Human excreta and food security in South Africa

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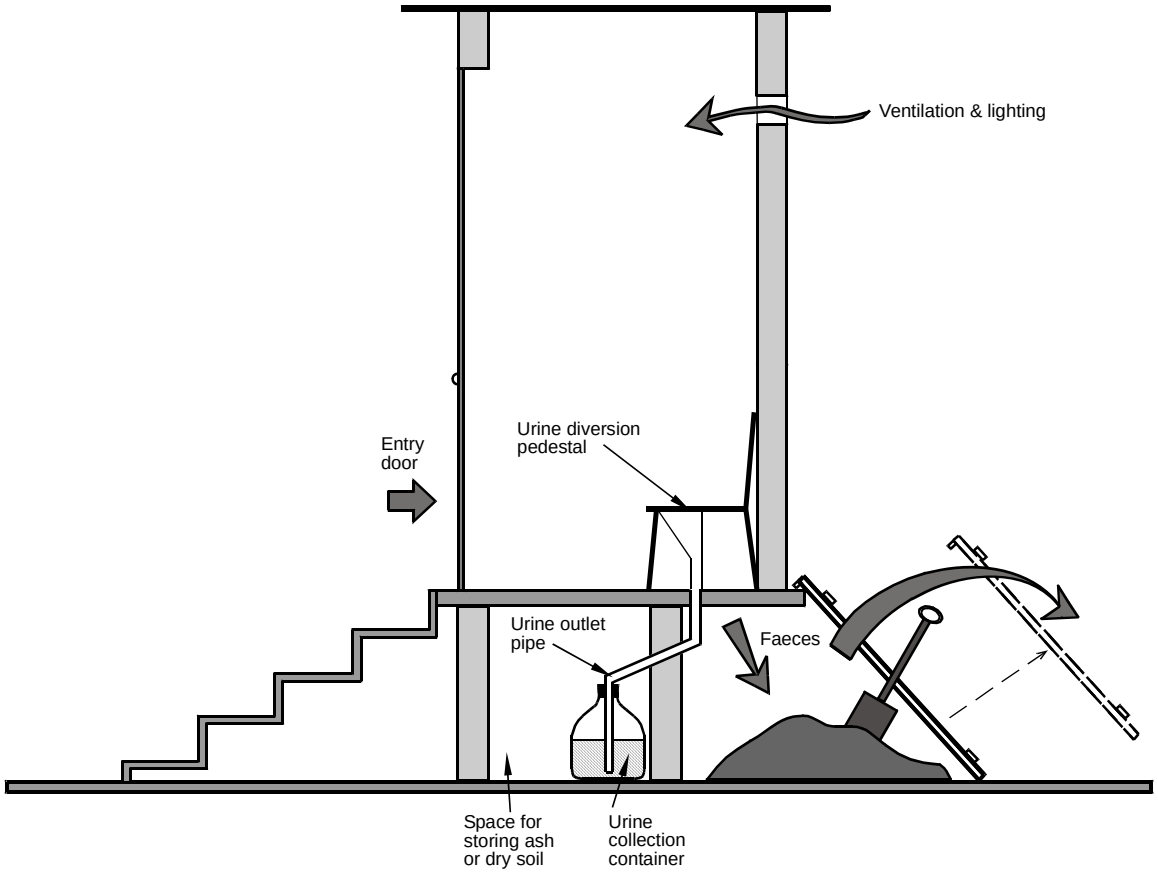
our future through science

Typical urine diversion toilet



Purpose of this research

- To determine the typical subsistence foods consumed by poor rural people in SA.
- To determine the quantities of N, P & K in these foods.
- To determine the quantities of N, P & K in urine and faeces.
- To determine the number of people required to fertilise each hectare of crop.

N, P and K in excreta

- The amount of N, P and K excreted by humans depends on the type and amount of food consumed.
- Also depends on the quantity of N, P and K in each food item.
- The amount of N, P and K consumed is equal to the amount excreted.

Some typical subsistence foods and NPK values for 10+ age group

Food item	Average g/p/d	N (mg/p/d)	P (mg/p/d)	K (mg/p/d)
Maize	839.5	4700.9	931.8	2518.4
Cooked leaves	40.7	143.3	16.3	232.0
Cooked potatoes	10.2	32.5	5.4	41.6
Dried beans	31.7	1080.3	136.0	415.3
Cooked cabbage	16.9	37.9	4.7	38.4
Cooked tomato/onion	23.6	71.6	14.4	82.7
Cooked sweet potato	9.6	26.1	4.5	50.9

Total N, P and K consumption per year for 10+ age group

	N	P	K
Total kg per person per year	3.98	0.58	1.47

Origin of nutrients in human excreta

	N (g/p/d)	P (g/p/d)	K (g/p/d)
Urine	12.0	1.0	3.0
Faeces	1.4	0.7	0.5

Estimated excretion of nutrients per capita for 10+ age group

	N (kg/p/yr)	**P (kg/p/yr)**	**K (kg/p/yr)**
Urine	3.56	0.34	1.26
Faeces	0.42	0.24	0.21
Total	3.98	0.58	1.47

N, P and K requirements of various subsistence crops for medium yields

Crop	N requirement (kg/ha)	P requirement (kg/ha)	K requirement (kg/ha)
Maize	20	7	16
Beans	35	16	23
Potatoes	80	107	230
Tomato	200	92.5	300
Pumpkin	100	70	60
Onion	165	90	80

Number of people's excreta needed to provide N, P and K requirements for crops

Crop	N requirement (people/ha/yr)		P requirement (people/ha/yr)		K requirement (people/ha/yr)	
	Urine	Faeces	Urine	Faeces	Urine	Faeces
Maize	6	48	21	29	13	76
Beans	10	83	47	67	18	110
Potatoes	22	190	315	446	183	1095
Tomato	56	476	272	385	238	1429
Pumpkin	28	238	206	292	48	286
Onion	46	393	265	375	63	381

Discussion/conclusions

- Agricultural production can be improved by utilising human excreta in the soil.
- This will improve household food security.
- Fertiliser application is a complex science, as climate and soils differ.
- Urine-faeces fertiliser should be applied according to the N requirement of the crop. Additional P and K may be needed.