Non-invasive phenotyping of model- and crop plants

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Plants in horti- and agriculture
stress

- drought/excess water
- heat/cold
- fertiliser
- soil
- animals/diseases
- pests/cold
- light
- neighbours/weeds
Plant Phenotyping

Environment ➔ Plant phenotype ➔ Genome

CCGTTGGAA
Plant phenotyping at Jülich: combination of science and technology
Phenotyping methods

model plant Arabidopsis thaliana
crop plants

- GROWSCREEN FLUORO
- computer-controlled imaging station with crane system
Phenotyping of *Arabidopsis thaliana* photosynthesis, growth and morphology

Measuring head with integrated chlorophyll fluorometer moves from plant to plant

GROWSCREEN FLUORO

population overviews

time courses of individual plants

Photo  Quantum yield  Mask  Area/outline  Surface coverage  Leaves  Diameter
Variability of phenotypes

One environment – different ecotypes

One ecotype – different potting substrates

One ecotype – different light- and water environments
One ecotype – different potting substrates
One ecotype – different light- and water environments
Phenotyping methods

model plant *Arabidopsis thaliana*

- GROWSCREEN FLUORO

crop plants

- computer-controlled imaging station with crane system
Imaging system for crop plants

Crane transports plants to a measuring station where image acquisition, weighing and water content measurement takes place.
Shoot phenotyping with crop plants

- rapeseed
- rice
- maize
Beta vulgaris imaging

One plant – several views from side and top

Next tasks:
Correlate images with biomass
Calculate 3D model of plant
Calculate morphologic factors
Phenotyping methods

model plant *Arabidopsis thaliana*

- GROWSCREEN FLUORO

crop plants

- computer-controlled imaging station with crane system

Ecophysiology
Environmental factors, stress
Breeding
Mutants, transgenic plants
Biotic & abiotic stress
Cropsense ZS1: Phenotyping the infection dynamics of leaf pathogens with non-invasive sensor technology

**Cercospora beticola**

- **Current status:** Computer recognises plant and calculates size
- **Intended development:** Computer recognises plant with pathogen symptoms and calculates the ratio of diseased leaf area

- **Multi- and hyperspectral imaging**

**Quantification of diseased leaf area**

**Selection of resistant lines for plant breeding**

**Doctoral student for multi- and hyperspectral imaging starts in October 2010**
The JPPC team