Metabolic dissection of leaf senescence and nutrient remobilization in oilseed rape

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Team
Yield under abiotic constraints

Direction
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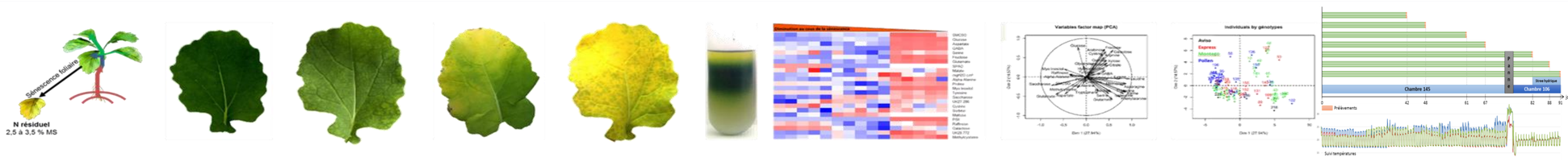

Social-economic context

Oilseed rape (*Brassica napus L.*) has become the main oil crop in France and Europe. Mainly grown for its seeds and extraction of edible oil and biofuel, the seed cake is used for animal feeding. Despite its high capacity for mineral nitrogen absorption from soil, the organic nitrogen remobilization from senescing to growing tissues and seeds are considered inefficient in this species and lead to energetic and ecological penalties during production because of high N fertilizers needs.

Scientific context

As a component of amino acids, chlorophylls, and regulatory metabolites, plants need a lot of nitrogen to grow. Remobilization process from senescent tissues are under strict genetic, chemical and environmental regulations which are not very well understood in plants. Constructing comprehensive and dynamic metabolic profiles during leaves ageing using modern analytical technologies while give new perspectives on metabolic process involved in nitrogen remobilization.

Objectives

To meet the current challenges of agro-ecology and sustainable agriculture, one of the main objectives is to optimize allocation and efficiency of carbon and nitrogen allocation from senescent source organs to sink organs. First in our work, the dynamics of growth during senescence was characterized by spectral and biometric non-destructive measurements, revealing physiological characteristics of ageing. Concurrently, the profiles of primary metabolites and plant hormones were achieved at three key stages during senescence and four spatial scales: the entire leaf, leaf tissular fractions, subcellular fractions established under a non-aqueous fractionation procedure and phloem sap collected at different leaf rank.

Results

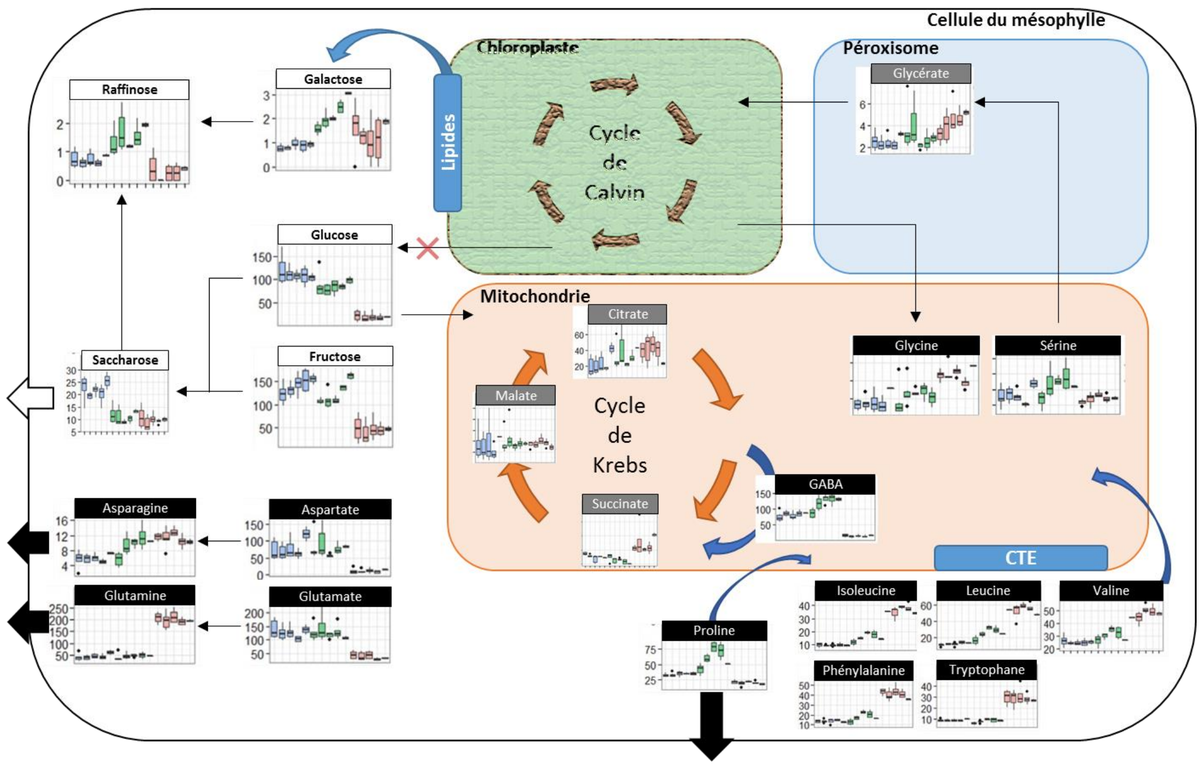

Figure 1 : Schema of a photosynthetic plant cell with primary metabolism evolution during ageing.

The results provide evidence of the spatial and temporal distribution of metabolites and metabolic adjustments related to the nutrient recycling and exporting processes. Variations in phytohormones concentrations also provide information on their regulatory role on the dynamics of spatial and temporal progression of leaf ageing. First pieces of evidence are available to assess the metabolomic attributes of senescence progression and identify potential markers of nitrogen remobilization efficiency (figure 1).

Perspectives

Finding metabolic biomarkers to assess the nitrogen use efficiency of a cultivar will greatly improve the discovery and selection of better variety requiring less fertilizer, and more tolerant one under abiotic stress.

Agro Ecology

Plant Health

Genome and Diversity