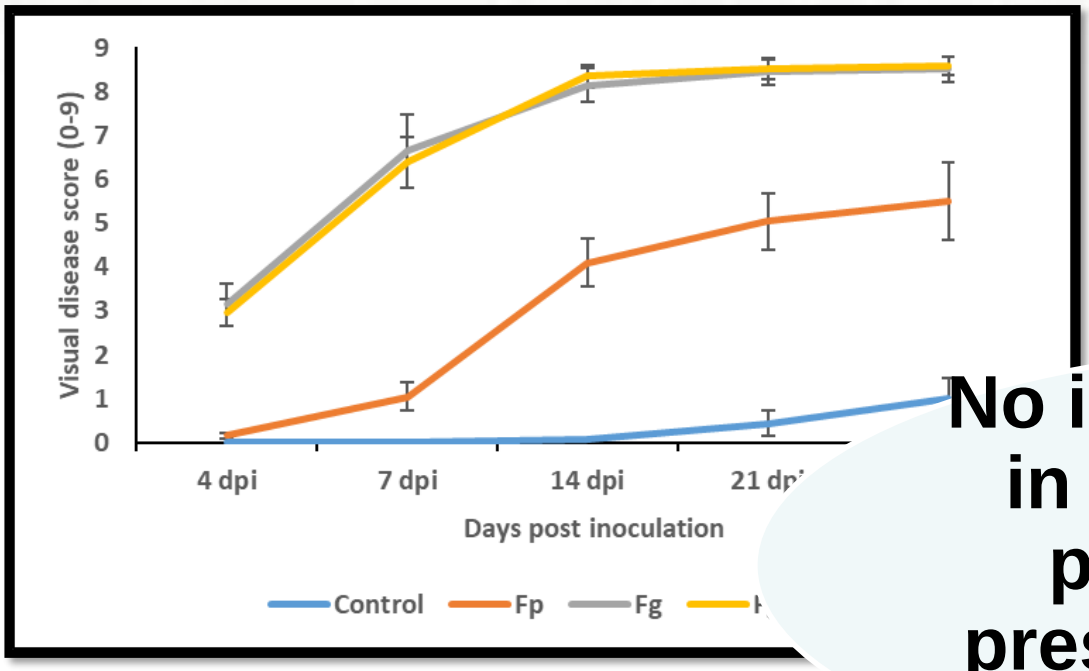
Assess visual severity of FHB in barley between single-inoculation vs. co-inoculation of *F. graminearum* and *F. poae*



VISUAL DISEASE ASSESSMENT

RESULTS

Assess visual severity of FHB in barley between single-inoculation vs. co-inoculation of *F. graminearum* and *F. poae*



- There was a significant difference in FHB severity between *Fusarium graminearum* and *F. poae*
- FHB severity was similar between *Fusarium graminearum*

No increased severity in FHB when both pathogens were present compared to *Fg* infection alone.

Acknowledgements

- Canadian Agricultural Partnership
- Canadian Barley Research Coalition
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- Grain Producers of Quebec
- Grain Farmers of Ontario
- Targeted and Useful Genomics for barley and Oat