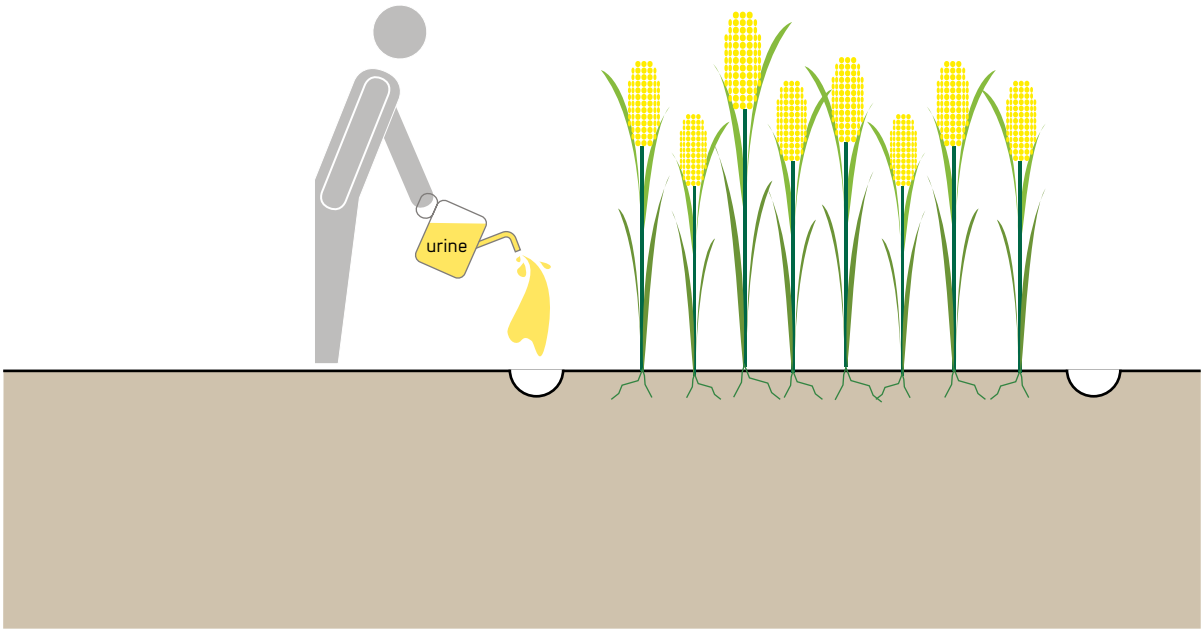
Application of Stored Urine

Phase of Emergency	Application Level / Scale	Management Level	Objectives / Key Features
Acute Response * Stabilisation ** Recovery	** Household ** Neighbourhood ** City	** Household ** Shared ** Public	Productive use of nutrients as liquid fertiliser
Space Required	**Technical Complexity**	**Inputs**	**Outputs**
*** High	* Low	● Stored Urine	● Biomass



Stored urine coming from urine diverting sanitation systems (U.2, S.8, S.9) is a concentrated source of nutrients that can be applied as a liquid fertiliser in agriculture (to replace or substitute chemical fertilisers) or as an additive to enrich compost.

Urine contains most of the nutrients excreted by the body. Soluble substances in urine include essential plant nutrients such as the macronutrients nitrogen (N), phosphorus (P) and potassium (K) as well as smaller quantities of micronutrients such as boron (B), iron (Fe) and zinc (Zn). The nutrients in urine are in a form readily available to plants, similar to ammonia and urea based fertilisers, and with comparable results on plant growth. The World Health Organization guidelines recommend that urine is stored for at least one month before being used in agriculture at the household level. In larger systems, storage times should be longer (up to six months). Urine from healthy people is considered free of pathogens. For fully grown individuals there is nearly a mass balance between nutrient consumption and excretion. The nutrient content in urine is dependent on diet, sex, climate, water intake, time of the day when excreted etc. Roughly 88 % of N, 61 % of P and 74 % of K excreted by the human body is in urine.

