Farm-based organic wheat variety trials network (LiveWheat)

Summary progress report (March 2021)

Introduction

Yield gaps between organic and conventional agriculture raise concerns about agricultural systems, which face an increasingly unpredictable climate and need to reduce external inputs. In the United Kingdom, the performance gap is especially severe for wheat. This has helped to contribute to a small and shrinking organic acreage.

In organic wheat production, most determinants of crop performance are managed at a rotation level, which leaves cultivar choice as the major decision on a seasonal basis. Yet, in the absence of a formal organic cultivar testing programme, little information is available support cultivar choice. Furthermore, uncertainty about field-scale crop performance (yield and quality) hinders positive developments in the supply chain of both grain and seeds.

LiveWheat is a research and development programme that aims to inform decision-making for sustainable organic and low-input wheat production. The main objective is to raise quantitative evidence on organic and low-input wheat performance in real-farm, field-scale conditions, as affected by cultivars, emergent crop and weed management strategies and climatic patterns. The approach is to establish a network of farmers and researchers able, with broad stakeholders' support, to undertake on-farm experimentation and data collection.

Methods

In 2019/20, thirteen winter wheat varieties were tested across a network of eight farms – six organic certified and two non-organic farms that adopt agroecological management and use minimal external inputs. An incomplete block design was adopted with cv. KWS Siskin as a common control cultivar. An extended survey of 22 additional fields of winter and spring wheat across 11 farms has been carried out.

The season had an unprecedented climatic pattern, with high, often continuous, rainfall during the autumn and winter. This prevented six farms out of the 14 originally planned from correctly drilling the experimental design. The season unfolded with an extended period of drought during the stem-extension stage in spring.

Interviews with farmers have ascertained the key descriptors of the field and of the cropping system, including preceding crop, soil preparation, drilling dates, pre- and post-emergence weed management operations and fertility management. Soil analyses on the experimental fields have been conducted post-harvest.

Data collection has focused on the early stem-extension stage and on the anthesis stage, with observations on crop morphology, vigour, response to diseases, yield components, weed abundance and community composition. Grain yield was measured by farmers at harvest and grain samples were analysed for standard quality assessments.

Interim results

In 2019/20, yield differences between winter and spring organic wheat were limited, with a slight yield advantage in winter wheat, of non-organic vs. organic farms. Non-organic winter wheat and organic spring wheat outperformed organic winter wheat in terms of grain protein content. Weed abundance was substantially equivalent between organic and non-organic farms. Marked differences were found in terms of weed community composition, with organic farms showing higher species richness than non-organic farms.

Comparisons against the previous two growing seasons suggest that 2019/20 was a lower-yielding year, with lower weed and disease pressure. Multivariate analysis shows the dependence of grain yield on spikelet density and on weed abundance at early stem extension. Simple visual scoring of crop vigour appeared as a powerful predictor of grain yield and of weed abundance, but this will need to be validated.

Varietal differences were detected in weed abundance, crop cover and crop height at early stem extension, crop cover and height at anthesis, and ear density. Grain yield and protein content were also affected, but to a lesser extent, by variety. Grain yield was driven by the compound effect of crop cover at anthesis and weed cover at stem extension and, to a lesser extent, by key yield components. Integration with data from the previous growing season highlights the importance of genetic differences on weed suppressive ability, with an advantage of genotypes with historic parentage, although useful variation was detected among modern varieties, especially for crop vigour at vegetative stages. Dynamic stability analysis suggests that these genetic differences are especially relevant with increasing weed pressure. Likewise, dynamic stability analysis suggests that varieties with historic parentage can be better adapted to ‘low-yield potential’ environments.

Dissemination

Due to the COVID19 pandemic and lockdown, dissemination activities were conducted online, with two key events (in cooperation with the AHDB):

1. ‘Seeds and Deeds – Collective plant breeding for reduced input farming’ webinar on 9 June 2020
2. ‘Risks are potentialities’ livestream webinar, part of AHDB Agronomy Week 2020, on 1 December 2020

Future developments

The project is on track with expectations. Key corrective actions will be to protect the project from fluctuations in seed availability, improve efficiency of data return and empower participating farmers to contribute their observations to the dataset. We will explore how to enable training on data collection, management and use to empower larger number of farmers to generate useful evidence, without excessive reliance on researchers. Furthermore, integration of climatic data, as well as engagement of supply chain stakeholders, in evaluation of processing quality, are underway.

Further information

ahdb.org.uk/livewheat