Better genes for tricky plants

Plant breeders are increasing their understanding of the genetically most complex crops. Good news for chrysanthemum growers, for instance, whose flowers are being sold increasingly further afield. With the right genes, the chrysanthemums will still look fresh even after a long journey to far-off countries.

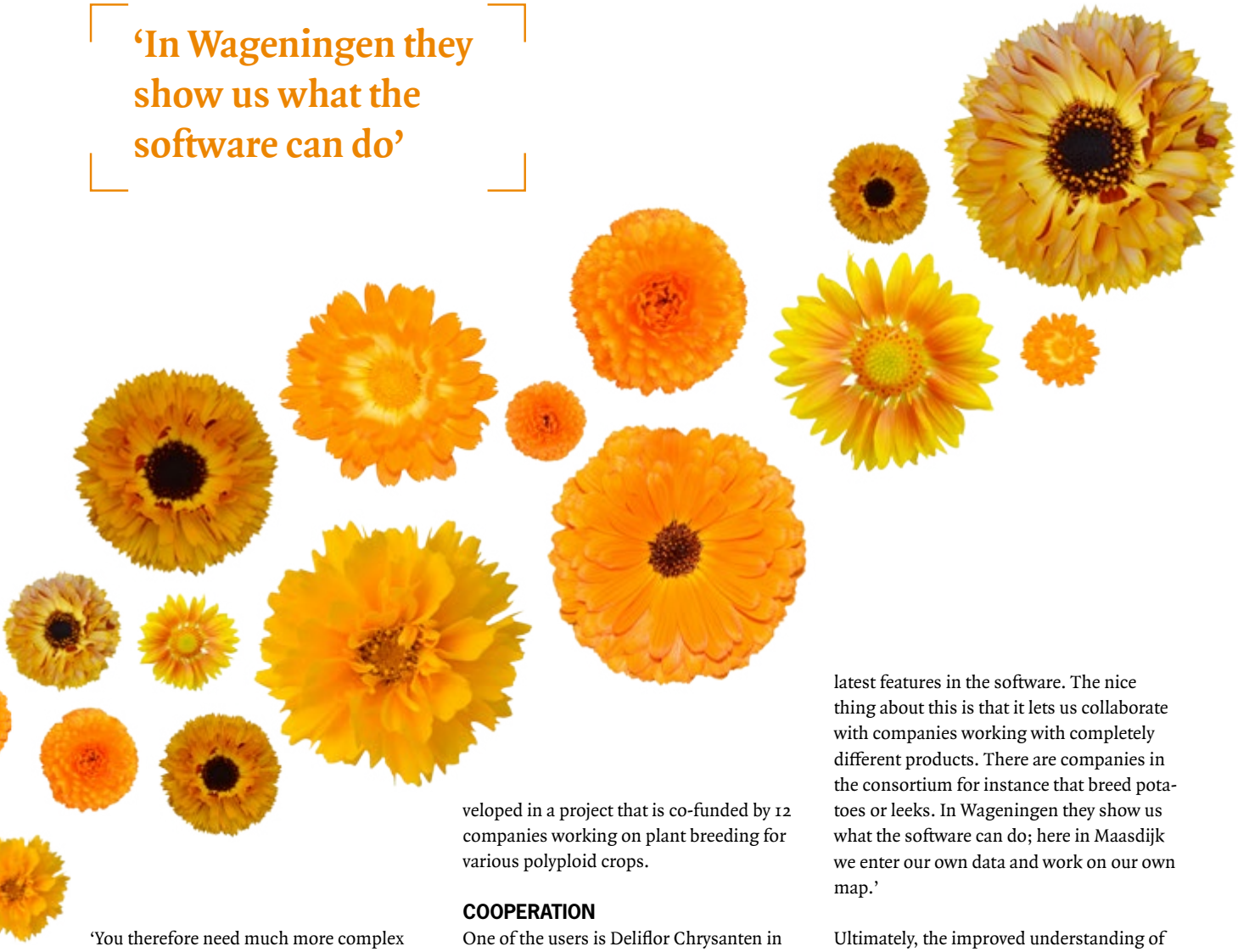
TEXT KORNÉ VERSLUIS **PHOTO** SHUTTERSTOCK

It was fortunate that Gregor Mendel, the 19th-century father of genetics, chose the pea as his preferred plant for his genetic experiments. If he had gone for a rose or chrysanthemum, he would never have discovered the laws of inheritance. For the pea, like mammals, has two copies of each chromosome in every cell (it is a diploid), one from the father and one from the mother. But other plants have more (they are polyploid). The rose, for example, has four copies of each chromosome, while six are standard in chrysanthemums. That makes genetic research more complicated.

LEAVING TRACES

One of the methods that has been used for decades in genetic research in diploid crops is to establish the frequency with which genes are exchanged. By closely examining the results of a cross, geneticists can determine whether genes are located close together or not. But it is much more difficult to obtain that information when plants have more than two copies of each chromosome.

‘In Wageningen they show us what the software can do’



‘You therefore need much more complex calculation methods and more powerful computers to create gene maps,’ explains Chris Maliepaard, a Plant Breeding researcher at Wageningen University & Research. Early this year, Maliepaard and colleagues published a detailed genetic map of the rose. The modern cultivated rose is the result of crosses between various species of wild rose and that pedigree has left traces in how the chromosomes behave, he says. For instance, some chromosomes still want nothing to do with chromosomes that arrived via distant relatives in the past. That means they exchange genes less often when forming the female sex cells and the pollen. ‘We discovered that most chromosomes have no clear preference when forming sets, but one of the chromosomes does.’

To produce the genetic map of the rose, he used software that he and his colleagues developed in a project that is co-funded by 12 companies working on plant breeding for various polyploid crops.

COOPERATION

One of the users is Deliflor Chrysanten in Maasdijk, the largest chrysanthemum breeding company in the world. For a long time breeding ornamental flowers was a craft, says Aike Post, the company’s manager for Breeding. That is not just because of the complex genetics. ‘The most important aspect by far is the aesthetics: do you get an attractive flower?’ An expert eye and a feeling for the market were more important than genes and DNA tests. But that is changing. Post: ‘In the past Dutch growers sold their flowers in Germany and Britain but Eastern Europe is now becoming more and more important. As a result the flowers have to meet increasingly tough demands in terms of shelf life.’

Deliflor is working on a map of the chrysanthemum genome. The company is using the software developed by Maliepaard. Post: ‘We get a workshop once or twice a year on the latest features in the software. The nice thing about this is that it lets us collaborate with companies working with completely different products. There are companies in the consortium for instance that breed potatoes or leeks. In Wageningen they show us what the software can do; here in Maasdijk we enter our own data and work on our own map.’

Ultimately, the improved understanding of the genome should make it possible to use selection methods that are already being used for diploid crops. Seedlings will then automatically be selected for their promising properties. Deliflor already does that to determine whether plants are resistant to the pathogen *Fusarium*. ‘That’s a simple property. One dominant gene is enough to make a plant resistant.’ In the future, Post also wants to be able to target more complex properties, such as colour, flower shape and post-harvest quality. The Wageningen PhD candidate Geert van Geest, for example, is doing research at Deliflor on the discoloration of the heart of the chrysanthemum flower. ‘We want our flowers still to look good even after they’ve been transported to Vladivostok,’ says Post. ■

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