Haploid Plants through Seeds

Tech ID: 19877 / UC Case 2010-030-0

ABSTRACT

Researchers at the University of California Davis have developed a novel method to produce haploid plants through seeds. This method induces genome elimination (from one parent in a cross) with a precise mutation, rather than by culturing haploid cells or by crossing distantly related plants.

FULL DESCRIPTION

Plant breeding relies on screening numerous plants to identify novel, desirable characteristics.Very large numbers of progeny from crosses often must be grown and evaluated over several years in order to select one or a few plants with a desired combination of traits.

Standard breeding of diploid plants often requires screening and back-crossing of a large number of plants to achieve the desired genotype. One solution to the problem of screening large numbers of progeny has been to produce haploid plants, the chromosomes of which can be doubled using colchicine or other means to achieve instantly homozygous, doubled-haploid plants.

With doubled haploid production systems, homozygosity is achieved in one generation. Thus, the breeder can eliminate the numerous cycles of inbreeding necessary to achieve practical levels of homzygosity using conventional methods. Indeed, true homozygosity for all traits is not achievable by conventional breeding methods.

Existing methods of generating haploid plants have numerous disadvantages. Culturing of haploid cells is expensive and laborious, and some species have proven recalcitrant to this technique. Crossing to a distantly related species (wide crosses) causes genome elimination in only a small number of species, and almost always requires embryo rescue *in vitro* to generate viable plants. Haploid-inducing lines in maize are genetically complex and yield haploids at low efficiency. All current methods may be extremely dependent on genotype. UC Davis researchers have developed a method of inducing haploids in a cross between plants of the same genotype which is based on exploitation of a universal feature of eukaryote chromosomes and which yields haploid plants from seeds.

APPLICATIONS

- Haploid inducers that may be generated via transgenic or non-transgenic methods
- Doubled haploid plants that do not bear transgenic or mutagenized genes
- Doubled haploid plants can rapidly create homozygous F2s from a hybrid F1
- Haploid plants are very useful for genomics because they contain only one version of each gene
- The method can transfer paternal chromosomes into maternal cytoplasm (it can create cytoplasmic male sterile lines with a desired genotype in a single step)

FEATURES/BENEFITS

- Genome elimination can be engineered with a precise molecular change that is not dependent on parental genotype
- The gene that is manipulated is found in all eukaryotes and serves a universal function
- Haploid plants can be made in species where conventional methods, such as tissue culture of haploid cells and wide crosses, are typically unsuccessful
- No tissue culture is required
- Haploids are produced through seed by simple genetic crosses
- Greatly reduced cost and labor required for haploid plant production
- Process accessible to breeders lacking specialized expertise in culturing haploid cells
- Plants from exactly the same cultivar can be crossed to eliminate one parental genome using a precise genetic change
- Simplifies synchronizing flowering time and readiness to cross (relative to the wide cross method of haploid production)
- Yields haploid plants much more efficiently than current wide crossing protocols, or existing haploid inducers in maize

CONTACT

Eugene Sisman
esisman@ucdavis.edu
tel: 530-754-7650.

INVENTORS

- Chan, Simon R.
- Maruthachalam, Ravi

OTHER INFORMATION

KEYWORDS

haploid, plant, cultivar, breeding, transgenic, non-transgenic

CATEGORIZED AS

- **Agriculture & Animal Science**
  - Plant Traits
  - Transgenics
- **Biotechnology**
  - Food
  - Industrial/ Energy
- **Research Tools**
  - Other

RELATED CASES

2010-030-0

▶ Apart from haploid-inducing lines in maize, this is the only known method of producing haploid plants in which paternal chromosomes are transferred into maternal cytoplasm, generating cytoplasmic male sterile lines with a desired genotype in a single step

RELATED MATERIALS

▶ Ravi M, Chan SW. 2010. Haploid plants produced by centromere-mediated genome elimination. Nature. 464(7288):615-8. - 03/25/2010

▶ Copenhaver GP, and Preuss D. 2010. Haploidy with histones. Nature Biotechnology. 28:423-424. doi:10.1038/nbt0510-423

PATENT STATUS

Country	Type	Number	Dated	Case
European Patent Office	Issued Patent	3560951	02/14/2024	2010-030
Canada	Issued Patent	2774941	10/04/2022	2010-030
India	Issued Patent	331366	02/05/2020	2010-030
Germany	Issued Patent	2486135	01/08/2020	2010-030
European Patent Office	Issued Patent	2486135	01/08/2020	2010-030
Spain	Issued Patent	2486135	01/08/2020	2010-030
France	Issued Patent	2486135	01/08/2020	2010-030
United Kingdom	Issued Patent	2486135	01/08/2020	2010-030
Netherlands (Holland)	Issued Patent	2486135	01/08/2020	2010-030
United States Of America	Issued Patent	10,306,848	06/04/2019	2010-030
Chile	Issued Patent	55896	02/01/2018	2010-030
Mexico	Issued Patent	349747	08/09/2017	2010-030
Australia	Issued Patent	2015200432	07/28/2017	2010-030
Mexico	Issued Patent	339939	06/17/2016	2010-030
United States Of America	Issued Patent	9,215,849	12/22/2015	2010-030
Russian Federation	Issued Patent	2571927	11/27/2015	2010-030
Mexico	Issued Patent	330546	06/05/2015	2010-030
Australia	Issued Patent	2010303635	02/12/2015	2010-030
United States Of America	Issued Patent	8,618,354	12/31/2013	2010-030
United States Of America	Published Application	20190343060	11/14/2019	2010-030
Canada	Published Application	3175800	04/14/2011	2010-030

Additional Patent Pending

PATENT INFORMATION

Issued U.S. Patent No. 8,618,354

Published U.S. Patent Application (Continuation) No. 14/088,065

International Patent Applications

University of California, Davis
Technology Transfer Office
1850 Research Park Drive, Suite 100, ,
Davis,CA 95618

Tel: 530.754.8649
techtransfer@ucdavis.edu
https://research.ucdavis.edu/technology-transfer/
Fax: 530.754.7620