Exploration of new techniques/tools for medium/high throughput phenotyping of Phenology (WP 11.2.1)

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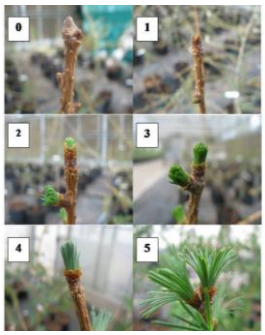
The Sub-task 11.2.1 was focused on *phenology*:"*the study of the timing of recurring biological events in the animal and plant world, the causes of their timing with regard to abiotic and biotic forces and the interrelation among phases of the same or different species*". (Lieth, 1974)



Why monitoring phenology?

Phenology is considered a key adaptative trait with high interest for breeders and ecologists, because it directly determines the growing season. It is genetically dependant, but it is also under strong climatic control.

Phenology monitoring is classically based on scoring systems, a non-destructive and rather fast methods.

But *planning*, observation on *juvenile and/or adult* tall trees, *subjectivity* of *phenology assessment* and *costs* are weak points for which alternative methodologies and different tools are needed.

Aim

To evaluate the capacity of different phenological methods (medium/high throughput, destructive or not, simplicity, cost, etc.) and to develop faster, undestructiveness and cheaper phenotyping techniques and to improve quality and quantity of collected information.

Research Institutes involved and material analysed

INRA (Orléans, France), CREA (Arezzo, Italy) and IBL (Raszyn, Poland)

A small set of common extreme standard accession of *Prunus avium* L. (INRA and CREA) and *Larix* sp. (INRA and IBL), monitored starting on Autumn 2012 until Autumn 2015.

Traits monitored and methods

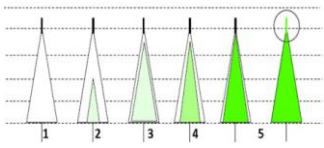
Flushing

1) in field via scoring visual systems;

2) in field via hourly/daily images collected by WINGSACAPES "TimelapseCam 8.0" cameras;

3) in field via LED captors;

4) Ex situ via forcing in climatic chambers.



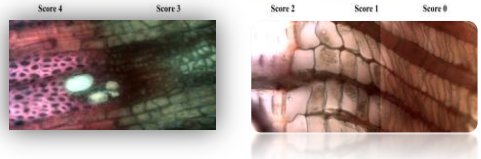
Senescence

1) In field via subjective scoring systems; 2) in field via hourly/daily images collected by WINGSACAPES "TimelapseCam 8.0"

Cambial activity

1) Via automatic dendrometers;

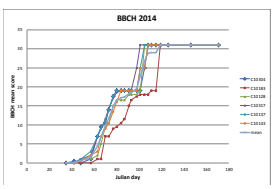
2) via microcores collection.



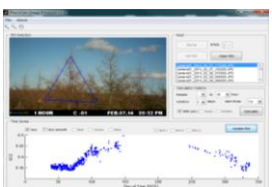
Physiological measurements – Water Use Efficiency

Results

In the following pictures some results are reported

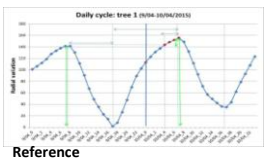


Dynamics of flushing via scoring system

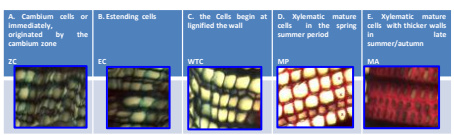


Kinetics of a GCC indice (Green Chromatic Component) obtained from PhenoCam software

Radial stem variation obtained via automatic dendrometers



Dynamics of vessel formation (different phenological phases of xylogenesis)



Reference

DUCCI F, DE CUYPER B, PÂQUES LE, PROIETTI R, WOLF H, (Compilers), 2012: Reference protocols for assessment of trait and reference genotypes to be used as standards in international research projects. Adaptive traits: Ed. CRA SEL - Arezzo, Italy.

MEIER U, 1997: Growth stages of Mono- and Dicotyledonus Plants. BBCH Monograph, Blackwell Wissenschafts-Verlag Berlin Wien.

RATHGEBER C.B.K., LONGUETAUD F., MOTHE F., CUNY H., LE MOGUÉDEC G., 2011. Phenology of wood formation: Data processing, analysis and visualization using R (package CAVIAR). Dendrochronologia, 29: 139–149