



PRACTICE ABSTRACT No. 2

Why do we use evolutionary populations?

PROBLEMS:

- There are only a limited number of varieties adapted to the environmental variability of low-input organic farming.
- Genetically homogeneous varieties are more susceptible to spatio-temporal changes in biotic/abiotic stresses and therefore have limited adaptability to local growing conditions.
- Environmental variability often affects crop yields more under low-input and organic conditions than in conventional agriculture.

SOLUTIONS:

- Growing genetically diverse populations could improve tolerance to a wide range of environmental stresses and different growing conditions by allowing them to evolve and adapt to changing conditions.
- Composite cross populations (CCPs) are populations of segregating individuals that are crossed with each other (e.g. by bulking the progenies of these crosses) to produce heterogeneous and diverse material. The development of CCPs is an example of evolutionary breeding.
- Many breeders and researchers have developed and tested heterogeneous populations over the past two decades. In ECOBREED, the Hungarian variety 'Mv Elit CCP', produced by crossing seven different parents, was tested in organic field trials in 2020 and 2021 and showed stable grain yields and high protein content. Compared to the variety 'Capo', which is popular with organic farmers and growers, 'Mv Elit CCP' showed a significantly higher protein content with a similar yield.

PRACTICAL RECOMMENDATIONS:

- Based on Regulation (EU) 2018/848 on organic production (<https://eur-lex.europa.eu/eli/reg/2018/848/oj>), organic heterogeneous material (OHM) such as CCPs can now be marketed and used (after listing) by organic farmers/growers, which will improve their development and availability.
- Look for availability of OHM in national or EU organic seed databases (after 1 January 2022) or ask breeders directly.
- Test OHM at your own site. As part of ECOBREED, the Hungarian wheat population (i.e. 'Mv Elit CCP') was evaluated on 14 commercial farms in Central Europe in the 2020-21 season and the initial results showed the competitiveness of the population compared to established organic varieties (Fig. 1).
- Maintain the population and let it regrow each year to allow natural selection for your specific environment. You may weed out plants with undesirable traits, such as individuals that are too tall, before harvesting (i.e., negative selection). Over time, multiplication and (natural) selection of CCPs will increase their adaptation to local growing conditions.

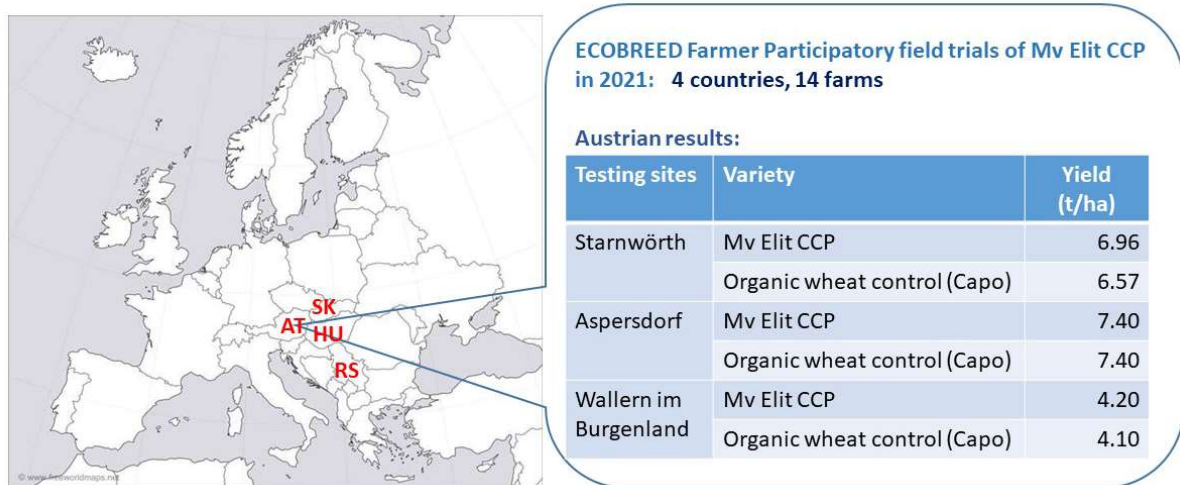


Fig. 1: ECOBREED trial network of Hungarian winter wheat population 'Mv Elit CCP' by Central European farmers in 2021 and exemplary results from Austria.

FURTHER INFORMATION

Ceccarelli S, Grando S (2020). Evolutionary plant breeding as a response to the complexity of climate change. *iScience* 23: 101815. doi: [10.1016/j.isci.2020.101815](https://doi.org/10.1016/j.isci.2020.101815)

Döring TF, Annicchiarico P, Clarke S, Haigh Z, Jones HE, Pearce H, Snape J, Zhang J, Wolfe MS (2016). Comparative analysis of performance and stability among composite cross populations, variety mixtures and pure lines of winter wheat in organic and conventional cropping systems. *Field Crops Research* 183: 235-245. doi: [10.1016/j.fcr.2015.08.009](https://doi.org/10.1016/j.fcr.2015.08.009)

EU Organic Seed Databases (including a complete list of weblinks to the National Organic Seed Databases): <https://www.liveseed.eu/tools-for-practitioners/eu-organic-seed-databases/>

Knapp S, Döring TF, Jones HE, Snape J, Wingen LU, Wolfe MS, Leverington-Waite M, Griffiths S (2020). Natural selection towards wild-type in composite cross populations of winter wheat. *Frontiers in Plant Science* 10: 1757. doi: [10.3389/fpls.2019.01757](https://doi.org/10.3389/fpls.2019.01757)

Suneson CA (1956). An evolutionary plant breeding method. *Agronomy Journal* 48: 188-191. doi: [10.2134/agronj1956.00021962004800040012x](https://doi.org/10.2134/agronj1956.00021962004800040012x)

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ECOBREED CONSORTIUM



ABOUT ECOBREED:

ECOBREED is a 5-year (2018-2023) project funded by European Union's Horizon 2020 research and innovation programme that will improve the availability of varieties and seed suitable for organic and low-input production. Activities will focus on four crop species i.e. wheat, potato, soybean and common buckwheat, selected for their potential contribution to increasing the competitiveness of the organic sector.

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