

The best parents: Genetically as divergent as possible with similar preferences

Gatersleben, 12.06.2020 The more diverse in genetics, than better. But only in cases of similar preferences. A team of researchers led by IPK Gatersleben has succeeded in providing answers to a long unsolved question in the breeding of plant hybrids.

It has shown that hybrids become more and more productive depending on the genetic distance between their parents. The question of whether there is an optimal genetic distance could definitely be answered negatively. Assuming that the parents are adapted to similar environments. This research result can be read in the next issue of the scientific journal "Science Advances".

For decades plant breeding has made use of the heterosis phenomenon: parents genetically as different as possible are crossed to produce offspring performing better than their parents on average. The so-called hybrid breeding is applied very successfully for maize, sugar beet, rye or sunflower. The maximum genetic distance between the parents to generate the best hybrid performance could not be clarified until now. Two studies in the 1960s came up with contradictory results. While one suggested that the genetic distance of the parents should be maximised, the other suggested that the increased performance of the offspring decreases again from a certain point of diversity.

"Thanks to progress in quantitative genetics, we were able to show that there is no optimum for the genetic distance of the parents," explains Prof. Dr. Jochen Reif. He heads the Department of Breeding Research at the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) and the affiliated Quantitative Genetics research group there. As the scientific coordinator of the research task, he knows: "Heterosis increases steadily with the genetic distance between the parents. Parent populations can be as far apart as possible without their offspring losing performance." This is a decisive finding for plant breeding, since it is no longer necessary to fear that the optimal genetic distance has been missed. However, it is important to be careful when it comes to the origin of the parent populations. The geneticist explains: "Parent populations must be adapted to the environment in which their offspring are to be cultivated, otherwise negative dominance effects can occur."

The team led by IPK Gatersleben was able to come to these results as part of a large-scale research cooperation project called ZUCHTWERT. It was funded by the Federal Ministry of Food and Agriculture and carried out by IPK Gatersleben, the State Plant Breeding Institute (Landessaatzuchtanstalt - LSA) at the University of Hohenheim and 15 well-known plant breeding companies. "Thanks to our latest developments in biometry and quantitative genetics, coupled with the extensive data material from the breeding industry, we were finally able to bring clarity to this long-standing issue," summarises Prof. Dr. Jochen Reif, adding: "In future, plant breeding will be able to select crossing partners on a rational basis for breeding new hybrid varieties, even for an organism as complex as wheat.



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Figures (for free use):

<https://ipk-cloud.ipk-gatersleben.de/s/5FqFCJ7TF9DhrWo>



Comparison of the hybrid (middle) with its two parent lines (right and left).



Evaluation of heterosis for grain yield in field trial. Photos: Norman Philipp/ IPK