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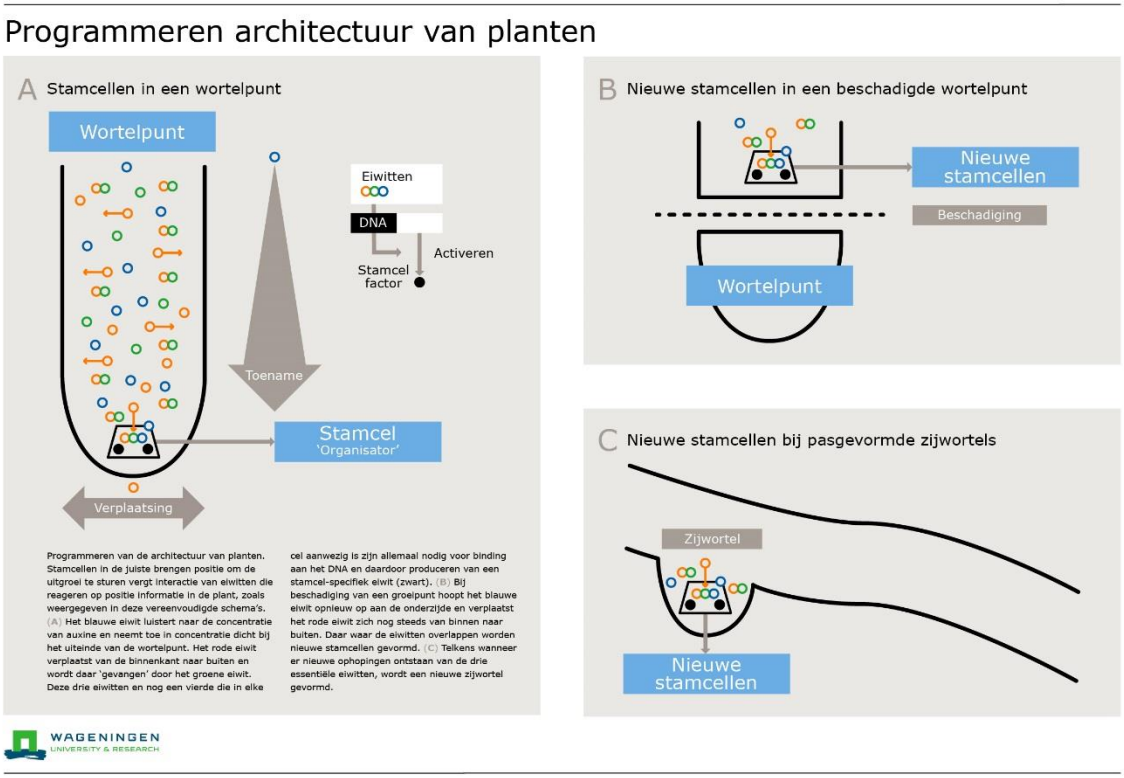
Groundwork for playing with the architecture of plants

Growing tomatoes to the same height so that they can be easily picked by a harvesting robot or growing deeper roots where the soil is dry: scientists from Wageningen University & Research have shown how to stimulate stem cells in a specific spot, enabling such adaptations of plant architecture possible in the future. "We're talking about proving a simple model for organising stem cells at a precise location in the plant," says Ben Scheres, professor in Development Biology. The research was recently published in *Genes & Development*.

Professor Scheres has been studying the Arabidopsis plant for many years in order to understand how plants program their stem cells in the seeds and reprogram them in the lateral roots: "Stem cells produce new plant tissue and continue to make new leaves, flowers and roots throughout the plant's life span. Our research shows that two very different systems collaborate in the plant root to determine to a very precise level where those stem cells should be."

Flexible systems

Both systems are extremely flexible: one constantly reacts to the quantity of the plant hormone auxin, which is always in flux, while the other responds to the changing movement of a protein in different locations such as the root tips, in recently developed lateral roots and during the regeneration (recovery) of damaged roots," says Scheres. "This knowledge will ultimately help us adapt the architecture of the plant, generating a variety of new applications for agriculture and horticulture."



Three lines of research

This work brings together three lines of years-long fundamental research. The first involves the hormone auxin and stem cells (via the *PLT* genes); a system for position determination that works from top to bottom and affects development of the stem cells. “We now combined this knowledge to the results of a study into the role of the vascular bundle in stem cell development (via the *SCR* gene),” explains Scheres. “This position determination system works from the inside out.” The two systems appear to work together in switching on one of the best described stem cell genes in roots – an ‘organizer’ gene (*WOX5*) – which has a key role in the preservation of stem cells.

Stem cells in root tips

The agricultural sector is constantly looking for ways to develop crops with a higher yield and production. “Deeper insight into the growth and development of the plant are essential in this framework,” Scheres continues. “When you cut off a root tip, you can actually see the stem cells under the microscope. The new research enables us to understand how new stem cells are programmed. This knowledge can also help accurately steer the regeneration (recovery) of plants from proliferating cells – an important process in horticulture – through the genes.”

The next step for the research team is to actually adapt the architecture of a crop. “We already have a few ideas in this regard, although I cannot reveal concrete examples at this point. In the future we may be able to predict from the drawing board: ‘this is how to make more and thicker roots’ or ‘this allows us to align all the leaves’.”