TROZ Centre for Agriculture in the Tropics and Subtropics
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Section: Agroecology in the Tropics and Subtropics

Leaf area and yield response of urine fertilised sorghum: A field trial in Ghana

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Introduction

A research project at Valley View University investigates the potential of different sanitary technologies to capture wastes rich in plant nutrients. While it seems obvious that these nutrients can enhance locally agricultural productivity, little is known about the profit margin of fertilisers derived from human urine or faeces.

Objective

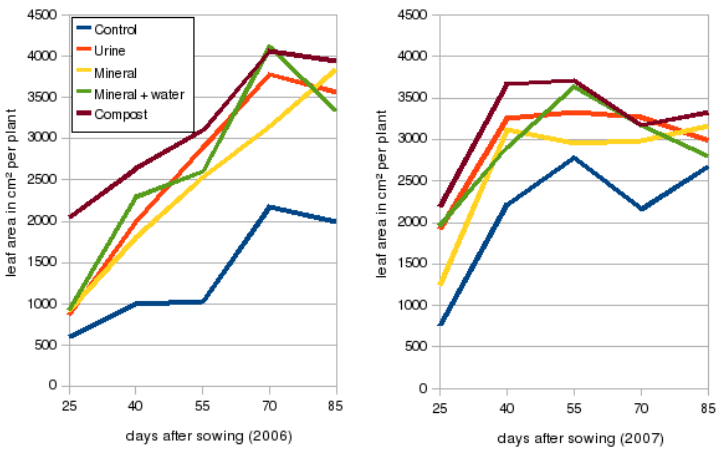
To investigate the nutrient efficiency of urine in comparison with mineral fertiliser and compost and to estimate the value of cereal fertilisation under local conditions.

Compact panicles of urine fertilised sorghum

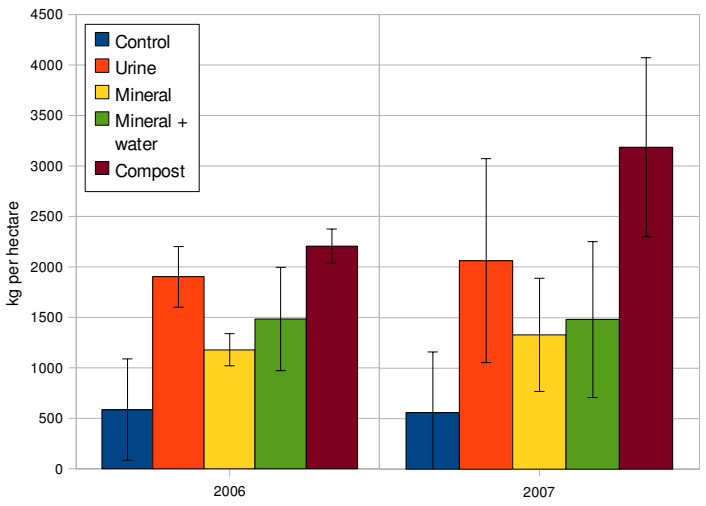
Method

The campus of the Valley View University lies 30 km north-eastern of Accra within Ghana's coastal savannah zone. A bimodal climate prevails characterised by two rainy seasons, from April to June and from September to October. The mean annual precipitation is about 800mm, but amount and distribution are erratic. Deeply weathered Ferric Acri- to Lixisols with a thin A horizon predominate. The 20 hectare agriculture area on campus was previously covered by bush savannah and spotted with termite hills. Land use was limited to browsing and fire wood extraction.

A trial compares urine treatment with unfertilised control and compound fertiliser, compound fertiliser plus water (same amount as supplied by urine) as well as compost treatment on the performance of cereals. The trial area was ploughed, harrowed and split into plots measuring 7*7.5 m to establish a 6*5 randomized block design. In 2004 and 2005 maize was sown and the nutrient supply was based on the application of 667 kg ha^{-1} NPK 15:15:15 compound fertiliser (100 kg N, 44 kg P and 83 kg K). Urine and compost were adjusted by the addition of TSP, KCl and Urea to provide the same amount of N, P and K. Due to the poor performance of maize under the local environmental conditions, sorghum was cultivated from 2006 onwards and the nutrient supply halved.



Leaf area development of sorghum fertilised with urine and alternative nutrient sources



Yield response of sorghum to fertilisation with urine and alternative nutrient sources

Results & conclusion

The leaf area development in the control plants was delayed and the maximum area smaller in both years in comparison with all treatments. In 2006 the initial leaf area expansion of the compost treated plants was distinctly faster than that of the other treatments. Probably a combined result of irregular rainfall and improved water holding capacity by the compost. In the second year leaf area development was faster, but maximal expansion smaller than in 2006 for all expect the control plots.

In both years the yield of the urine and compost treatment were significantly higher than in the control ($p<0.05$). It is concluded that the fertilisation with P and K enriched urine increases the yield of sorghum about 3.5 times under the given conditions. Therefore, as a nutrient source its efficiency is at least comparable to mineral fertiliser. The additional sorghum grain yield of 1.4 t ha^{-1} has locally a current market value of 1.000€ and sets off manifold the equivalent NPK fertiliser cost of 100€ (200€ without subsidies). Amending the soil with compost results in a 2.1 t ha^{-1} yield increase worth 1.600€.

Important questions that remain to be answered are: a) how stable is the yield advantage of urine fertilisation in long term, b) if urine is not enriched with P and K will a nutrient deficiency of the soil or plant develop, c) does continuous fertilisation with urine enhance salinisation under local semi-arid conditions and d) how can the equivalent fertiliser cost pay for collection, transport and application of urine?

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