INTRODUCTION AND METHODS

The Glenlea rotation is Canada’s oldest organic vs conventional comparison study, started in 1992. The experiment includes two crop rotations, an annual grain rotation (wheat-flax-oats-soybean or green manure in organic) and a perennial hay-grain rotation (alfalfa-alfalfa-wheat-flax). Two interventions in the organic systems are: perennial plots were split in 2007 with half the plots receiving manure to replenish soil P stocks; and the annual plots were split between 2015 and 2020 to insert a 5-year alfalfa crop to increase soil N status and control weeds. From 1992 to 2020, a common wheat cultivar was used in the organic and conventional plots. Details of rotation and input management are provided in Carkner et al. (2020).

Breeding spring wheat for organic production started in Manitoba in 2004 (Kirk et al. 2012). In 2011, farmers were invited to participate in the organic wheat breeding process. F₃ populations from the AAFC Cereal Research Centre were made available to the farmers who selected on their organic farms for 3 consecutive years (F₃ to F₅). Yield testing showed that some of the farmer lines performed better than conventionally bred lines when grown under organic conditions, both in terms of grain yield and fusarium tolerance (Entz et al. 2018). Given this, one of the farmer selections (a cross between BW433 and BW430) has been grown in the organic plots at Glenlea since 2021. This “organic line” averaged 100 cm in height (compared with 82 for AAC Brandon) and was 1 day later in maturity (Entz et al. 2018).

RESULTS

The average yields for all wheat treatments are shown in Table 1. Higher average yields during the 2011 to 2020 period were attributed to better growing conditions. Time period two (2021-2023) was characterized by extreme droughts in 2021 and 2023 and excess spring precipitation in 2022 (Fig. 1) which delayed spring planting and reduced yield potential. Wheat grain yield and wheat aboveground biomass “losses” due to organic production are shown in Fig. 2 and 3. In the annual rotation, yield loss due to organic was similar for the two time periods. However, the annual rotation was “improved”, through a 5-year alfalfa crop, yield loss due to organic was reduced. In the perennial rotation, yield and aboveground biomass loss due to organic was much less where the organic line was used (time period two) (Fig. 2 and 3). The positive effect of the organic line to lessen the yield loss from organic was especially noticeable where manure has been added to the perennial rotation; in this case there was virtually no yield loss from organic production.

DISCUSSION AND CONCLUSIONS

Under the stressful conditions during time period two — the period when the organic plots were seeded to an organically selected wheat line — “yield loss due to organic” depended on the cropping system. Under conditions of adequate nutrient supply (either from use of manure to eliminate P deficiency in the perennial rotation, or the inclusion of alfalfa to increase N supply in the annual grain rotation), the use of the organically bred line reduced the “yield loss to organic”. In the perennial with manure system, there was no yield difference between organic and conventional wheat yields. This result demonstrates the value of breeding programs aimed specifically at organic production.

REFERENCES


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