Tougher climate-resistant crops

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Might it be possible to make better plants more quickly than we do today? And without the public objection that accompanies genetic manipulation? Climate change means that this is now an urgent question. The EU funded ABSTRESS project is intended to address it. "Climate change means that we don't know whether next year's harvest will be affected by floods or by drought. So we need more resilient crops," project coordinator Adrian Charlton tells youris.com, referring to the need to reduce EU's dependency on imports.

Charlton, who is also team leader for chemical and biochemical profiling at the Food and Environment Research Agency, based in York, UK, adds: "the aim of this project is to respond to climate change by telescoping the plant breeding cycle, from perhaps 8-10 years to the five years of this project from 2012 to 201." Faster breeding is much needed, experts agree. "Plant breeders agree that climate change is real. So if it takes 12-15 years to breed a new type, the environment it will be used in will not be today's environment. Water and heat stress are among the most important changes. A crop that grows well in an area today is unlikely to do as well in the same place in 2050," explains Walter de Jong, associate professor of plant breeding and genetics at Cornell University in the US.

But testing is the main reason why plant breeding takes so long, he believes. "You need to see how plants cope in a variety of environments and seasons," de Jong tells youris.com, "and that is even more of a problem when the environment is a moving target." He adds that there have been many attempts over the past 50 years to speed things up, but improvements so far have been marginal.

To achieve its aim, the project is looking at legumes, a key group of crops such as peas that take nitrogen from the atmosphere and add it to the soil. Growing them reduces the need for nitrogenous fertilisers. "Reduced legume growing in the EU means that it now imports up to 90% of the protein it used in animal feed, in the form of soya. If we can get tougher legumes, we can cut that bill." As an example, he says that if peas plants were tougher, more peas would be grown in Europe as they will not be damaged by the rain. Sheep and cattle find them even tastier than imported soya.

The plan, says Charlton, is to subject a standard experimental plant, called barrel clover, or Medicago truncatula, to a "challenge experiment" in which it is exposed to bugs— so-called biotic challenges—and to abiotic ones such as drought. The project scientists will then find out which genes the plant has turned on to help it survive, and in particular the "hub" genes that control the activity of the others. "This method does not involve transplanting genes from one species to another, but it does use modern genetic technology and IT to speed up conventional plant breeding," Charlton says, "So it should not raise the public fears and objections that genetic manipulation does."

Charlton explains that the same hub genes are found across plant species, with only minor variation, because of the plants' common evolutionary history. So this knowledge will allow other legume species such as peas and beans to be improved by selecting for the same genes. Then improved seeds from these species will be tested in field trials and crossed into commercial varieties of plant for commercial use. In the longer term, less closely-related crops such as tomatoes and wheat could also benefit.

De Jong recognises the cutting edge approach of this project. "Nobody else has ever tried to improve these important plant traits on this scale," he tells youris.com. But he is sceptical about the speed at which any results will appear in the marketplace in the form of hardier crops. He points out that improving "the actual crops we eat" remains a stubbornly slow process. "The fundamental science community always underestimates how long it takes for new discoveries to be applied, because they don't understand the hurdles to bringing their ideas to fruition," he adds. He also says that the science has got a lot faster because of new genetic approaches, but the process of implementing discoveries has not.

Other observers agree that the priorities of the project are the right ones. "Drought in particular is going to be a growing issue in parts of Europe," says John Spink, department head at Teagasc, the Irish agriculture and food development authority located near Carlow in Ireland. He says that it can take 50 years to transfer a gene for some desirable property such as insect resistance into a crop from the wild. While genetic manipulation is far faster, it also involves later stages of testing and verification. "[Genetic analysis] removes the need to grow many generations of the crop and can reduce development time by 60-70%," he notes.

But Spink warns that even if a new seed is found with good properties, there are still big hurdles to jump. The real difficulty, he says, is getting from the laboratory to the marketplace, which involves testing the new variety and building up stocks of seeds for sale.

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