

Effects of different soils and drought conditions on yield and water use efficiency of East African green leafy vegetables

Taewan Park¹, Sahrah Fischer¹, Christine Lambert², Thomas Hilger¹, Georg Cadisch¹

¹ Institute of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), University of Hohenheim

² Institute for Nutritional Sciences, University of Hohenheim

Abstract

Most research on crops, and interactions with soil fertility and water availability, has focussed on staple and cash crops. Green leafy vegetables, vital for food and nutrition security and human health, have been neglected. In a time when intensive agriculture is degrading soils, and climate change is causing increasing cases of erratic weather, this lack of knowledge can be harmful. The main aim of this research was to evaluate the effect of (i) soil fertility and (ii) drought on yield and water use efficiency of East African green leafy vegetables.

For this purpose, the green leafy vegetables cowpea (*Vigna unguiculata*), black nightshade (*Solanum nigrum*), and Sukumawiki (*Brassica oleracea* var. *viridis*) were cultivated in a greenhouse trial. The vegetables were subjected to three watering regimes, i.e. 25% (severe drought), 50% (mild drought) and 75% pot capacity (control), and cultivated on two soils (low vs. high fertility). The vegetables were evaluated on above- and belowground biomass, yield, nodulation in cowpea, total water use, water use efficiency of yield (WUE_Y) and Vitamin A, B1, C and E.

The yield of cowpea and nightshade was higher in the fertile soil under all watering regimes than in the infertile soil. Severe drought resulted in the highest WUE_Y of all vegetables in fertile soil (cowpea: 14.6 g L⁻¹, nightshade: 19.0 g L⁻¹ and Sukumawiki: 34.8 g L⁻¹). Sukumawiki had the highest WUE_Y in all treatments. In conclusion, cowpea and nightshade were more dependent on soil fertility than Sukumawiki in terms of yield, and Sukumawiki was the most productive vegetable under drought conditions. In rural areas, green leafy vegetables often represent the main source of nutrients in the diet. The results can be used to suggest better-quality and -quantity diets in rural areas and understand the effects of drought and soil fertility on food and nutrition security.