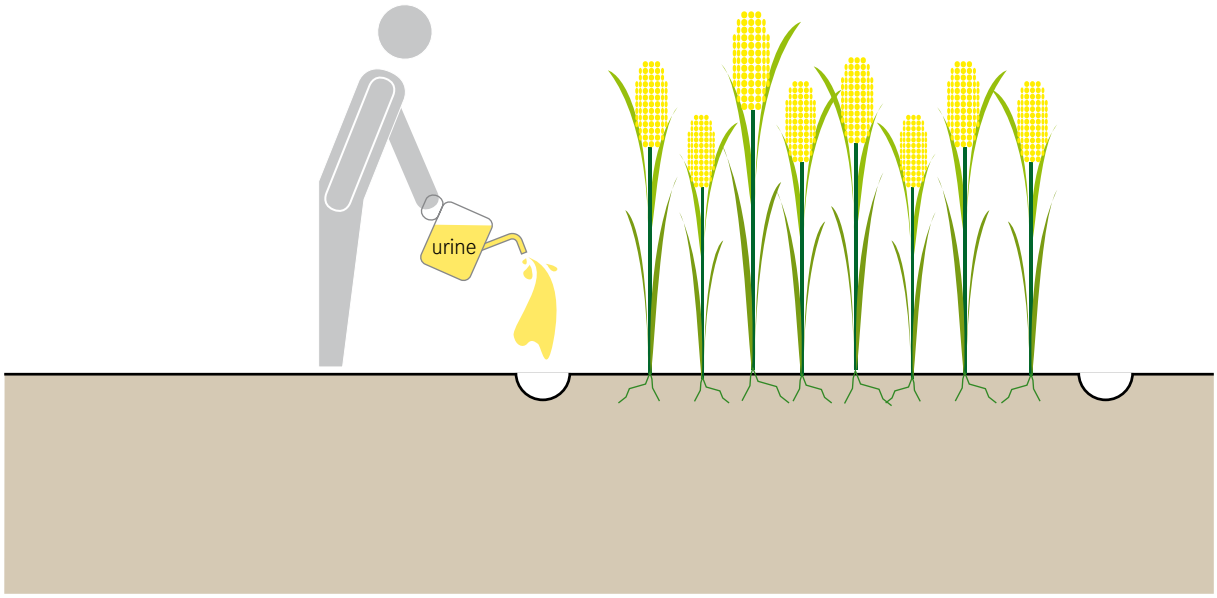
D.2 Application of Stored Urine

Applicable to: **Systems 4, 5, 9**

Application Level:	Management Level:	Inputs: Stored Urine
★★ Household ★★ Neighbourhood ★★ City	★★ Household ★★ Shared ★★ Public	Outputs: Biomass



Stored urine is a concentrated source of nutrients that can be applied as a liquid fertilizer in agriculture and replace all or some commercial chemical fertilizers.

The guidelines for urine use are based on storage time and temperature (see WHO guidelines on excreta use in agriculture for specific requirements). However, it is generally accepted that if urine is stored for at least 1 month, it will be safe for agricultural application at the household level. If urine is used for crops that are eaten by people other than the urine producer, it should be stored beforehand for 6 months.

Another beneficial use of urine is as an additive to enrich compost. Technologies for the production of urine-based fertilizers are currently under research (e.g., struvite, see Emerging Sanitation Technologies, p. 166).

From normal, healthy people, urine is virtually free of pathogens. Urine also contains the majority of nutrients that are excreted by the body. Its composition varies depending on diet, gender, climate, water intake, etc., but roughly 88% of nitrogen, 61% of phosphorus and 74% of potassium excreted from the body is in urine.

Design Considerations Stored urine should not be applied directly to plants because of its high pH and concentrated form. Instead, it can be:

1) mixed undiluted into soil before planting;
2) poured into furrows, but at a sufficient distance away from the roots of the plants and immediately covered (although this should take place no more than once or twice during the growing season); and
3) diluted several times, whereby it can be frequently used around plants (up to two times weekly).

