



## Human urine is fertilizing crops and saving money in India

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Human urine is indeed not an unwanted waste, but it is a useful resource, Urine, it turns out, is a huge and mostly untapped reserve of crop fertilizer. If Indians collected and applied 40 per cent of their urine, the country could save 1.2 billion rupees in fertilizer costs.

**Generation rate of human urine per person :** Human urine is a liquid waste product of the human body secreted by the kidneys by a process of filtration from blood called urination and excreted through the urethra. As urine is produced after filtration of the blood in the kidneys, it contains low-molecular-weight compounds as proteins are not filtered. Each individual produces 1–1.5 L of urine per day in 4–5 times (and an adult person excretes on average of 500 L urine per year). However, children urinates about half of that of the adults amount.

Human urine has approximately the same composition of fertilizing elements as liquid fertilizer used for crop production. The relatively high cost of standard compost production and chemical fertilizers is a constraint particularly for economically less sound farmers but still they need to cultivate food to sustain their life. With a better-closed nutrient loop, many more people, including low-income farmers in the South, would be able to produce more food and other plant products by using human urine. Use of human urine as an alternative source of fertilizer in agriculture not only reduce the fertilizer cost but also it reduce the pollution effects from unsafe excreta disposal and surplus use of chemical fertilizers and protect surface and groundwater and the air.

**Composition of human urine :** Of the human excreta, urine contains the major part of the daily excretion of nitrogen (N), phosphorous (P) and potassium (K) contributing 88 per cent, 67 per cent and 73 per cent, respectively. However, the composition of human urine varies from person to person and from region to region depending on his/her feeding habits, the amount of drinking water consumed, physical activities, body size, and environmental factors. In human urine about 75–90 per cent of N excreted is urea and the remainder being in the form of creatinine, amino acids and uric acid. Most of the nitrogen fractions in urine are taken up by plant and which is same as that of the urea or ammonium fertilizer

with nitrogen efficiency approximately 90 per cent of that of mineral fertilizer. Concentration of heavy metals in human urine is also lower than that of farmyard manure and have less cadmium than artificial P-fertilizers, making them clean fertilizers. Moreover, it comprises of trace elements B, Cu, Zn, Mo, Fe, Co and Mn.

**Isolation of human urine :** Separating human urine at source enhances the sustainability and efficiency of wastewater management as human urine containing about 80 per cent of the total nitrogen load in wastewater. Moreover, source-separation of urine could significantly improve effluent quality and saves energy utilization, as well as investment costs of the receiving wastewater treatment plants. Besides this, human urine collected in separating systems can be used directly as a liquid fertilizer. When urine becomes mixed with faeces, this mixture is much more difficult to handle hygienically outside the wastewater treatment plants. To overcome this problem, a model of ecological sanitation (ECOSAN) toilet, alternatively urine diverting toilet or no mix toilet can be used to separate human urine at source for the purpose of better recycling of nutrients from human urine.

**Human urine in agriculture :** Even though, human urine is a valuable source of different nutrients that has been used since ancient times to enhance the growth of plants, notably leafy vegetables and is universally available at little-to-no cost. Based on the scientific research in use of human urine for crop production, the recommendation of human urine was derived.

**Precaution of human urine use :** Therefore, human urine may be used for agricultural production by maintaining the following precautions:

- Human urine is generally free of pathogens (germs) when excreted by a healthy person. However, post excretion, cross contamination, may occur. Therefore, urine should never be applied directly onto the part of the plant to be harvested and crops should not be fertilized within a month before harvest followed by the test of possible contamination due to endocrine disruptors.
- Spreading the urine at the wrong time or unevenly on the field can cause considerable crop failures.

Recommendation of human urine dosage to different crops				
crop	Plants/ha	Recommended dose of fertilizers (kg/ha)	Human urine (lit/ha)	Urine required / plant (lit)
Maize	55,555	150:75:40	50,000	0.90
Finger millet	3,33,333	100:50:25	33,333	0.60
Paddy	1,11,111	100:50:50	33,333	0.29
Banana	2500	405:245:507	1,35,000	54.00
Tomato	24,691	250:250:250	38,333	1.55



Gents toilet



Ladies toilet

#### Structure of Ecosan toilet

- From the angle of hygiene, urine should be stored in a sealed vessel for six months before spreading;
- Naturally, as with all other manures, hand washing after working with urine is strongly recommended.

**Conclusion :** The ecological sanitation concept can provide many benefits to communities and individual households. The recycling of nutrients not only improves the environment, but can provide safe sanitation in areas with water shortage and improve food security by providing cheap fertilizers. However, the systems put a lot of emphasis on the householder to operate the facility and more critically, they must operate it effectively else they will place themselves and the local community at risk. In urban areas there is likely to be a need for good service provision to empty facilities and take the compost to a suitable place to be used. In order to



realise the benefits of ecological sanitation care must be taken to develop a suitable solution for the area in question. Careful planning must take place to assess people's

willingness to handle the by-product of ecosan and whether they will be willing to use this for agriculture. The recent research reveals that it is possible to use human urine as an alternative source of multnutrient fertilizer, which could be achieved only by introducing new areas of scientific research in

research frontier. Success will ultimately depend on the employment of a holistic approach to integrate the work of plant biologists, soil microbiologists, agronomists and environmental engineers.

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