PROJECT: Betaflorage

Date: **27.11.2023** **REPORTING**

ID: 23

PROJECT TITLE

Sugar beet (Beta vulgaris) taproot plasticity during inflorescence formation: An MRI-imaging-based analysis

CONSORTIUM

P 1	Benjamin Pommerrenig		
P 2	Isabel Keller		

SUMMARY OF THE REPORT

Sugar beet (*Beta vulgaris*) is the sole source of sugar in the form of sucrose in temperate climates. Despite its biennial lifestyle, sugar beet is grown as an annual crop from spring to fall. During the first year of its life cycle, the plant forms a giant sucrose-storing taproot. The stored sugar is used to fuel the outgrowth of a flowering seed stalk during the reproductive phase in the second year of growth. Induction of flowering requires an extended period of low temperatures called vernalization. During the early stages of vernalization, shoot carbon fixation decreases, and shoot tissues become dependent on carbon supply from the taproot to allow later outgrowth of the inflorescence. This cold redistribution of sucrose is at the expense of taproot sugar content and thus yield. Omics analyses of vernalized taproots revealed that the remobilization of sucrose from the taproot is enabled by opposing regulation of two vacuolar sucrose transporters, *Bv*TST2.1 and *Bv*SUT4 (Rodrigues et al., 2020). These transporter adjustments establish the sugar beet storage root as a new carbon source for photosynthetically inactive shoot tissue during vernalization and strongly suggest that the taproot organ is involved in the initiation of flowering. Further metabolic and anatomical rearrangements, particularly involving vascular tissue of the taproot, must be postulated to promote inflorescence outgrowth after vernalization. However, the developmental processes leading to the formation of the large reproductive organ and its taproot tissue origins are largely unknown. Using Magnetic Resonance Imaging (MRI), we record changes in taproot morphology and anatomy during and after vernalization at the onset of inflorescence formation, to shed light on the connections between taproot sugar remobilization and inflorescence formation.