Plants cloned as seeds

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Plants have for the first time been cloned as seeds. The research by aUC Davis plant scientists and their international collaborators, published Feb. 18 in the journal *Science*, is a major step towards making hybrid crop plants that can retain favorable traits from generation to generation.

Most successful crop varieties are hybrids, said Simon Chan, assistant professor of plant biology at UC Davis and an author of the paper. But when hybrids go through sexual reproduction, their traits, such as fruit size or frost resistance, get scrambled and may be lost.

"We're trying to make a hybrid that breeds true," Chan said, so that plants grown from the seed would be genetically identical to one parent.

Some plants, especially fruit trees, can be cloned from cuttings, but this approach is impractical for most crops. Other plants, especially weeds such as hawkweed and dandelions, can produce true seeds that are clones of themselves without sexual reproduction -- a still poorly understood process called apomixis.

The new discovery gets to the same result as apomixis, although by a different route, Chan said.

Normally, eggs and sperm are haploid -- they have half the number of chromosomes of the parent. The fertilized egg and the adult plant it grows into are diploid -- containing a full complement of chromosomes, half contributed by each parent.

Chan and his colleagues focused their work on the laboratory plant Arabidopsis, which has certain genetic mutations that allow it to produce diploid eggs without sexual recombination. These eggs have the same genes and number of chromosomes as their parents. But those eggs cannot be grown into adult plants without fertilization by sperm, which adds another parent's set of chromosomes.

Last year, Chan and UC Davis postdoctoral researcher Maruthachalam Ravi showed that they could breed haploid Arabidopsis plants that carried chromosomes from only one parent. They introduced a genetic change so that after the eggs were fertilized, the chromosomes from one of the parents were eliminated. Such haploid plants would reduce the time needed to breed new varieties.

In the new study, Chan's lab, with colleagues from India and France, crossed these Arabidopsis plants programmed to eliminate a parent's genes with either of two mutants that can produce diploid eggs.

The result? In about one-third of the seeds produced, the diploid eggs were successfully fertilized, then the chromosomes from one parent were eliminated, leaving a diploid seed that was a clone of one of its parents.

Ravi described the result as a step on the way towards artificial apomixis. The team hopes to produce crop plants, such as lettuce and tomato, that can fertilize themselves and produce clonal seeds. Applications for provisional patents on the work have been filed.

Provided by University of California - Davis

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