Interactive exhibit

PHENODYN: a high throughput platform for measurement of organ elongation rate and plant transpiration with high temporal resolution

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Leaf elongation rate (LER) is the first trait affected by water deficit or high evaporative demand, with typical time constants of 30 min for change in LER upon rapid changes in soil water content or air vapour pressure deficit (VPD). The same applies to other organs such as maize silks. Phenodyn (https://www6.montpellier.inra.fr/lepse/M3P/plateforme-PHENODYN) measures organ elongation rate and transpiration rate of hundreds of plants with a temporal resolution of 3 min (or more if required) in order to follow the changes in LER and transpiration in fluctuating conditions of soil water content, evaporative demand and temperature. Phenodyn imposes known soil water potentials to each plant via independent automatic irrigation. Climatic conditions are either imposed in the growth chamber or left to naturally fluctuate in the greenhouse. Elongation rate is measured with 500 rotational displacement transducers with a precision of 0.2 mm. Transpiration and soil water content are measured with scales; changes in weight are attributed to changes in soil water content after correction for the increase in plant biomass. A set of sensors measures meristem temperature, incident light, air temperature and VPD every minute. Phenodyn is associated to an information system for real time monitoring of experiments, post-analysis of large datasets (around 700.000 data points are generated in each experiment) and identification of genotypic parameters such as rates or time constants. It has been used (i) for analyzing the response of LER to soil water potential and to VPD in mapping populations, diversity panel for association genetics or insertion lines, (ii) for establishing response curves to temperature in different species and genotypes, (iii) for following jointly changes in transpiration and in elongation rates of leaves or silks together with hydraulic variables. It has been used in maize, rice, wheat, sorghum, millet, apple tree and vine. Phenodyn is part of the M3P facility (https://www6.montpellier.inra.fr/lepse/M3P). It is accessible to public or private scientists via the website of the national project Phenome-FPPN (https://www.phenome-fppn.fr/).