Statement of achievements

Dirk Inzé has an enduring fascination with unraveling the intricate molecular mechanisms governing plant organ growth, biomass productivity, and seed yield. The growth of plant organs, a phenomenon shaped by the orchestrated interplay of cell division and cell expansion, has been the central focus of his lifelong research journey. Specifically, organ growth hinges on factors such as cell count, cell division speed, and the developmental window in which critical cell division processes occur. In the realm of plant science, the Inzé lab has made groundbreaking contributions that illuminate the regulation of the plant cell cycle and growth mechanisms.

Dirk Inzé's pioneering work has encompassed the identification and functional characterization of fundamental components of the plant cell cycle machinery, encompassing cyclin-dependent kinases (CDKs), cyclins, CDK inhibitors, E2F/DP transcription factors, and components of the anaphase promoting complex/cyclosome (APC/C). His team has also delved into the molecular characterization of various regulatory pathways influencing the cell cycle, such as the PEAPOD repressor complex, the DA1 proteolysis system, and the ANGUSTIFOLIA/GROWTH REGULATION FACTOR complex, among others.

To deepen our comprehension of how these regulatory pathways impact growth, intensive investigations were carried out on leaf organ growth in both Arabidopsis and maize. This endeavor led to the identification of five critical processes influencing organ size: primordium initiation, cell cycle duration, the transition from cell proliferation to expansion, cell expansion rate and duration, and meristemoid activity (relevant only in dicots). In Arabidopsis and maize, many genes that enhance organ size when overexpressed or mutated were pinpointed, further elucidating the intricacies of growth regulation.

Dirk Inzé's visionary perspective extends beyond the confines of laboratory research. He fervently advocates for bridging the gap between laboratory experiments and real-world field conditions. Using maize as a model system, his team conducted extensive field trials, demonstrating that in some cases insights gained in controlled environments translate remarkably well to field settings. For instance, by modifying a PLA1 gene in maize hybrids, his group achieved in multi-year field trials both in Belgium and the US over a 10% increase in seed yield, underscoring the potential of applying laboratory discoveries to enhance crop resilience in the face of climate change.

In recent years, Dirk Inzé's lab has investigated the synergy of growth-promoting genes, revealing that binary combinations often lead to additive or synergistic effects on organ size. Notably, some triple gene combinations have shown remarkable positive impacts on leaf, root, seed, and flower sizes. This paradigm shift has resonated globally, prompting academia and industry alike to recognize the potential of engineering gene combinations to significantly boost crop yields. However, many agronomic traits are multigenic and require the simultaneous engineering om many genes to achieve for example a higher yield and an enhanced resilience to environmental unfavorable

Recognizing the transformative potential of CRISPR-Cas-based gene editing, Dirk Inzé's work has pioneered the development of the BREEDIT gene discovery pipeline. This innovative approach combines multiplex genome editing with crossing schemes to enhance complex traits, such as yield and drought tolerance. This groundbreaking research heralds a novel strategy to identify subsets of genes that, when modified in higher-order combinations, can substantially improve multigenic traits, like yield and drought tolerance. The profound interest generated by this work has sparked enthusiasm both in academia and industry.

Understanding growth as a quantitative process necessitates advanced imaging systems, and Dirk Inzé's group stands at the forefront of this technology. They were among the first globally to design custom-made imaging robots for measuring growth in Arabidopsis and maize plants over time. These robots facilitate large-scale experimentation, allowing the simultaneous testing of numerous plants exposed to different watering regimes. For instance, the PHENOVISION platform enables the growth of 400 maize plants from seedling stage to maturity, employing RGB, thermal, and hyperspectral detection systems. Dirk's team's expertise in imaging plant growth is internationally acclaimed, consistently enriching our understanding of plant growth regulation.

The plant phenotyping robots have also played a pivotal role in studying the impact of drought stress on Arabidopsis and maize growth. Dirk Inzé's group unveiled a highly interconnected transcriptional network governing growth under mild drought stress and controlling the altered expression of stress defense genes. The plant hormone ethylene was shown to master these drought responses on organ growth. Furthermore, his work underscores the complexity of stress responses and the imperative need to decipher these networks for developing stress-tolerant crops. When applied in conjunction with the BREEDIT technology, this research is poised to revolutionize our ability to select and engineer crops with enhanced drought tolerance.

Beyond academia, Dirk Inzé's vision extended to entrepreneurship. In 1998, he founded the spin-off company CropDesign with support from UGent and VIB tech transfer offices. He played a pivotal role in securing venture capital investment and guiding the company's early growth. CropDesign's remarkable success, marked by the identification of numerous pivotal yield-related genes, culminated in its acquisition by BASF in 2006. The journey from fundamental research in Inzé's lab to the establishment of a thriving company has inspired countless individuals to embark on careers in plant science. CropDesign's (BASF) presence at the UGent Technology Park further attracted other crop improvement companies to the campus, fostering a vibrant research ecosystem with more than thousand persons active in plant biotechnology.

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In addition to his scientific endeavors, Dirk Inzé has made significant contributions to the broader scientific community. He was offered a prestigious Max-Planck Directorship in Gölm, Germany, but opted instead to accept the highly competitive position of director at the VIB-UGent Center for Plant Systems Biology (PSB). Under his leadership, this center has grown into an internationally renowned institution employing 300 researchers, operating at the highest echelons of scientific excellence. Under his leadership, PSB founded four additional companies: Aphea.bio (microbiome); Biotalys (biopesticides); Protealis (soybean) and Animab (animal diseases).

Dirk Inzé's research legacy is evident in his numerous high-impact publications and reviews, which have garnered over 61,000 citations (H-factor 140, Web of Science). He gave more than 200 lectures at international conference and his groundbreaking work has been recognized with prestigious accolades such as the Körber Foundation Prize, presented by the German President in 1994, the Francqui Prize in 2005, the Five-Year Prize of the Flanders Science Foundation, and the World Agriculture Prize. Dirk is also a distinguished member of four academies, including Academia Europaea, and serves on the Scientific Council of the European Research Council (ERC). He is a valued member of the Scientific Advisory Boards of CSRS (Riken, Japan), IPMB (Academia Sinica, Taiwan), UPSC (Umea, Sweden), CEITEC (Brno, Czech Republic), the Bill & Melinda Gates C4 project, and Rothamsted Research (UK). He also served the editorial board several leading journals such as Trends in Plant Science, Plant Physiology, Plant Biotechnology Journal, Journal of Experimental Botany.

Dirk Inzé's commitment to advancing plant science transcends the laboratory. He is the founder and chairperson of EU-SAGE (European Sustainable Agriculture through Gene Editing), a pan-European non-profit organization that unites 150 leading plant research centers. EU-SAGE advocates for the responsible use of gene editing in European agriculture, especially in light of the European Court of Justice's classification of gene-edited crops as GMOs. The collective efforts of EU-SAGE have played a pivotal role in influencing the recent proposal by the EU Commission to permit certain forms of gene editing for crop improvement in Europe.