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RCA
Yield under Abiotic
Challenges

Direction

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Impact of biotic and abiotic stresses on the acquisition of nutritional and physiological seed quality in oilseed rape (SQUAL)



Social-economic context

Oilseed rape (*Brassica napus*) is one of the main worldwide oilseed crop. Faced with the challenges of adapting agriculture to climate change, seed production should have increased resilience to abiotic stress factors and the expected proliferation of pathogens. This concerns both the nutritional quality, especially the oil/protein composition, and seed vigour, a crucial factor in seedling establishment and yield. Therefore, seed companies invest considerable resources to maintain and enhance seed quality.

Scientific context

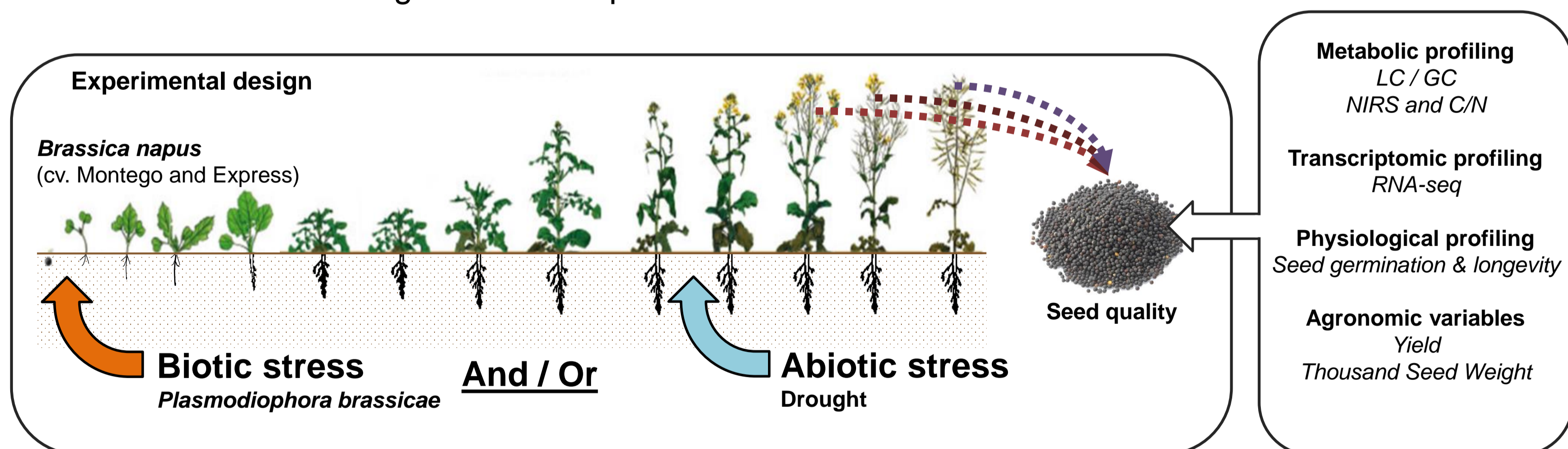
Nutritional quality is determined by the amount and composition of the oil and of storage proteins, as well as its digestibility and the presence of anti-nutritional compounds. The desirable characteristics of physiological quality are the seed storability in the dry state (longevity), high and synchronous germination and seedling establishment. In field conditions, *B. napus* use to experience numerous stresses such as clubroot and drought. Clubroot, caused by the soil-born biotroph *Plasmodiophora brassicae*, is a major disease of Brassicaceae, causing severe damage, especially in oilseed rape. Drought significantly affects physiological quality of oilseed rape, as well as yield. Previous studies suggest that plants response differently to multiple stresses compared to individual stress. Indeed, prior installation of clubroot on the crop is likely to affect the subsequent tolerance to water stress, but the precise interaction and its impact on the elaboration of seed quality remains to be elucidated. This thesis represents a strong emerging challenge, given that i) seed quality is a complex trait determined by G x E interactions, and ii) the lack of understanding between seed vigour and composition.

Objectives

Using oilseed rape as a model, the objectives of this PhD thesis are to understand:

- How are seed quality traits acquired throughout the seed maturation process.
- How are oil/protein composition and seed vigour influenced when plants are subjected to drought, clubroot, or a combination thereof ?
- What are the biochemical events and actors that underlie changes in seed quality by the environmental constraints ?

Attention will be paid to address i) the interplay between nutritional and physiological quality and ii) the actors involved during seed development.



To answer these questions, two *B. napus* genotypes (cv. Montego and Express) with contrasting sensitivity to clubroot will be grown under semi-controlled field-like conditions. By investigating the changes in transcriptome, metabolome and hormonal pathways in seed development during the perturbation of the maternal environment by clubroot in combination with water deficit as well as single stresses, the SQUAL project will provide an integrative vision on the effect of combination of biotic and abiotic stresses on the elaboration of seed quality in oilseed rape.

Perspectives

The expected results will contribute to a better understanding of the crosstalk between the responses to water deprivation and/or pathogen defence and how it compromises seed quality. A better understanding of the effect and responses of the seed to (a)biotic stress at molecular and physiological scales will be a first step to meet scientific and technological challenges of adapting seeds to their environment.

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