

Cultivating a diverse wheat population suitable for low-input and organic farming

Problem

Monoculture pure line wheat varieties bred for high input conditions do not provide the genetic and physical diversity needed to increase crop capacity and resilience. Organic crop production requires plant varieties that are disease resistant, competitive against weeds and effective at scavenging for nutrients.

Solution

Genetic and physical crop diversity can bring stability and increased productivity. As a result of investigating composite cross populations, the ORC Wakelyns Population was developed. The breeding programme involved making 190 crosses from 20 parent varieties and mixing the resulting seed which then went through 11 generations of natural field selection. Parent varieties varied in their disease tolerance, adaptability to various weather conditions, yield capabilities, and nutritional quality.

Outcome

The Population produces more stable yields than those of the parent varieties due to more efficient use of soil nutrients and water, and lower plant disease and pest levels. When compared to the parent varieties, it produces yields of higher quality; increased protein content, improved hardness, good baking quality, comparable nutrition levels, and it is suitable for animal feed.

Practical recommendation

- The Population is most suitable for growing in low input or organic systems (under high input conditions it maintains its stability, but could yield significantly lower than pure line varieties).
- It is able to adapt to changing environmental and weather conditions and cope with variation in diseases and weeds. To further increase crop resilience, you could also consider intercropping grain legumes and cereals.
- Evolutionary change can occur within 2 to 3 years, but grain yield, disease incidence and genetic diversity should not be affected.
- Sowing too deep or too shallow could delay or decrease establishment.
- When grown organically, it may provide a better potential for bread-making than modern quality varieties bred for conventional conditions but grown under organic conditions.
- Under conventional conditions, it may have potential for producing bread from crops with a lower nitrogen input.
- Carefully identify a target market for the Population, finding one that suits the characteristics of the wheat. This is likely to be smaller-scale, artisan bakers and home bakers, who can adapt their processes to suit the flour.
- There are many artisan and locally produced flours and breads on the market, so the unique selling points of the Population should be clearly explained to consumers.

Applicability box

Theme

Crop specific

Geographical coverage:

Europe

Application time:

Autumn (September, October, November)

Required time:

No additional time required

Period of impact:

Crop

Equipment:

Standard machinery used for wheat cultivation.

Best in:

Wheat. The wheat population will adapt to local conditions over time. Due to its genetic diversity it is well equipped to buffer against environmental fluctuations such as varying weather conditions.



Figure 1: ORC Wakelyns Population, taken in July 2015 (Organic Research Centre)

Practical testing and sharing of the results

If this method seems to be suitable for your farm, we recommend that you test it under your own farm conditions.

Use the comment section on the [Farmknowledge platform](#) to share your experiences with other farmers, advisors and scientists! If you have any questions concerning the method, please contact the author of the practice abstract by e-mail.



Further Information

Video

- A [video presentation](#) filmed at the OF&G's National Organic Combinable Crops in 2015 features Bruce Pearce outlining Organic Research Centre advances in developing wheat populations and describing the process since 2001 that has led up to the launch of the *ORC Wakelyns Population* (English).
- A [video](#) of the achievements of the CORE Organic II COBRA crop breeding project that includes wheat populations.

Further readings

- [Adaptive winter wheat populations: development, genetic characterisation and application.](#)
- [Populations: diversity in plant breeding.](#) The publication summarises information about the ORC Wakelyns Population.
- [Stabilising wheat yields: Can genetic diversity increase reliability of wheat performance?](#)
- [The effect of the year of wheat variety release on productivity and stability of performance on two organic and two non-organic farms.](#)

Weblinks

- Check the [Farmknowledge Tool Database](#) for more practical recommendations.
- [Coordinating Organic Plant Breeding Activities for Diversity](#)
- [Plant breeding for crop resilience](#)
- [Strategies for Organic and Low-input Integrated Breeding and Management](#)
- [Wheat and Barley Breeding Improvement](#)

About this practice abstract and OK-Net Arable

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