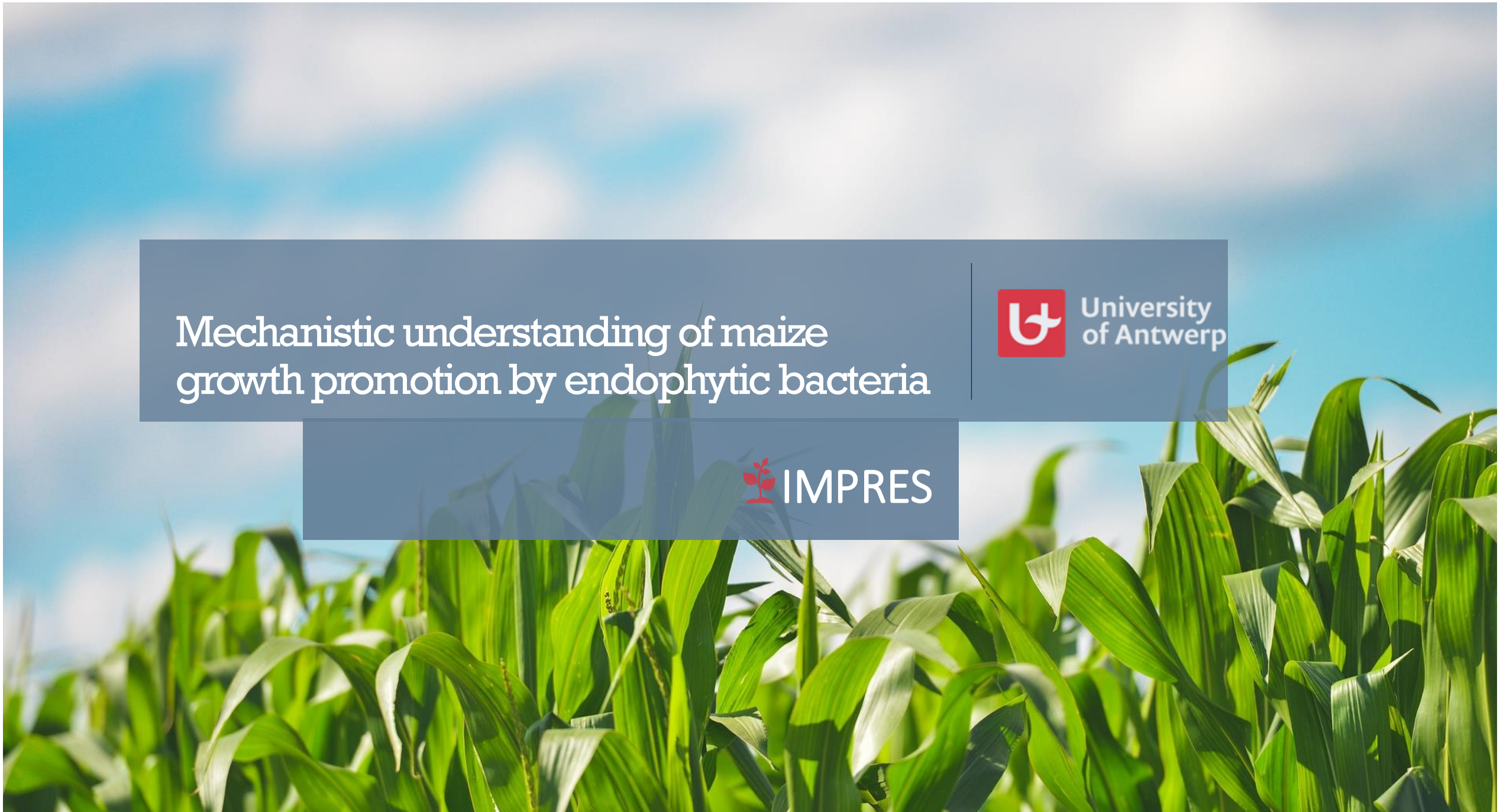


Mechanistic understanding of maize growth promotion by endophytic bacteria

University of Antwerp

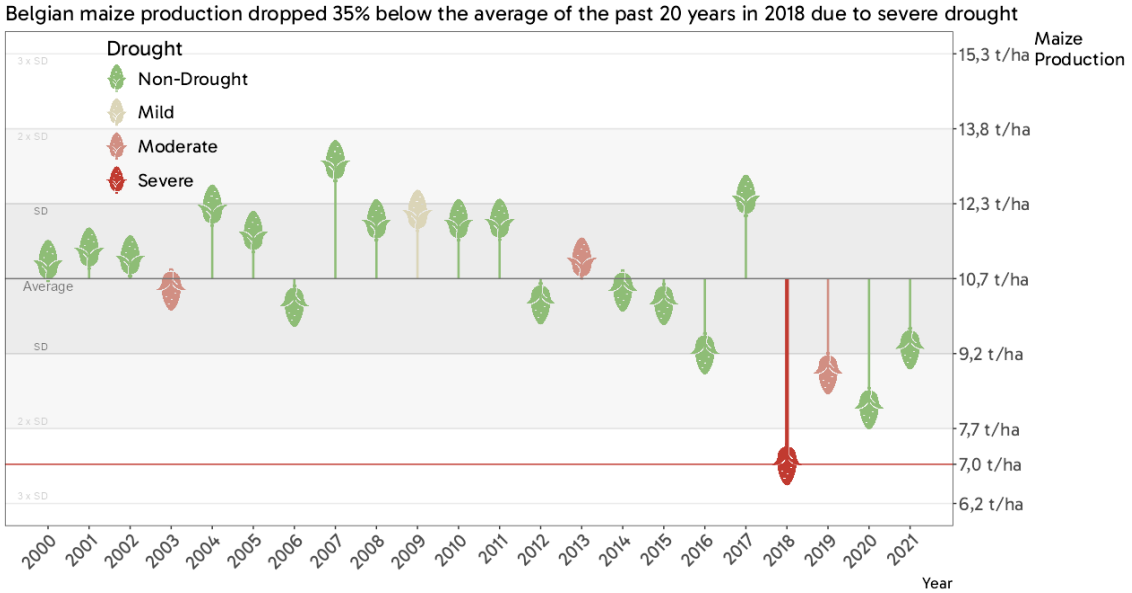
IMPRES

Studying endophytes under drought in maize

- Due to **climate change**, drought frequency and intensity are set to increase, which will greatly impact maize yield
- **Endophytes** are endosymbionts, bacteria or fungi, that live within plant tissues without causing disease
- Many of these have shown to **promote plant growth** under different conditions
- By using growth promoting endophytes we may be able to **mitigate** these effects.

This research project aims to elucidate the physiological and molecular mechanisms through which specific endophytes enhance maize growth under drought stress

