Adaptation to extreme conditions in wheat populations?

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Spring wheat trial, July 2008

Background

The Organic Research Centre's Wheat Breeding project (AR0914) has produced winter wheat populations which are made up of a hugely diverse set of genotypes. This wide genetic base may enable the populations to perform stably by buffering fluctuating environmental conditions, and to improve in performance over time through a process of natural selection. This theory is being studied further in the current Wheat Breeding LINK project (LK0999).

Project outline

The Spring Wheat project, funded by The Organic Research Centre, is an extension of this, and asks the question: Can winter wheat populations adapt to extreme conditions? Here, the "extreme" condition that the winter wheat populations are being subjected to is drilling in spring.

The trial started in March 2008, and is now in its third year. According to theoretical expectations, in the first year very few plants would manage to flower successfully without vernalisation. We therefore expected the crop to yield poorly. On the other hand, it was also predicted that there would be some genotypes that can flower without the cold stimulus. These would go on to produce the seed that forms the basis for the subsequent year's crop – simple survival of the fittest. Adaptation to such extreme conditions would then be proved if crop yields of the populations improve over time.

Variety Tybalt

The winter wheat populations are being trialled alongside two commonly grown spring wheats, Paragon and Tybalt, as well as winter wheat mixtures. In the first year, the winter wheat populations performed outstandingly as a spring cereal – outyielding Paragon. However, in the second year of trials the population performance did not improve as we had expected, but was considerably poorer, yielding only about half that of the spring wheat varieties. It is likely that the results are dependent on the temperatures in late spring – if there is a cold spell after drilling, then vernalisation can still occur even with spring drilling, and this may go some way to explain the results we have seen so far.

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