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Different Drought Adaptation Strategies of *Coffea Arabica* Populations Along a Rainfall Gradient in Ethiopia

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Abstract

Ethiopia is the centre of genetic diversity of *Coffea arabica*. The CoCE project aims to assess the diversity and the economic value of the Ethiopian coffee gene pool, focussing on traits inherent to the wild coffee populations and their possible usefulness for breeders.

We compared the water use of four wild *Coffea arabica* populations along a rainfall gradient in Ethiopia. Measurements were carried out *in situ*, as well as in an experiment where seeds of the original sites were used to raise seedlings. Measurements tackled all relevant parts of water transport, i.e. soil conditions, the hydraulic conductivity of the root and the shoot system, stomatal control of gas exchange, and the atmospheric demand for water vapour.

Water use efficiency *in situ* was found to be higher in the dry than in the wet season, and on dry sites compared to wet sites, thus reflecting the availability of water. Unexpectedly, no correlation with the rainfall gradient was observed neither when measuring the hydraulic system *in situ*, nor when looking at the reaction of seedlings to drought and radiation stress under *ex situ* conditions. Plants from the driest site, Harennä, showed highest transpiration and production. The root system of Harennä trees was the most extensive compared to the other sites, and the hydraulic system showed the highest efficiency for water transport, stomatal behaviour was liberal. Therefore these plants were most vulnerable to drought stress, and eventually they were the first of all to be damaged by drought. Plants from the wettest site were most conservative in water use and longer withstood drought stress, but had lower productivity.

The results showed that the precipitation gradient was not reflected in a simple way by drought stress tolerance of trees. Presumably populations follow different strategies under drought stress conditions. Harennä populations might find their way out of serious droughts by putting their main effort into seed production (conserving the population as a whole), while trees from other populations seem to be more oriented to ensure survival of the individuals.

Keywords: Biodiversity, *coffea arabica*, in-situ conservation, water relations