The optimal application rate depends on the nitrogen demand and tolerance of the crop on which it will be used, the nitrogen concentration of the liquid, as well as the rate of ammonia loss during application. As a general rule of thumb, one can assume that 1 m^2 of cropland can receive 1.5 L of urine per growing season (this quantity corresponds to the daily urine production of one person and to 40-110 kg N/ha). The urine of one person during one year is, thus, sufficient to fertilize 300 to 400 m^2 of cropland.

A 3:1 mix of water and urine is an effective dilution for vegetables, although the correct amount depends on the soil and the type of vegetables. If diluted urine is used in an irrigation system, it is referred to as “fertiga-

tion" (see D.6). During the rainy season, urine can also be applied directly into small holes near plants; then it is diluted naturally.

Appropriateness Urine is especially beneficial for crops lacking in nitrogen. Examples of some crops that grow well with urine include: maize, rice, millet, sorghum, wheat, chard, turnip, carrots, kale, cabbage, lettuce, bananas, paw-paw, and oranges. Urine application is ideal for rural and peri-urban areas where agricultural lands are close to the point of urine collection. Households can use their own urine on their own plot of land. Alternatively, if facilities and infrastructure exist, urine can be collected at a semi-centralized location for distribution and transport to agricultural land. Regardless, the most important aspect is that there is a need for nutrients from fertilizer for agriculture which can be supplied by the stored urine. When there is no such need, the urine can become a source of pollution and a nuisance.

Health Aspects/Acceptance Urine poses a minimal risk of infection, especially when it has been stored for an extended period of time. Yet, urine should be carefully handled and should not be applied to crops less than one month before they are harvested. This waiting period is especially important for crops that are consumed raw (refer to WHO guidelines for specific guidance).
Social acceptance may be difficult. Stored urine has a strong smell and some may find it offensive to work with it or to have it nearby. If urine is diluted and/or immediately tilled into the earth, however, its smell can be reduced. The use of urine may be less accepted in urban or peri-urban areas when household gardens are close to peoples' homes than in rural areas where houses and crop land are kept separate.

Operation & Maintenance Over time, some minerals in urine will precipitate (especially, calcium and magnesium phosphates). Equipment that is used to collect, transport or apply urine (i.e., watering cans with small holes) may become clogged over time. Most deposits can easily be removed with hot water and a bit of acid (vinegar), or in more extreme cases, manually chipped off.

Pros & Cons

+ May encourage income generation (improved yield and productivity of plants)
+ Reduces dependence on costly chemical fertilizers
+ Low risk of pathogen transmission
+ Low costs
- Urine is heavy and difficult to transport
- Smell may be offensive
- Labour intensive
- Risk of soil salinization if the soil is prone to the accumulation of salts
- Social acceptance may be low in some areas

References & Further Reading

_ Morgan, P. R. (2004). *An Ecological Approach to Sanitation in Africa. A Compilation of Experiences.* Aquamor, Harare, ZW. Chapter 10: The Usefulness of Urine.
Available at: www.ecosanres.org

_ Morgan, P. R. (2007). *Toilets That Make Compost. Low-Cost, Sanitary Toilets That Produce Valuable Compost for Crops in an African Context.* Stockholm Environment Institute, Stockholm, SE.
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_ von Münch, E. and Winker, M. (2011). *Technology Review of Urine Diversion Components. Overview of Urine Diversion Components Such as Waterless Urinals, Urine Diversion Toilets, Urine Storage and Reuse Systems.* Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Eschborn, DE.
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_ Richert, A., Gensch, R., Jönsson, H., Stenström, T. A., and Dagerskog, L. (2010). *Practical Guidance on the Use of Urine in Crop Production.* EcoSanRes, Stockholm Environment Institute, Stockholm, SE.
Available at: www.susana.org/library

_ WHO (2006). *Guidelines for the Safe Use of Wastewater, Excreta and Greywater. Volume 4: Excreta and Greywater Use in Agriculture.* World Health Organization, Geneva, CH.
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(Health risks and recommended guidelines for urine application)