#116

Water shortages during flowering impact seed qualities in oilseed rape

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Faced with the challenges of developing sustainable agriculture in the context of climate change, the seed production has to improve its resilience towards multiple abiotic constraints or environmental stresses, among which drought events are expected to be more frequent and severe in the near future. As one of the most important oil crops in the world, oilseed rape's response to abiotic constraints has received increasing attention in the last decades. However, data about the impacts of drought on seed metabolic and physiological changes are still scarce. To address this issue, two genotypes of winter oilseed rape were grown over three cropping seasons under semi-controlled conditions allowing field-like management. Moderate water shortages were applied and fine-tuned from the flowering stage until seed harvest. Our results demonstrated that the seed number was dramatically reduced by water deficit inducing huge yield losses. On the opposite, the seed weight was not significantly affected by drought, although a significant decrease of the oil/protein ratio was recorded. Metabolic profiling analyses pointed out variations in seed metabolite contents under water shortage. Among these changes, the malate content was significantly higher in seeds produced under drought conditions. In addition, germination tests performed on seeds with or without artificial ageing revealed that drought accelerated the germination speed while reducing seed longevity. Interestingly, the malate content and seed physiological features appeared to be correlated in mature dry seeds. This latter result prompted us to consider the malate as a potential biomarker of the seed response to drought events.