



Tropentag, September 20-22, 2017, Bonn

“Future Agriculture:
Socio-ecological transitions and bio-cultural shifts”

Drought Effects on the Synchrony of Aboveground and Belowground Phenology of Five Potato Clones

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Abstract

Literature describes the belowground and aboveground development of potato to be closely and quasi-linearly related. For example, bud formation is synchronous with tuber initiation and flowering with tuber filling. Thus, many agronomic and breeding studies in potato use non-destructive aboveground phenology to assess belowground development. No information is currently available on the influence of water deficit or salinity on the synchrony of aboveground and belowground development in potato. In order to assess the effects of water deficit on belowground development of potato it is important to know if the synchrony between aboveground and belowground development is maintained or broken. A field experiment with 5 potato genotypes was conducted between October 2013 and February 2014 in a coastal arid region of southern Peru. Plants were subjected to four irrigation treatments: fully watered, early drought (withholding irrigation 50 days after planting, DAP), intermediate (65 DAP) and late drought (80 DAP). In 5-day intervals after withholding water, detailed belowground and aboveground development was recorded.

Results showed that the synchrony between aboveground and belowground development is strongly influenced by both water deficit as such and by the development stage during which the water deficit was imposed. Whereas in early drought treatment the aboveground development appears to be faster and belowground development was retarded. The opposite was found in later development stages. Under full irrigation, on average physiological maturity of potato tubers was reached after 90 days. Stolon initiation accounted for 11 %, tuber filling for 50 % and bulking for 22 % of the time to physiological maturity under full irrigation. Under early, intermediate and late drought, tuber filling phase was prolonged over all genotypes by 5 %, 10 % and 13 % in comparison to the full irrigated control, while bulking phase was shortened. Drought also slowed down the aboveground development to flowering by a couple of days, however, there was a strong disparity between aboveground and belowground development, as aboveground phenological development appears to be slower under drought.

We highlight here the importance of investigating the aboveground development separately from the belowground development, since the assumed synchrony can be considerably affected under drought conditions.

Keywords: Abiotic stress, phenological development, *Solanum tuberosum*