University of Manitoba | Faculty of Graduate Studies

Ph.D. Oral Examination

Michelle Carkner, Ph.D. Candidate
Plant Science

The oral examination of the doctoral thesis titled

An Evaluation of Farmer-selected Wheat Genotypes from Canada's First Organic Participatory Breeding Program

will be held on

Friday, February 23rd, 2024, at 09:00 AM (CST)

218 Plant Science Building

Examining Committee

Advisor: Dr. Martin Entz, Department of Plant Science

Examiners:
Dr. Robert Duncan, Department of Plant Science
Dr. Santosh Kumar, Agriculture and Agri-Food Canada
Dr. Kimberley Schneider, University of Guelph

External Examiner:
Dr. Thomas Doring
Bonn University
Germany

Chair

Dr. Brian Amiro, Department of Soil Science

Thesis Abstract

GENERAL ABSTRACT

An Evaluation of Farmer-selected Wheat Genotypes from Canada's First Organic Participatory Breeding Program

Despite organic spring wheat's (*Triticum aestivum* L.) economic and cultural importance to Canadian agriculture, breeding for organic production systems remains a challenge. Organic growing environments are different from conventional farms in terms of weed species and abundance, fertility, and soil biology. More specifically, many organic farms where most of the organic wheat in Canada is grown (Alberta, Saskatchewan, and Manitoba), are deficient in soil test phosphorus (P). To address these complex challenges, the unorthodox breeding model, participatory plant breeding (PPB), has been proposed. An organic PPB wheat program has been practiced across Canada over the past decade, providing an unprecedented opportunity to explore the influence that selection environment diversity has on the agronomic performance under organic management. Field trials testing 25 PPB genotypes against 6 check cultivars across 12 environments demonstrated three PPB genotypes and one check cultivar to be top yield performers. A second experiment compared a modern cultivar and a landrace cultivar used as parental material in the PPB program, as well as the product of two farmer-selected PPB genotypes by farmers in different geographic locations from the same cross. The genotypes were tested under P limited and P-amended organic conditions, to investigate resilience against P limited conditions. There were no significant differences in yield among genotypes. Farmer genotypes were similar to the modern parent cultivar for protein concentration and lodging severity, and similar to the landrace parent in plant height and kernel mass. More detailed measurements pertinent to phosphorus use, physiology, and uptake efficiency demonstrated that two different phosphorus uptake and use efficiency mechanisms may be occurring between the farmer genotypes. Overall, this research provides evidence that early generation farmer selection is an effective breeding strategy to create distinct genotypes with phenotypic characteristics that are beneficial for organic production systems in Canada. More research is needed to determine how PPB initiatives can better serve organic production systems with a focus on specific site selection at the early generation phase in combination with parental material that may enhance pest resistance and greater phosphorus uptake efficiency. A proposed model of future PPB breeding schemes with special attention to selection environment is presented.