Grafting using GM plants

'The better half'

Plant cells have a great capacity for regeneration and growth, as any gardener multiplying plants through cuttings is well aware of. Even more remarkable is the possibility to fuse the parts from two separate plants to create a new, chimeric plant. Commonly used in fruit orchards, the technique called *grafting* exploits this phenomena to join the scion, or above-ground part, of one plant and attach it to the rootstock of another plant. The resulting chimeric plant takes advantage of the best of two different cultivars. It is thereby possible to use for instance a transgenic rootstock with improved rooting ability but leaving the edible fruits without the slightest trace of a transgene.

Benefits

Grafting makes it possible to combine the excellent rooting properties of one cultivar with the desired above-ground traits of another. This will greatly improve the vegetative propagation of elite cultivars as many scions may be difficult and slow to root by themselves. Many fruit trees also have a painstakingly long juvenile phase, but grafting can shorten the time to reproduction and harvest. Similarly, new hybrids from breeding programmes can be raised more rapidly this way. An alternative to breeding for disease resistance and stress tolerance is also to combine selected rootstocks and scions for a resistant and hardy plant. To increase the harvest, the desired scions are often grafted onto the rootstocks of dwarf cultivars that yield more fruit per unit of area.

Scientific description

Grafting is a horticultural technique that has been used for millenia. Common in fruit trees, parts from one plant are attached to those of another plant so that the two sets of vascular tissues join to produce a chimeric plant. In most cases one plant is selected for its rooting ability – providing the rootstock – whereas the other plant will have desirable traits for the above-ground parts – providing the scion. The scion is most often a branch or a twig, but in the case of for example roses and peach, buds can also be used. The most common method is the so called cleft grafting, where a small cut is made in the stalk of the rootstock and the pointed end of the scion is inserted. Tape is used to hold the scion in place and grafting wax is applied to prevent the cambium layers from drying as well as a protection against infections. Whip grafting is also common, with a "z" shape of the cut to add strength.

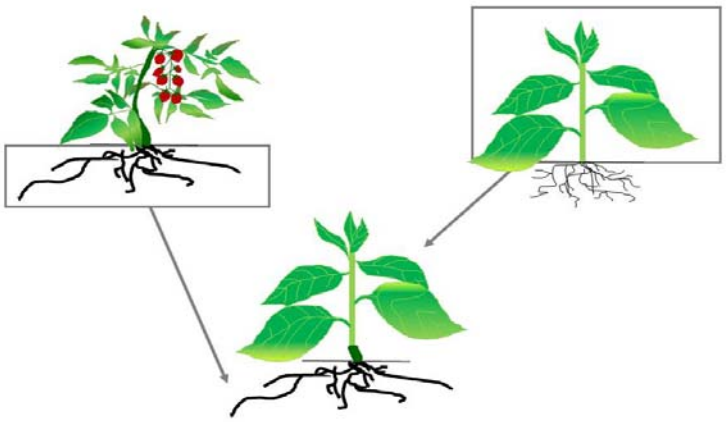

Image: Helga Schinkel, Fraunhofer Institute

Applications

Most commonly used in woody fruit trees such as apple, cherry, plum and orange tree, and also grapevine, grafting is also applied in non-woody, herbaceous plants such as tomato, potato, cucumber, eggplant and watermelon. Field trials in the EU have been carried out with GM rootstocks of apple and pear for improved rooting ability, grapevine with virus resistance, as well as orange tree with dwarf phenotype and fungal disease resistance. In the breeding pipeline are also GM rootstocks of walnut resistant to bacteria, fungi, virus and nematode.

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