- Research interests
  1. How do these endophytes affect normal responses to stress at the **molecular, cellular and organ scale**?
  2. Do these endophytes act in a specific plant tissue and what **signals** do they use to stimulate growth?



Data: FAOSTAT & Global Drought Monitor



Main experiments and analyses at our lab

Automated leaf length tracker, measuring leaf elongation rates at minute resolution.

Kinematic analysis

- Analysing cell division and expansion rates. Provides information that allows for strategic sampling of the important tissues to study the interaction in more detail

Transcriptomic analysis

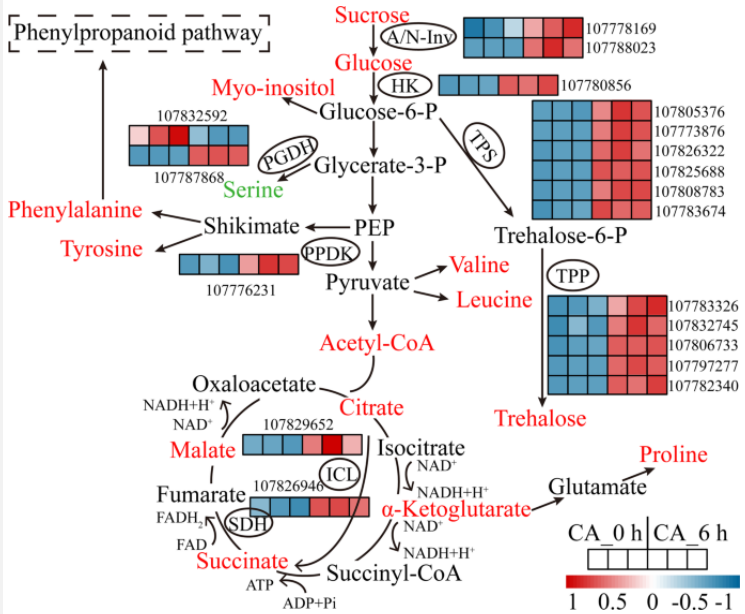
- Provides genome wide information on gene up-/downregulation under specific conditions

