Dossier
Breeding methods

Plantum

No unnecessary regulation of new breeding methods

Society is placing ever-higher demands on crops for food and ornamental plants. Yield levels must be increased in order to keep up with world population growth, yet at the same time another challenge is to reduce the use of crop protection chemicals. Furthermore, modern-day crops must be able to cope with the changing climate, the emergence of new diseases and pests, and the introduction of innovative, sustainable production methods, while continuing to produce healthy products. In order to meet all these needs, plant researchers are continuously developing more efficient breeding methods, and the advancements have really gathered pace over the past 15 years. Nowadays, breeding companies can quickly and precisely develop new plant varieties adapted to changing circumstances, and the methods they use are just as safe as conventional breeding methods.

Plantum believes that these new plant breeding methods must remain free of unnecessary regulatory pressure to enable them to become widely available.

People have been cross-breeding and selecting plants to improve plant traits for centuries. Thanks to today's deeper understanding of plant genetics, these improvements can be made faster and more precisely than ever before. Cisgenesis is a good example of this. In potatoes, for example, resistance genes from one potato variety, such as a wild species, are directly placed into the DNA of a different potato variety, such as a high-yielding type. This results in a productive and resistant potato variety that could also have been developed by conventional breeding methods (cross-breeding and selection). However, that would have taken decades longer, during which breeders would have had to spend a lot of time breeding out undesirable traits.

One important difference between cisgenesis and genetic modification (transgenesis) is that cisgenesis stays within type boundaries. Cisgenesis enables the development of a new potato variety to be shortened from 30 years to just a few years. Cisgenesis was used by Dutch researchers back in 2007 to make potatoes resistant to blight; this advancement has the potential to substantially reduce the use of crop protection agents.

CRISPR-Cas9

There has recently been a lot of media coverage of CRISPR-Cas9, a new breeding method which enables a trait to be altered with more precision than ever before. This is done using a protein modifier (Cas9), which can alter one or more genes at a desired location in the DNA. A laboratory working with CRISPR-Cas9 can introduce a new trait, such as a resistance against a bacterial disease or virus, into an existing variety within just a couple of months.

Genetic modification, yes or no?

Since 2007, the European Commission has been investigating whether this, along with a number of other new plant breeding methods (see box), should be governed by the legislation for genetic modification (legal framework for GMOs). So far, no decision has been reached. According to a legal study by the New Breeding Technologies platform, these new breeding methods do not fall under the GMO legislation. The key reasons for this are:

- The new method is comparable with another method for which it has been decided that it does not fall under the GMO legislation;
- The plants resulting from the new method do not have foreign DNA.

If it is decided that the new breeding methods do fall under the GMO legislation, the application of these new methods will involve extremely costly and time-consuming procedures because genetically modified varieties must undergo a wide range of safety tests. Only the biggest companies in the industry can afford to pay these costs. Furthermore, the costs can only be recouped in the case of commodity crops such as corn and soybeans. After all the safety testing, all EU member states must then decide whether to actually approve cultivation of the crop, and that process can often take several more years.

Mutation is nothing new

The mutation (alteration) of plant DNA is a natural, ongoing process; it creates huge diversity. Having looked to Mother Nature for guidance, breeders have been using chemicals and radiation to stimulate mutations for over 80 years. Targeted mutation such as with CRISPR-Cas9 is no less safe than these conventional mutation methods, according to the conclusions of the Dutch advisory commission Cogem and the agricultural ministries of Sweden and Germany. Furthermore, a panel of academic advisors to the European Commission expect that targeted mutations are likely to have fewer unpredicted effects than the more established and fully accepted mutation methods.

Need for quick decision-making

Targeted mutation, provided that species barriers are not crossed should, according to the Dutch government, not be regulated as GMO. However, until the European Commission has reached a decision, the new plant breeding methods will continue to fall under the GMO legislation.

Plantum is therefore lobbying for a quick and clear decision. As long as the new methods fall under the GMO legislation, companies based in the Netherlands will not invest in them which puts their strong position in the global market at risk. Various non-European countries have already approved cisgenesis and varieties developed using CRISPR-Cas9.

New plant breeding methods that do not result in foreign DNA in the end product are:

- CRISPR-Cas9 targeted mutation: one or more DNA nucleic acids are targeted and altered
- ODM and zinc finger nuclease technology: similar to CRISPR-Cas9, but less efficient
- Cisgenesis: a gene from one variety is directly introduced into the DNA of a different variety (of the same crop type)
- Grafting: a non-genetically modified plant is grafted onto a genetically modified rootstock
- Agro-infiltration: a GMO technique is used to select plants rather than to alter them
- RNA-dependent DNA-methylation: genes are silenced with the polymeric molecule RNA
- Reverse breeding: a technique for selecting parent plants from a hybrid.

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Plantum is the Dutch association of companies that produce and trade plant reproductive material. The companies are active in plant breeding, propagation, cultivation and trade of seeds, bulbs, tubers, cuttings and young plants of agricultural and horticultural crops.