Wheat trials

How reliably do wheat varieties perform under different organic farming conditions? The Organic Research Centre team report on recent research.

A major obstacle to the development of organic farming in the UK is the central problem of winter wheat production. At present, there is a substantial gap between the supply of home-grown organic milling wheat and demand, partially due to shortfalls in both wheat yield and quality.

Variety choice is very important when striving for higher yields and better quality organic wheat. Yet very few wheat varieties have been bred or selected to thrive under organic conditions, and the use of non-organic or ‘conventionally bred’ wheat varieties in organic systems often results in a considerably decreased productivity, with the added disadvantage of relatively low protein levels.

There is therefore a pressing need for wheat varieties that are more adapted to organic farming conditions and the wish-list of traits for such varieties is long: higher competitiveness against weeds, better resistance to fungal pathogens, and the ability to scavenge more efficiently for nutrients in the soil, to name a few.

Progress is being made in organic wheat breeding programmes across Europe, although the varieties arising from these are not widely available in the UK. A crucial and unanswered question is how reliably varieties will perform under the diverse conditions that prevail on organic farms. But even when varietal traits are tested and established in organic research, how far are these findings really transferable to the specific conditions that are found on a farm with, for example, different sowing densities, undersowing practices, weeding techniques, or drilling equipment?

Pessimists would expect that predictions of the behaviour of varieties are impossible, as they will strongly depend on specific farming practices. An over-optimistic view, on the other hand, might imagine that all properties of organic wheat varieties would be preserved across virtually all farming practices. The truth, of course, will lie somewhere in between - but where exactly? To investigate how reliably varieties perform under varied farming conditions, we tested wheat varieties under various combinations of organic management practice. And our results indicate that there is reason to be cautiously optimistic.

The Wheat LINK project

Our experiments were part of a larger project (see the Wheat LINK project, right) which aimed to achieve a more comprehensive understanding of the interactions that one could expect to occur among a range of agronomic factors - and their effect on organic wheat production. Here we focus on the interactions between varieties and other organic management factors.

Comparisons were made between a conventionally-bred control variety (Hereward), a variety specifically bred for low input systems (Aristos), and a wheat population from crosses of diverse parents (YQ) (see farmer-led breeding, right). All three varieties were subjected to various combinations of management practices, including wide or narrow rows (10 or 20 cm), high or low sowing density (250 or 150 kg/ha), and undersowing with clover (with or without). Using plot trials on three organic farms, we studied yield, grain quality and various other parameters over three years.

The choice of variety did not consistently influence yield. However, Aristos and the population performed relatively
Farmer-led breeding

In the Wheat LINK project, led by Organic Research Centre (ORC) and with Scottish Agricultural College as research partner, was funded by Defra under the Sustainable Arable LINK programme and industry partners and ran from 2005–6 to 2007–8. The main aim of the project was to reduce unpredictability and variability in organic wheat production. To achieve improved and more reliable wheat production an ecological approach was used, analysing the interactions of a range of key variables: wheat genotype, seed density, weeding, undersowing with white clover, and spatial arrangement of seed. This last factor included narrow rows, wide rows and the Claydon machinery for strip drilling. The experiments were run on three organic farms: Sheepdrove Organic Farm in Berkshire, Wakelyns Agroforestry in Suffolk, and Chapel Farm in North Berwick. A full report of the findings will soon be available on the ORC and Defra websites.

Research into practice

Since a main aim of the project was to explore the effect of interactions of management practices, finding that so few interactions were significant seemed a bit disappointing at first. However, we soon realised that it is a rather reassuring result because it means that observations made for a variety in one environment (with a specific set of management practices) may be transferred to another set of management conditions without the risk of being completely off track. This makes life a bit simpler, since we don’t need to test each variety under every possible management regime. We expect, therefore, that the results of variety trials, when carried out under organic conditions, will provide reliable results for a relatively wide range of farming practices.

In the past, the tendency to investigate varietal and agronomic aspects as independent factors has been criticised because potential interactions are ignored. While this criticism is justified in principle, our results indicate that the main effects of variety, location, year, or farming practice may often be more important than the complex interactions among these factors. While our conclusions are, of course, limited by the number of varieties we tested, we believe that they will help increase the impact of organic breeding for improved productivity of wheat in the UK.

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