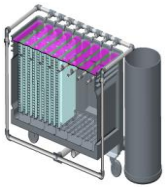
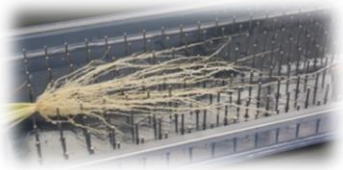
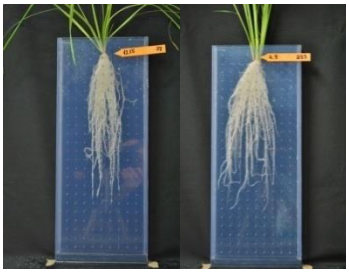


Rhizoscope: a phenotyping system for root architecture studies

Objective: Cirad is setting up a phenotyping system called Rhizoscope fully devoted to the measures of the root system under growth chamber conditions in a semi-hydroponic system. The system enables a finer direct evaluation of the root system, necessary for a better understanding of mechanisms in cause to different constraint adaptation. It has been designed to be used on sets of about 192 plants simultaneously. It is a flow compatible with an objective of understanding mechanisms, genetic analyses (population or association mapping) or functional characterization of genes of interest.



Description: The principle is based on a Mixed hydroponic system with glass beads as inert substrate. It consists in plexiglass sandwiches filled with glass bead in which a nutrient solution is circulating. Plates are distributed in 4 independent tanks, each tank having its own nutrient solution supplier. This system enables the simultaneous growth of 192 plants (Ghneim et al, in prep). The plates have a 50 cm x 20 cm x 2 cm dimension. The glass beads present the advantage to recreate the conditions of mechanical resistance to penetration while getting rid of complex properties of soil ionic exchange and heterogeneity, but also eliminate the cleaning difficulties in a system using soil. A sliding trap door at the base of the plate enables removing easily the glass beads without damaging the root system that remains in place due to a grid of regularly spaced nails and without losing roots. This system presents the advantage of a good visibility of roots and allows a coupling with imaging tools. Transparent nail-board system in aerated culture solution. The system is connected with an appropriate picture taking system and an automated system of image analysis.



Indica rice

Japonica rice

Durum wheat

Cotton

Results:

- First results shown a large architecture diversity for rice species.
- The system is generic because different species were positively tested (Rice, Wheat, Barley, Cotton, Wild species).
- Different treatments are possible (pH, nutrient concentration,…) because of the independence of the tanks.
- Bead dimension can also be manipulated to study root penetration.
- Histology studies on roots are easy.

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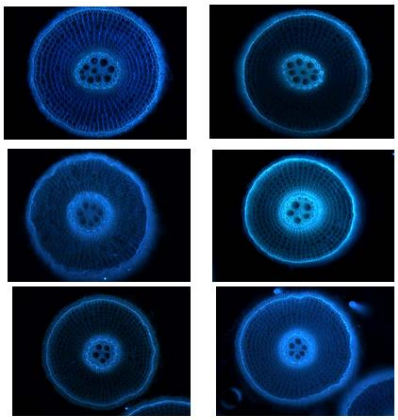

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