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Progress in Predictive Breeding in Oilseed Rape: A Path to Heterotic Pools and Beyond

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The vigour of hybrids, or heterosis, is important for improving the yield performance of outcrossing crops. In oilseed rape (Brassica napus L.), hybrids today make up the major share of the global seed market. However, in comparison to other important hybrid crops oilseed rape shows relatively low levels of yield heterosis. Therefore, a better exploitation of heterosis for the improvement of hybrid performance would be highly beneficial for the breeding of oilseed rape.

The effectiveness of breeding strategies to increase heterosis in hybrid oilseed rape could be improved, if complexities associated with the genome structure could be captured in realistic gene-to-phenotype predictive models and represented in a quantitative manner useful for selection. Several new techniques including the Brassica 60K or 15K SNP Illumina arrays and Whole Genome Sequencing are now available and are used to investigate genome-scale diversity present in any oilseed rape germplasm. When linked to precise hybrid phenotypes and using appropriate statistical models for prediction of hybrid performance, it is now possible to predict hybrid vigour based on the parental genome profiles.

In the present study we will discuss how these new techniques could help to predict hybrid performance in oilseed rape and how to increase heterosis by associating genetic diversity into heterotic pools.