

Response of grain sorghum to fertilisation with human urine

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Abstract

Human urine is rich in valuable plant nutrients, and, when separately collected, it can substitute for fertilisers. A high valorisation of urine in crop production requires that each nutrient be balanced to match the actual demand. The objective of the present study was to evaluate the effectiveness of phosphorus- (P) and potassium- (K) balanced urine as a nutrient source for the cultivation of sorghum (*Sorghum bicolor* (L.) Moench). For this purpose, human urine, mineral fertiliser and compost plus urine were compared in field experiments. Triple super phosphate and potassium chloride were added to the urine fertiliser and potassium chloride to the compost-urine fertiliser to supply similar amounts of nitrogen (N), P and K (100, 44, 83 kg ha⁻¹ in 2006; 50, 22, 42 kg ha⁻¹ in 2007 and 2009) as NPK mineral fertiliser. The mineral fertiliser treatment was repeated with the addition of water at the same volume as contained in urine to one variant.

No distinct changes in the chemical soil properties were detected, but a consistent decrease in pH and cation content was observed for mineral fertiliser, while these parameters increased in the urine and compost treatments. The plants responded to all fertilisers with faster development and significant increases in the number of green leaves, size and total area. One hectare produced 520 kg grains in non-fertilised control soil while grain yields per hectare were 1657 kg in urine fertilised, 1244 kg in mineral fertilised and 1363 kg in mineral fertilised and water added and 2127 kg in compost fertilised plots.

Our results demonstrate that for the cultivation of sorghum, the N requirement can be fully met and the P and K requirements can be partially met by urine and substitute mineral fertilisers. Where feasible, the combined application of compost and urine is recommended. The long-term impact of fertilisation with human urine requires further investigation with respect to N efficiency, the effect of sulphur and soil salinisation.

Highlights

► Human urine is rich in valuable plant nutrients. A high valorisation of human urine as a nutrient source requires that each nutrient be balanced to meet the actual demand. ► P and K balanced human urine and mineral NPK fertilised grain sorghum performs equally well. ► Sorghum grain yield is slightly higher in urine than in mineral fertiliser treatments. The yield advantage might be due to the content of S and additional micro-nutrient in urine. ► The combined application of compost and urine results in better leaf area development and higher yield than in urine and mineral fertiliser treatments. The outperformance of compost appears to result from improved water holding capacity.

Keywords: Savannah agriculture; Soil fertility; Food security; Ecological nutrient cycling; Waste treatment