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Advances of the Embrapa potato breeding program aiming tolerance to heat stress

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Overview

The Brazilian Agricultural Research Corporation (Embrapa) coordinates a national potato breeding program, as well as hosting the potato genebank. Under its scope, the research activities aim to develop varieties adapted to high temperature and low thermal amplitude conditions of the tropical and subtropical regions of Brazil. To achieve this goal, since 2015, several studies were developed aiming to establish environmental conditions to assess heat tolerant potato germplasm, as well as to identify physiological and morphoagronomic traits associated with heat tolerance. Studies were conducted in growth chambers using a chlorophyll fluorometer (IMAGING-PAM) to reveal the effect of supra-optimal temperature on morphophysiological traits associated with tuber yield and to explore the use of non-invasive phenotyping methodologies as a tool to select heat tolerant genotypes and to uncover the genetic variability for adaptation to supra-optimal temperatures maintained in the Embrapa potato genebank. Our results showed that the temperature did not influence the induction to the tuber initiation stage. However, it extended the period for plant emergence and reduced tuber yield and quality. A methodology for a rapid and non-destructive selection of heat tolerant potato germplasm was established, based on changes of physiological parameters. So far, 24 potato genotypes were evaluated under severe heat stress, control (14 to 27°C) and supra-optimal (24 to 34°C), and 65 clones under moderate stress (19 to 29°C). Important genetic variation was found to be used on germplasm improvement. Next activities will include developing and genotyping multi-parental populations, aiming to incorporate genomics-assisted selection into the routine of the breeding program. All these research activities have been contributing to Embrapa's potato breeding program for the development of successful varieties, which have gained space in the Brazilian market, until recently, supplied almost entirely by imported genetic material.