

Common Bunt Resistant Wheat Composite Cross Populations

Philipp Steffan¹, Anders Borgen², Gunter Backes¹ and Søren K. Rasmussen¹

¹ University of Copenhagen, Molecular Plant Breeding Group, Bülowsvej 17, 1870 Frederiksberg C, Denmark, Søren K. Rasmussen: skr@life.ku.dk; ² Agrológica, Houvej 55, DK-9550 Mariager

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Utilising diverse populations instead of single line varieties is expected to lead to a number of advantages in cereal production. These include reduced epidemics of plant diseases, improved weed competition and better exploitation of soil nutrients, resulting in improved yield stability. However, a number of challenges must be met before diverse wheat populations can be introduced into commercial wheat production: one of these is the development of breeding technologies based on mass selection which enable breeders and farmers to improve specific traits in populations and maintain diversity at the same time.

BIOBREED is a project started in Denmark in 2011 to meet these challenges for wheat population breeding. The project is focusing on the development of tools and methods for mass selection of traits relevant for organic and low input production, where it is expected that the highest benefits of utilizing diverse populations can be achieved. BIOBREED focuses on three main aspects of wheat population breeding for organic and low input production systems: **i)** common bunt (caused by *Tilletia caries*) resistance, **ii)** selection for improved protein content and **iii)** the influence on population diversity of different selection pathways.

Selection for common bunt resistance in wheat composite cross populations

33 crosses were made between 23 common bunt resistant winter wheat varieties in order to generate two populations. Progeny of all crosses was bulked in the F₃ to constitute the first population *Pop.No.Sel.* Prior to the creation of the second population *Pop.Sel.*, the F₃ of the parental crosses was sown as head-rows with common bunt infection. Only lines that showed resistance to common bunt were used to create *Pop.Sel.* in generation F₄. Afterwards the two populations were grown with and without inoculation with common bunt in order to i) select for bunt resistance and ii) to be able to compare the effect on diversity of this selection step. Preliminary results show a higher level of common bunt resistance in *Pop.Sel.* in the first year.

Single seed sorting for protein content

Prior to sowing the F₅ seed of the population *Pop.Sel.*, the seed were sorted individually for protein content using a *BoMill IQ Grain Quality Sorter 1002S*. The fraction of seeds containing the 10% highest and another fraction containing the 10% lowest protein content were selected. The four populations, *Pop.No.Sel.*, *Pop.Sel.*, and *Pop.Sel.high.Protein* and *Pop.Sel.low.Protein* and the parental lines were sown in a randomized complete block yield trial at two locations in Denmark in order to assess their yield and quality parameters such as protein content and baking quality of the parents and there derived populations. Results are expected in the summer 2013.

Diversity of wheat composite cross populations

The practical question of “how much diversity is needed in populations?” has not been answered yet. BIOBREED will aim to to quantify the levels of diversity in wheat composite cross populations after the different selection steps i) cultivation with and without common bunt inoculum, and ii) sorting for single protein content. In a first attempt SSR markers will be used to describe the influence these different selection pathways will have on the population diversity. 90 SSR markers—about two markers per chromosome arm—will be used to describe the initial genetic diversity of the 23 parental lines. F₆ seed of the different populations will be analysed with the same markers and population diversity after different selection pathways will be quantified.

References:

BoMill Grain Sorter: http://bomill.com/BoMill_We_Add_Value_to_Your_Grain/Products.html

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