COBRA: a new European research project for organic plant breeding

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Implications

Development of organic plant breeding and seed production will have a valuable impact on organic plant production. Breeding of plant material adapted for organic agriculture is crucial in order to cope with stresses such as climate change, weeds and seed borne diseases. Conventional varieties may not meet the specific needs of organic agriculture. The use of plant material adapted to conditions of organic agriculture will have a positive effect on the productivity and sustainability of organic crop production.

Background and objectives

One of the obstacles to the successful development of organic farming systems is the lack of appropriate plant varieties that are adapted to conditions of organic agriculture (e.g. Wolfe et al. 2008). Plant breeding efforts for organic systems need to be better coordinated to address and resolve these issues. In addition, using plant material with higher genetic diversity has great potential in breeding for these systems. Higher levels of in-field diversity can be used to buffer against the relatively higher environmental variability in organic systems. Continued loss of genetic diversity in the agricultural landscape is of particular importance for organic agriculture, as this germplasm is often more suited for organic systems.

A new European research project called COBRA (Coordinating Organic plant Breeding Activities for Diversity) aims to unleash the potential of plant genetic diversity for organic agriculture by linking up efforts on both pure line breeding and High genetic Diversity (Hi-D) systems in cereals and grain legumes.

In conjunction with the need to breed specifically adapted pure line varieties for organic crop production, a complementary approach is the use of plant material with Hi-D e.g. as in Composite Cross Populations (CCPs) (Döring et al. 2011). Apart from buffering against environmental fluctuations and providing insurance in stressful environments, Hi-D-based approaches allow for evolutionary adaptation to organic farming conditions. However, despite the promising results Hi-D-based systems have shown under organic management, their benefits cannot be used at present due to agronomic, technical and regulatory hurdles. These constraints of Hi-D breeding approaches are shared with and linked to organic plant breeding in general.

Approach

The COBRA project is part of the CORE II program and is led by the Organic Research Centre (UK). It started in March 2013 and brings together 41 partner organizations from 18 countries. COBRA focuses on four major arable crops: wheat, barley, pea and faba bean. It will address five specific areas:

(1) Seed health;

Organic farming systems greatly rely on healthy and vital seed. Furthermore organic production systems only have access to a very limited amount of seed treatments for infected seed. The project will address both germination capacity, vitality of seed and seed borne diseases by improving diagnostic tools, coordinating (by creating a database

for seed borne diseases) and improving screening methods for seed borne diseases, improving resistance breeding methods in genetically diverse populations, and by developing methods for direct control of seed borne diseases with the use of essential oils.

(2) Response of crops to multiple stresses;

Organic agriculture is facing the challenges of multiple stresses such as weed control in a time of climate change. Climate change is predicted to cause increased climatic variability and more extreme weather events. One objective of the COBRA project is to study the potential of Composite Cross Populations and specific genotypes to adapt to such climatic fluctuations, to find determinants of early vigour and competitiveness to weeds, and to identify strategies for coping with multiple stressors.

(3) Improvements in breeding efficiency for organic systems;

In organic agriculture there are stronger interactions between genotypes and environment when compared to conventional agriculture. There is a need to exchange germplasm and introduce more material into the genepools available to breeders. In the COBRA network there will be extensive exchange of germplasm. The project also aims to develop and identify methods for improvement of Hi-D material, to improve adaptation of Hi-D material to conditions of organic farming and to further develop breeding methodologies for participatory plant breeding.

(4) Structural issues such as funding for breeding and the regulatory framework;

The European seed regulation is currently under revision, and the project will support the effort by member states and organic organisations to overcome legal hurdles and create legal space for plant material suited for organic cultivation within the seed regulations.

The area of certified organic agricultural land in the EU is increasing and this offers new possibilities for breeders to expand their breeding activities. It is important that breeders become aware of the changing situation. Different organization and financing models for organic plant breeding will be evaluated in order to propose sustainable financing models and possibilities for transnational cooperation.

(5) Networking and coordination.

Activities in organic plant breeding are still fragmented and transnational coordination of these activities is of great importance to ensure successful development. It is valuable to have this trans-European network in order to exchange breeding material, harmonize evaluation tests and not least to exchange experiences and results.

The project will have a public website, and there will be announcements for conferences, workshops, field days and other activities.

References

Döring TF, Knapp S, Kovacs G, Wolfe MS & Murphy K 2011. Evolutionary plant breeding in cereals – into a new era. Sustainability 3: 1944-1971.

Wolfe MS, Baresel JP, Desclaux D, Goldringer I, Hoad S, Kovacs G, Löschenberger F, Miedaner T, Østergård H, Lammerts van Bueren ET 2008. Developments in breeding cereals for organic agriculture. Euphytica 163: 323-346.