

When genes get crossed



Scientists at Nunhems, the vegetable seed business of Bayer CropScience, are searching for the genes responsible for traits like storage life and disease resistance in tomatoes, cucumbers, peppers and other vegetables. The company combines expertise from different disciplines to ensure an integrated breeding approach to optimize crops and speed up the breeding of new, high-yielding, flavorful vegetable varieties.

Red, yellow, green, purple: nature provides us with food in all the colors of the rainbow. What's more, the variety of vegetables is as great as their dietary value. Apart from essential vitamins, minerals and fiber, vegetables contain numerous substances that can protect the body against disease. They are said to prevent harmful oxidation of human cell membranes, reduce cholesterol and inhibit blood coagulation.

But none of the vegetables we enjoy so much today would exist without human intervention. They all are the result of breeding, a process of crossing and selection, frequently span-

ning decades, which requires special skills of breeders and pre-breeders. Scientists at Nunhems, Bayer CropScience's vegetable seed business, are applying a concept that not only greatly accelerates this process, but also makes it considerably more effective. "With the help of integrated breeding, we can screen thousands of plants and select those with the targeted traits, without having to repeatedly grow and cross-breed them," says Roger Muren, Head of Cell Biology at the Nunhems breeding center in Brooks, Oregon. "We save years of development work, and we can more specifically address



Title story

Safe harvests – worldwide

the needs of farmers and consumers when breeding new, improved varieties."

Nunhems today already has grown to become one of the world's leading vegetable seed suppliers. With its portfolio of 28 species and some 2,500 varieties, it is one of the most innovative businesses in the industry. The vegetable experts have the rapid progress in biotechnology to thank more than anything else for the new breeding concept. "Over the last 20 years, biotechnology has undergone massive expansion in terms of the range of methods available to scientists," explains Muren. For example, modern sequencing techniques enable researchers for the first time to identify individual genes responsible for specific traits in vegetable varieties, such as disease resistance, fruit color, or sugar content.

Using molecular markers to deactivate undesired traits

By identifying and carefully observing DNA fragments, known in the technical jargon as "molecular markers", Bayer CropScience researchers look for desired traits in young seedlings even before visual selection. They can then screen the progeny from the cross to determine whether or not the target gene has been introduced. As an example, through this method, genetic information from wild plants lost from years of breeding can be reintroduced into today's crops, or specific genes for undesirable traits such as bitterness or pungency can be eliminated.

"When developing a new variety of vegetable, a breeder previously had to juggle any number of factors, from pest resistance and seed yield to the selection and crossing of the

respective plants," explains Muren. "Today we have different specialists who can manage the complex technologies and special requirements much more successfully." At Nunhems, geneticists, plant disease specialists, molecular and cell biologists, bioinformatics experts and seed technologists are integrated in the interdisciplinary research process right from the outset.

With integrated breeding, Bayer researchers recently solved a global problem in vegetable farming: the spread of tomato viruses. These pathogens repeatedly attack plantations in Mexico, Brazil, Spain and India, frequently destroying entire crops in one blow. Using specific markers, Nunhems succeeded in breeding seed lines that carry a natural resistance to tomato viruses in their genes. Farmers who use the new seed are protected against losing their crop to these "cell pirates".

"If we can supply more people with high-quality, good-tasting fruit and vegetables that would be a great achievement – for the health of the global population," says Muren.

 www.fao.org
The homepage of the Food and Agriculture Organization of the United Nations features extensive information on the topic of "marker-assisted breeding".

Vegetable experts: Jorge Marin Ruiz (large photo) harvests tomatoes grown from seeds which Nunhems researchers modified to give them a natural resistance to tomato viruses. Corrie Tulmans, Roger Muren, Paul Bouten and Ailton Riberio (center photo, left to right) are using molecular biology to optimize cucumber seeds (right) as well.

