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Effects of Soils and Droughts on Yield, Water Use Efficiency and Thiamine of Leafy Vegetables

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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, water use and thiamine (Vitamin B1) content of green leafy vegetables. For this purpose, the green leafy vegetables cowpea (*Vigna unguiculata*), black nightshade (*Solanum nigrum*), and collard greens (*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 (WUEY) and thiamine. The yield of cowpea and nightshade was higher in the fertile soil under all watering regimes than in the infertile soil. Fertile soil had a higher WUEY than infertile soil in all three vegetables. Severe drought resulted in the highest WUEY of all vegetables in fertile soil (cowpea: 15.0 g L⁻¹, nightshade: 16.7 g L⁻¹ and collards: 37.3 g L⁻¹). Collards had the highest WUEY in all treatments. Thiamine of collards and cowpea was significantly increased in infertile soil under mild and severe drought (collards: 141 – 305 % and cowpea: 133 – 185 % to fertile soil), however the absolute thiamine amount was lower due to the decreased yield. In conclusion, cowpea and nightshade were more dependent on soil fertility than collards in terms of yield, and collards 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.

Keywords: Drought, food quality, green leafy vegetables, nutrition, soil fertility, vitamin