Validation experiments

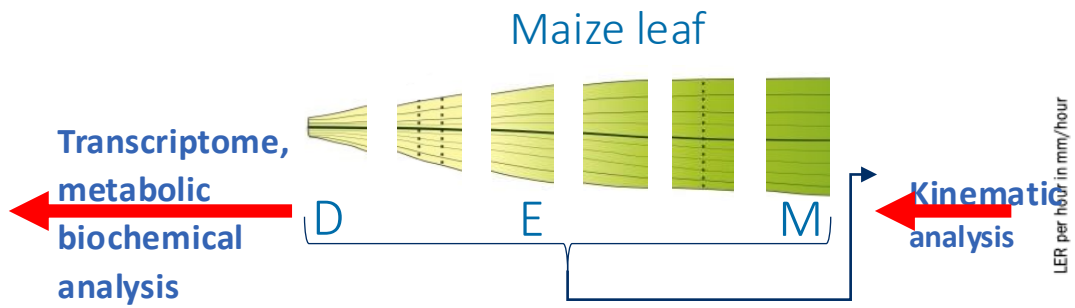
RT-qPCR: Validation of target gene expression derived from NGS data

Metabolic & Enzyme Profiling: Quantifies of key metabolites and enzyme activities of potential pathways

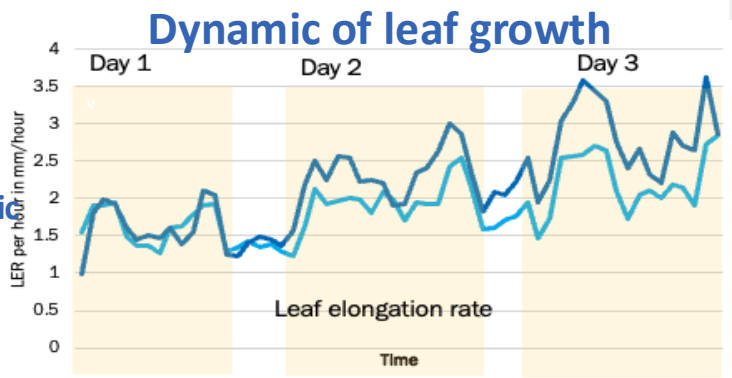
Functional & Genetic Characterization: Uses mutant/knockout maize lines and feeding experiments to elucidate molecular mode of action.







Study zone-specific effects in the maize leaf



Planned localisation experiments

- Our bacterial strains **E7 and E14**
  - Obtained from a collection of microbes extracted from grasses grown in arid environments through collaborations with universities in Egypt and Saudi-Arabia
- **Fluorescent labelling** of the two strains to obtain information on (sub-cellular) localisation and abundance *in planta*
  - Bacterial transformation
  - Colonization experiments
  - Fluorescence microscopy
  - Quantification using qPCR

