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"Development on the margin"

Functional Responses of Baobab Seedlings to Drought Conditions: Differences between Western and Southeastern Africa

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Abstract

The African baobab, an important multipurpose tree species, is well-known for its drought tolerance at adult stage. However, there is little information on the ability of this species´ seedlings to withstand drought. Therefore, the aim of this study was to investigate the functional responses of baobab seedlings under a short-term soil drought stress. As genetic differences between baobab trees from western and south-eastern Africa have been reported, seeds were collected in both Mali and Malawi (western and southeastern Africa, respectively).

Baobab seedlings were found to use a number of mechanisms to cope with drought. First, leaf area was reduced due to leaf shedding, though not all leaves were shed and even some leaves with altered morphology were formed. Secondly, under drought, relatively more biomass was allocated to the root system. Thirdly, as baobab seedlings had a tight stomatal control, under drought conditions photosynthesis and transpiration were significantly reduced while leaf water potential barely changed. As drought persevered, non-stomatal limitations on photosynthesis became important. Water stored in the taproot was being used for the salvation of part of the old leaves, for the formation of new ones, for the formation of new roots, and for the maintenance of metabolic processes. There was a significant correlation between water content of the taproot and stomatal closure.

Differences between the drought responses of baobab seedlings from different origins were observed: Malawian seedlings were able to retain more leaves and to form more new ones, while Malian seedlings tended to allocate more biomass to their root system. Therefore, baobab seedlings from western Africa showed more drought-avoidance characteristics. These different strategies between Malawi and Mali agree with genetic differences between baobab clades, and suggest that superior planting material in terms of drought tolerance can be selected.

Keywords: Adaptation, baobab, drought avoidance, photosynthesis, semi-arid regions, stem succulence, stomatal conductance

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