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EPPN2020/FLOWERINGUNDERSTRESS – SENSOR AND DEEP PHYSIOLOGICAL PHENOTYPING OF TERMINAL DROUGHT AND HEAT-EFFECTS ON CHICKPEA FLOWERING, SEED YIELD AND QUALITY

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Chickpeas (Cicer arietinum L.) are included in the Zero Hunger program, are the world's second most cultivated food legume, and have one of the best nutritional compositions among the grain legumes. Drought typically reduces grain yield, namely when occurring during pod set and seed filling, which is further reduced in combination with elevated temperatures. With this EPPN2020 project, we focused the phenotyping during the critical flowering and seed filling stages. Phenological responses to terminal drought and heat were evaluated by non-invasive thermo-, multireflectance- and multifluorescence imaging in the Phenolab at the University of Copenhagen (DK) to relate physiological responses at plant level with the activity signatures of key enzymes of carbohydrate and antioxidant metabolism and its final impact on seed yield and quality. Two chickpea genotypes with high production potential were evaluated: Elvar, adapted to dry conditions; Electra, selected due to large seed size. The impact of high temperature was combined with a 40% or 10% watering regime and compared with plants kept at 40% watering regime and ambient temperature. The sensor based phenotyping in the Phenolab was complemented with seed yield and quality analysis. Both seed weight and seed number were negatively affected by high temperatures irrespectively of the watering regime. Seeds from both genotypes obtained under high temperature conditions showed increased protein content and lower starch. Protein content was further affected by the watering regime. Alterations in protein-to-starch indicates modifications in sink-source relationships. The differential effects were mirrored in distinct sensor based and biochemical biosignatures. This study contributes to the mechanistic knowledge on how combined effects of severe terminal drought and high temperature modulate sink capacity and chickpea productivity (yield and quality) and identifies predictive biomarkers for the breeding.