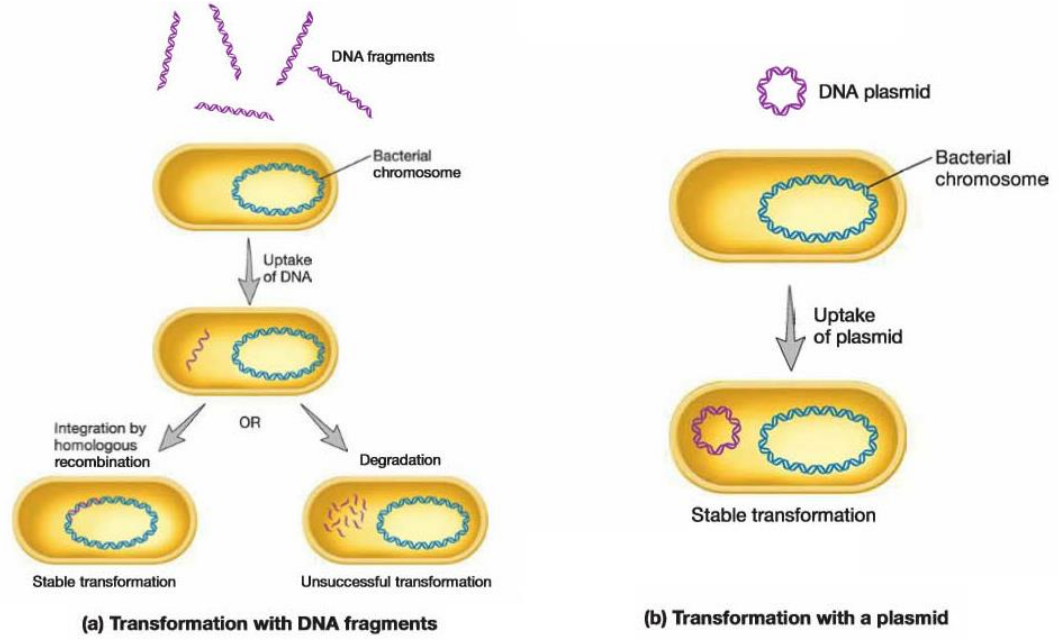
Bacterial transformation is currently being optimised in order to create fluorescently labelled strains



Fluorescence microscopy



Quantification using qPCR



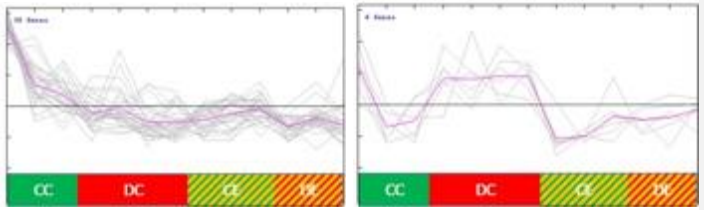
Molecular Mechanisms Underlying Bacterial Mitigation of Drought Stress: lignin

- **Bacterial strain 327** inhibits **lignin** production that may cause **cell wall stiffening** under drought conditions.