Design Considerations: Stored urine should not be applied directly to plants due its high pH. Instead, it can be applied directly to the soil before planting, by pouring into furrows or holes at a sufficient distance away from plant roots and immediately covered, or it can be diluted several times, and used frequently on plants as a general fertiliser. A good availability of nutrients is particularly important in the early stages of cultivation. Once crops enter their reproductive stage they adsorb few nutrients. Fertilisation should therefore stop after ⅔ to ¾ of the time between sowing and harvest. The optimal application rate depends on N demand, the tolerance of the crops and N concentration in the (diluted) urine. The annual urine volume from

one person is sufficient to fertilise around 300–400 m^2 of cropland. There is no standard recommendation for dilution and existing recommendations vary widely (usually between ratios of 1:3 to 1:10). The advantages of dilution are a noticeable odour reduction and a decreased risk of over-application. At the same time dilution increases the total volume and thus labour and transport needs. Diluted urine can also be used like any fertiliser in (drip) irrigation systems, commonly referred to as "fertigation".

Materials: Materials needed include sufficient closed containers to store urine for one month or more, agricultural equipment to dig furrows and holes and watering pots or (drip) irrigation devices. People involved in using urine in agricultural production should be provided with personal protective equipment such as shoes, gloves and masks.

Applicability: Urine Application is not considered a priority in acute emergencies, but might be an option during the stabilisation and recovery phases provided it is acceptable to the local population and farmers have an interest in using urine as a fertiliser. Urine fertilisation is ideal for rural and peri-urban areas where agricultural lands are close to the point of urine collection. Households can use urine on their own plot of land or if facilities and infrastructure exist, urine can be collected at a semi-centralised location for distribution and transport to agricultural land. Stored urine has a relatively strong odour and can be offensive to work with. If urine is diluted and immediately tilled into the soil the odour can be reduced.

Operation and Maintenance: Over time, some minerals in urine will precipitate (e.g. calcium and magnesium phosphates). Equipment that is used to collect, transport or apply urine (e.g. watering cans with small holes) can thus clog over time. Most deposits can easily be removed with hot water and a little weak acid, such as vinegar.

Health and Safety: Urine poses a minimal risk of infection, especially when stored for an extended period, however urine should be carefully handled and a waiting period of one month between fertilisation and harvest should be respected. Urine should be applied close to the ground, thus reducing the possibility of direct contact with the edible parts of plants. As an additional safety measure, urine use could be restricted to non-food crops (flowers), crops that are processed or cooked before consumption (e.g. eggplant), or crops or trees that allow for a minimum distance between the soil and harvested part of the crop (e.g. all kinds of fruit trees). As hormones and pharmaceuticals are partly excreted with urine, there is a small possibility that these will be adsorbed by plants and enter the human food chain. This risk is however minimal when compared to the risks associated with the pharmaceuticals in animal manure, pesticide use or the direct discharge of untreated wastewater into water bodies.

Costs: The costs for urine application are low. However, urine application can be labour intensive and land availability could be an issue. If urine needs to be transported over longer distances, transport costs might be considerable and not always economically viable as urine has a relatively low value per volume. However, urine fertilisation could offer livelihood opportunities, improved yields and the potential to substitute costly chemical fertilisers with a readily available product.

Social Considerations: The potential application of urine in agriculture should be discussed with the affected communities beforehand. Regular training or orientation may be needed in order to support acceptance, ensure proper application and to avoid accidental misuse.

Strengths and Weaknesses:

- ⊕ May encourage income generation (improved yields)
- ⊕ Reduces dependence on chemical fertilisers
- ⊕ Low risk of pathogen transmission
- ⊕ Low cost

- ⊖ Urine is heavy, difficult to transport and application is labour intensive
- ⊖ Odour may be offensive
- ⊖ Risk of soil salinisation if the soil is prone to accumulation of salts
- ⊖ Social acceptance may be low in some areas

→ **References and further reading material for this technology can be found on page 195**