PROJECT TITLE

Terminal drought and heat-effects on chickpea flowering, seed yield and quality

CONSORTIUM

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SUMMARY OF THE REPORT

Chickpeas (*Cicer arietinum* L.) are included in the Zero Hunger program, an initiative of World Food Programme for food safety and better nutrition. Chickpea is the world's second most cultivated food legume, and first in the Mediterranean basin, and has one of the best nutritional compositions among the dry edible grain legumes (Kashiwagi et al. 2013; Ribeiro et al. 2017). Drought typically reduces chickpea grain yield, namely when occurring during pod set and seed filling (Duarte-Maçãs 2003; Krishnamurthy et al. 2010; Pang et al. 2017). Reported yield losses due to drought vary between 36 and 42% (Saxena et al. 1993; Khodadadi 2013) and in combination with elevated temperatures seed filling is further compromised and yield further reduced (Devasirvatham et al. 2015).

In this project, two chickpea genotypes developed under the Portuguese Breeding Program at Portugal (Elvas, INIAV) were evaluated regarding **terminal drought in combination with high temperatures** (performed at Phenolab). Elvar was the 1st cultivar developed and is available from the Portuguese varieties catalogue since 1993. Adapted to dry conditions, it as a high production potential (100 seed weight ranging from 32-38 g) and is the main variety produced in Portugal and South of France. CHK5810 was in the meantime released as Electra (2020) and was selected due to its production potential (100 seed weight ranging from 45-48 g) and large seed size.

We focused the phenotyping during flowering and seed filling stages, the most critical stages for seed yield. The goal is to evaluate the physiological responses at plant level relating it to the activity signatures of key enzymes of carbohydrate and antioxidant metabolism. We target both the leaves and the seeds. Our experimental design included the analysis of plants from each genotype that were kept in the greenhouse to serve as a normalising control (to account for the impact of the pot effect). The phenotyping approach at Phenolab will be complemented with seed production (yield) and quality analysis. One additional goal is to compare the seeds obtained at Taastrup (Danmark) with the seeds obtained at Elvas (Portugal). Seed phenotypes obtained in each condition are presented in **Figure 1**.

With this project, we aim to contribute to understanding chickpea productivity under warmer and drier climates by gathering information on how sink capacity is modulated by challenging environmental conditions (single and/or combined).

Figure 1. Chickpea seeds phenotypes. Seeds obtained from the 2020 growing season at Elvas were shipped to Taastrup and were used for the greenhouse and Phenolab assays. At Elvas, seeds were also multiplied during the 2021 growing season. Seeds were photographed inside 9 cm petri dishes.