Experimental plan and analytical approach

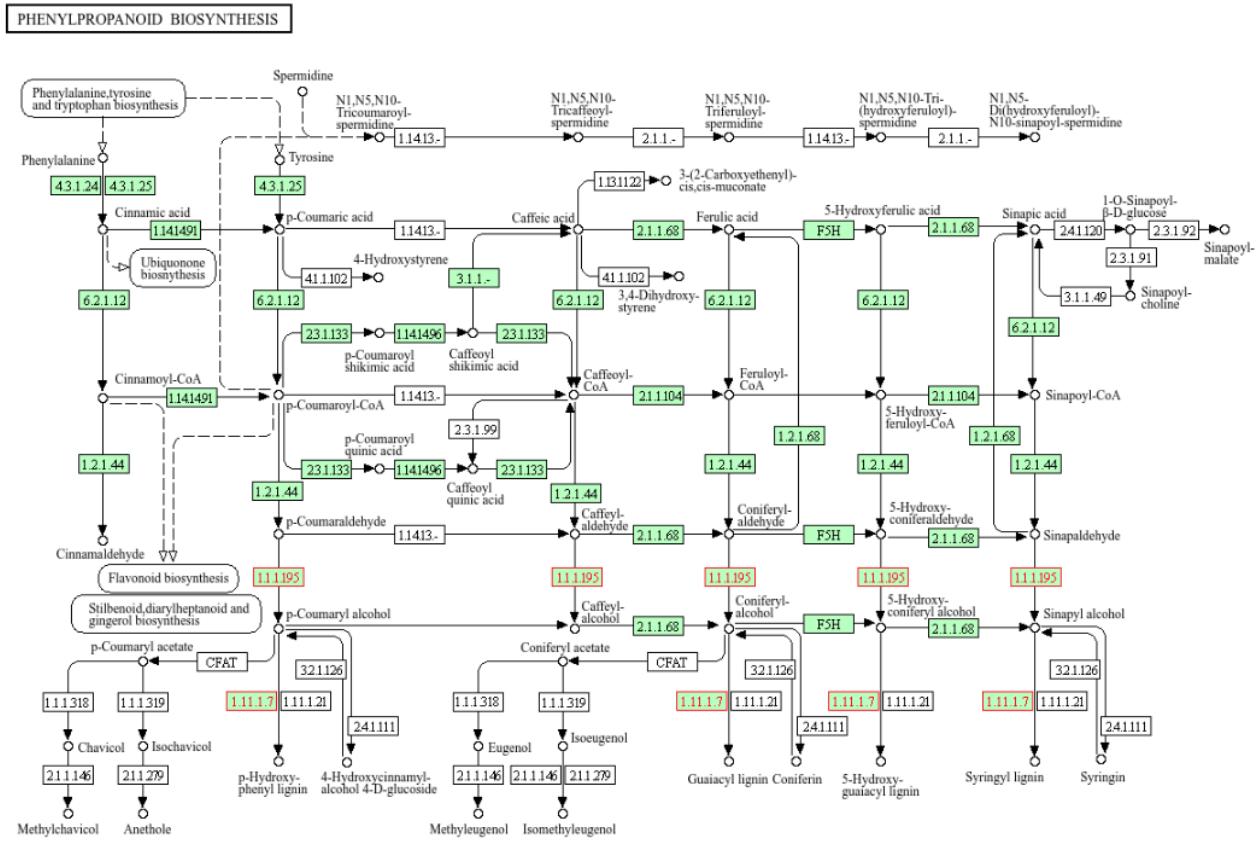
- Perform genotyping and screening of maize mutants (impaired in lignin production) in their growth response to drought stress in presence and absence of 327
- Impact of lignin production inhibitors on plant growth responses to drought stress in presence and absence of 327
- High resolution growth analyses and cellular profiling analysis
- Transcriptome analysis
- Metabolic and biochemical analyses of lignin pathway

Downregulation of lignin production by endophyte 327



p-Coumaric acid —CAD, POX/LAC→ Lignin

Upregulation of cell wall and T6P production by endophyte 571



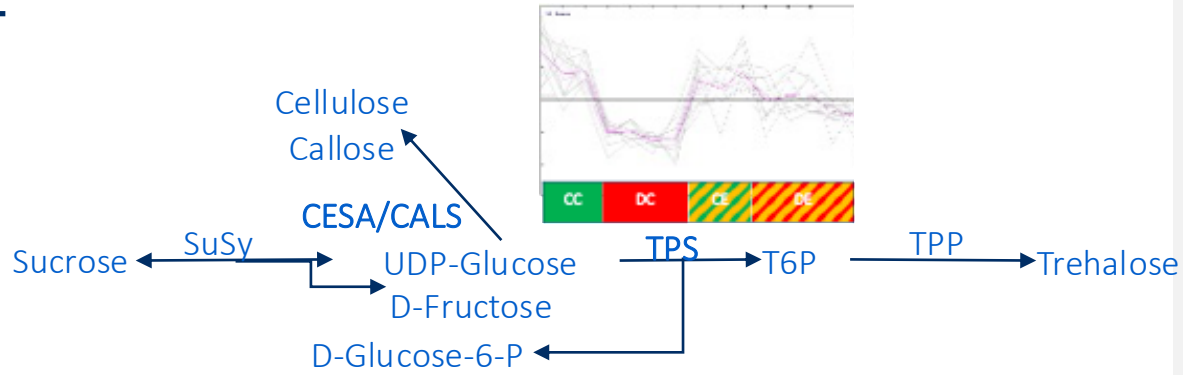
Molecular Mechanisms Underlying Bacterial Mitigation of Drought Stress : Sugar signaling

