



Sanitation Problem and Possibilities in Developing Countries

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Keywords: separating toilet, urine fertilizer, nitrogen, compost, cultivation.

INTRODUCTION

Water borne diseases are major problems in most of the developing countries. Open field defecation and unhygienic toilet are main cause of water sources contamination, which is common practice in many rural areas of Developing Countries. Potable water, better health and food demand are higher with population increase. Improvement of sanitation by using urine separation toilet can be a good idea to solve these problems. It reduces water source contamination and gives free fertilizer. In human excreta urine contains most of the plant nutrients N, P and K, about 90 % nitrogen, 50-60 % phosphorus and 50-80 % potassium. Generally pure human urine does not contain pathogens that can be transmitted through the environment. In another hand high pH due to urea transformed in to ammonia destroys the enteric micro-organisms such as *Salmonella* [1] and viruses [2].

Small scale systems can improve the sustainability of sanitation systems as they more easily close the water and nutrient loops. They also provide alternate solutions to centrally managed large scale infrastructures. Appropriate sanitation provision can improve the lives of people with inadequate sanitation through health benefits and reuse of possible waste products. Sanitation systems need to be selected according to the local social, economic and environmental conditions and should aim to be sustainable as well.

According to Wolgast [3], the annual amount of nitrogen, phosphorus and potash excreted by one person is equal to the amount of fertiliser needed to produce 250 kg of cereal which is also the amount of cereal that one person needs to consume per year. When urine is excreted, the major fraction of the nitrogen is present as urea and this is converted to ammonium, so its pH increases up on the concentration of ammonium. It is important that the whole system for collection, storage and handling of human urine is constructed to minimize nutrient losses.

Human urine collected in separating systems can be used directly as a liquid fertilizer [3]. the fertilizer value of pure urine is similar to NPK 18:2:5 [4].

The chemical composition of urine depends upon diet, amount of drinking water, physical activity, body size of the individuals and other environmental factors (Table 1).



Chemical fertilizers are expensive and also not available in many parts of the developing countries, particularly places where road is not connected. People have different opinion about this new concept. In many cultures excreta is not accepted to use in any purposes. People do not accept its direct use in edible plants particularly in vegetables. Still people need basic knowledge about collection of pure urine, handling during applies and doses to use properly. It can be more reasonable in dry season in many parts of the tropical reason, where they need to travel many kilometres to collect water. Use of urine in grass lands would improve the vegetation which protect for erosion and food for animals.

The nutrients in urine are in forms which are readily plant available. The nitrogen is in the form of urea, which readily degrades to ammonium and nitrate, phosphorous, potassium and sulphates are in ionic forms. This makes urine a unique biologic fertiliser. In most biologic fertilisers, like compost, the nutrients are mainly in organic form and these have to be mineralised before the nutrient becomes plant available. This is especially true and important for nitrogen, the nutrient which in most farming systems limits the yield the most and which gives the largest response when supplied.

Table 1. Nutrients contents in urine g/l.

N (t)	P (t)	K	References
2.4-3.1	0.15-0.23	0.59-1.7	Heinonen-Tanski et al., 2006
14.21	0.713	2.51	Regmi et al.,2005
4.6-5.3	0.26-0.42	not given	MATRA Project Romania
7.3	0.7	1.7	Swedish EPA, 1995
3.8	0.4	1.5	FAO,2001 for Kenya
2.5	0.17	1.2	Danish EPA 2001
6.7	0.5	1.8	Simons Jürgen University of Bonn (www.wiwmbh.de)

N (t) = total nitrogen; P (t) = total phosphorus; K = potash

METHODS

Pure urine can be collected by using urine-separating toilets available in markets or by using different pan only for urination. Collected urine can be used daily/weekly with recommended amount and procedure, so all seasonal crops can be cultivated. Urine fertilizer should apply to the soil nearest to the plant root; direct apply on any plant parts can burn it. It can be use in different plants i.e. vegetables, flowers, fruits and timbers. It can be also use in playing field and cattle grazing field. Pure urine can also be use with greywater for fertigation if it is possible.

It is advantageous and saves labour if the urine is utilised without dilution. It is also advantageous to apply water after fertilisation to better flush the urine into the soil if it is possible. Simply the urine can be poured from the jerry can directly for fertilization. It can be better if a flexible hose is connected to the opening, to increase precision in application and to prevent splashing.



RESULTS

Urine separating toilet is more feasible for rural and peri-urban area in developing countries. People can get urine fertilizer as a new natural resource. It improves public health by improving water and food quality. Urine fertilizer improve plants and yields quality, it helps in growth of the plants, producing more yields and making more colorful and attractive flowers, which is important for pollination and aesthetic value. Improvement of vegetation for cattle increases milk and meat production. It also protects soil erosion with vegetation increase in slope area. Collections of urine separately reduce total amount of faecal matter which make easier for composting. Urine collection separately and use as a fertilizer or use with greywater for fertigation can reduce wastewater pressure in municipal wastewater system.

CONCLUSION

Industrial fertilizer is not adequately available and expensive. Fertilizer demand is higher due to high food demand with increasing population, which could be substituted to a certain degree by using urine fertilizer. Free access fertilizer promotes to cultivate all seasonal vegetables or plants. It improves public health by reducing contamination level and can get free fertilizer. The pit of the cheap pit latrine can be use for long time due to dramatic reduction of the faecal matter. Urine with greywater can be more reasonable during dry season.

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