Double Haploid Technology

On the way to variety approval or efficient production of hybrid varieties, the use of double-haploid (DH) plants is a valuable shortcut and quality-enhancing breeding element. Phytowelt offers DH production for various cereals, oilseeds and vegetables as a standard service. For varieties and species for which no DH protocols are available yet, we are happy to have new protocols developed by our experienced scientists upon customer request.

Figure 1 Ripening ear of a double-haploid winter onion plant

What are DH plants?

The degree of ploidy of a cell describes the number of chromosome sets. Plant gametes, the male spores and the female ovules, have only one set of chromosomes - they are haploid. During pollination, male and female gametes fuse and in most plants a diploid cell develops which carries both sets of chromosomes of the parent plants. In these cells, many genes are now present in two different versions, they are heterozygous. As a result, many genes are not expressed and are not passed on to all further offspring. In order to achieve 100% homozygosity and 100% inheritance of all genes, DH technology tries to regenerate plants from gametes. Since a haploid plant is sterile and usually only weakly growing, a doubling of the haploid chromosome set of the gametes is induced in plant tissue culture - a fertile double-haploid plant can thus be regenerated. The doubling of the haploid chromosome set is comparable to a "copy-paste function", all gene loci are now homozygous and the customer receives a pure homozygous plant, which can also be called a pure inbred line.

The key is our experience

Reliable production of the desired number of DH plants is influenced by many variables. It starts with the cultivation of the donor plants under controlled conditions, immature buds/ears must be harvested at the right time to isolate the male gametes at the right stage of development. This can happen in the form of the stamens (anthe-ren) or a pollen precursor, the microspore. Now the harvested material is treated in our laboratories under sterile conditions on different growth media, the doubling of the haploid chromosome set is induced and young plants are regenerated in our culture rooms. DH plants are selected using a method called flow cytometry (DFLC) and transferred to our customers.
We have optimised this process from year to year and have been able to overcome complex hurdles in chromosome doubling and seedling regeneration, especially due to our broad experience in plant tissue culture.

What are the advantages of DH plants?

The phenotypic stability of a DH line is its greatest added value. Due to 100% homozygosity, all traits of a DH line are inherited by offspring and the desired phenotype remains stable in subsequent generations. This means that DH lines can be submitted immediately for variety approval and the plant breeder is spared the work of several years for time-consuming backcrossing. Furthermore, DH lines are the perfect parent lines for the production of hybrid varieties. Due to the perfect inbreeding in these lines, homogeneous hybrid seeds can be produced and the yield gain of the hybrid varieties

through the heterosis effect can be maximised and is well predictable for the breeder.

Figure 2: Double-haploid winter barley regenerated from anthers in tissue culture

Reliable DH production to order

At Phytowelt we have established a reliable production platform for the most important cereal species. On request, we can produce tested DH lines from your winter wheat or winter barley lines. Even for triticale, a cereal that is difficult to grow in tissue culture, we have developed a reliable DH protocol thanks to our more than twenty years of experience. We also offer our customers this service for rapeseed.

You think there is no protocol?
We say "Not yet!"

There is no DH protocol for your plant species yet, but the advantages of DH lines would also bring great benefits to your breeding project? Please contact us. As a contract researcher, the development of new protocols is part of our core business. We have already successfully developed efficient DH protocols for customers in vegetable and medicinal plant breeding. Such protocols can be exclusively purchased or licensed from us. As with our standard platforms, after the development of a protocol, contract production is of course also an option at Phytowelt.

After having successfully worked with over 40 plant species and many varieties in our tissue culture department, we are more than confident to establish or develop an efficient protocol for your needs as well.

Are you interested in our services? Please contact us. We are happy to answer your questions!

Contact

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