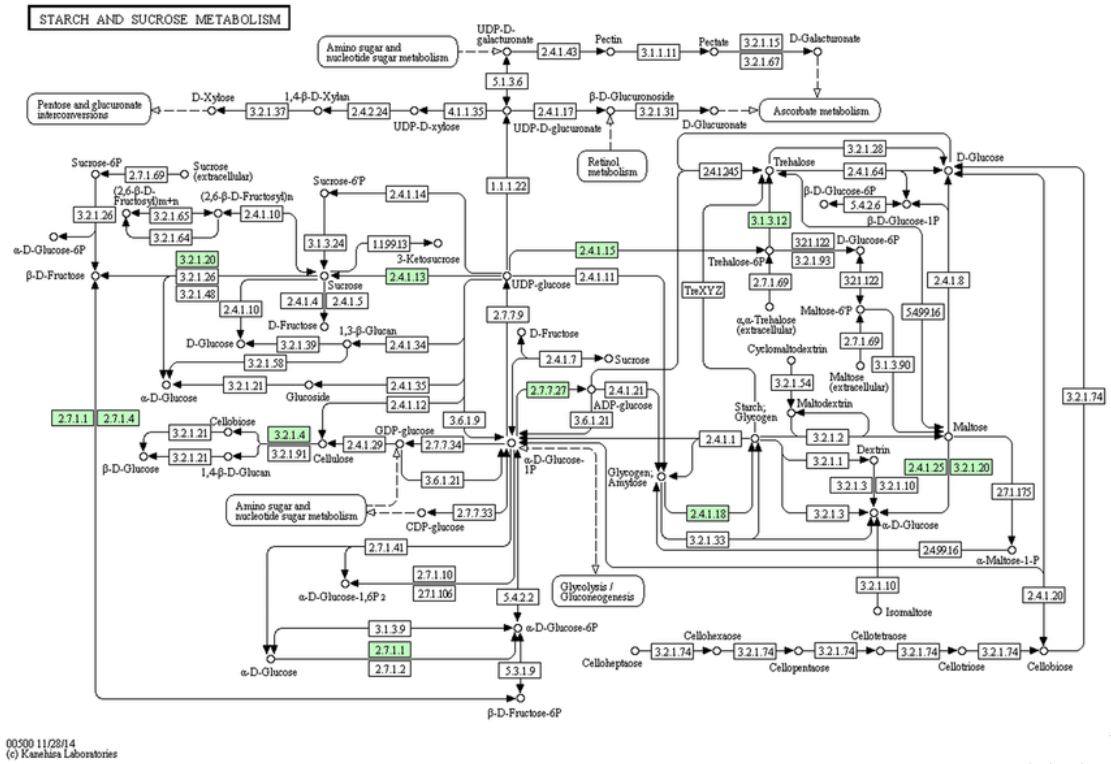
- Three **bacterial strains** 571 enhances **trehalose-6-phosphate** synthesis (a growth signaling sugar) and **cell wall** production under drought conditions

Experimental plan and analytical approach

- Perform genotyping and screening of maize mutants (impaired in cellulose production, sucrose and T6P production) in their growth response to drought stress in presence and absence of 571
- Impact of sugar feeding on plant growth responses to drought stress in presence and absence of 571
- High resolution growth analyses and cellular profiling
- Transcriptome analysis
- Metabolic and biochemical analyses of lignin and sugar Pathways

Upregulation of cell wall and T6P production by endophyte 571

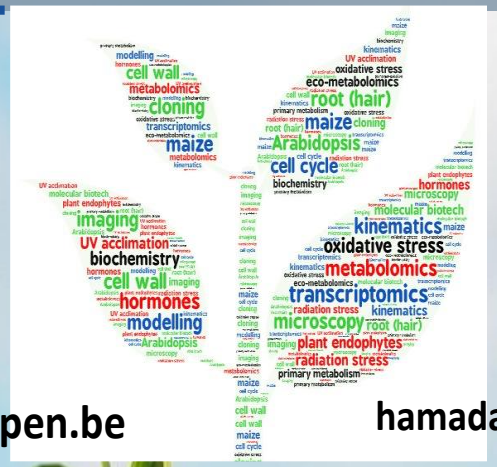




Thank you!

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