EcosanRes Uganda knowledge node

NETWAS Uganda

Risks and Safe Handling of excreta from composting toilets: Arbor loo and Fossa Alterna toilets

Composting toilets are toilets with no urine diversion. These are Fossa alterna and Arborloo toilets.

FOSSA ALTERNA- Is a double alternating pit compost toilet

It is made up of 6 parts; two pits (about 1.5m deep), two ring beams to protect the two pits, a single concrete slab which sits on one of the ring beams and the toilet house for privacy. Each pit fills up with a mix of excreta, soil, wood ash and leaves. Leaves are put in the base of the pit before use and every day some soil, leaves and ash are added to the pit. When the first pit is full, the slab and structure are moved on to the second pit and top soil placed over the contents of the first pit which is then left to compost. The second pit is then put to use while the contents of the first pit are composting.

Empty fossa alterna pit

Excreta from a fossa pit after 12 months

Arbor loo- Is a single pit compost toilet

It is a single pit compost toilet made up of 4 parts; the pit (about 1 m deep), the ring beam to protect the pit, the concrete slab which sits on the ring beam and the toilet house for privacy. The pit fills up with a mix of excreta, soil, wood ash and leaves. Leaves are put in the base of the pit before use and every day some soil and ash are added to the pit. Dry leaves are also added from time to time. When the pit is full, parts of the toilet are moved to another place, rebuilt and used in the same way again. A thick layer of soil is placed over the filled pit. A young tree or banana stem is planted in this soil, watered and cared for.

BENEFITS OF USING EXCRETA IN AGRICULTURE

The use of excreta in agriculture improves the nutrient content and water retention capacity of the soil. Feaces are a good soil conditioner due to their possession of very high organic matter. The content of organic matter in feaces increases the water holding and ion-buffering capacities of soils, which is of importance for improving soil structure and stimulates microbial activity.

The total amount of nutrients excreted is lower in feaces than in urine but the concentration of [especially] phosphorus and potassium is higher in feaces than in urine.

Urine has a formulation similar to ammonium and urea composition, which are fertilizers with comparable results on plant growth. It is a liquid fertilizer, which is rich in valuable plant nutrients i.e.

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nitrogen, potassium, phosphorus and sulphur. This is because most of the nutrients absorbed by the human body from the food we eat are excreted via urine.

When excreta is applied to crops instead of fertilizers, we save the expenditure on the latter while achieving the same yield increase.

A well-nourished plant will grow faster, develop more leaves and produce greater yield.

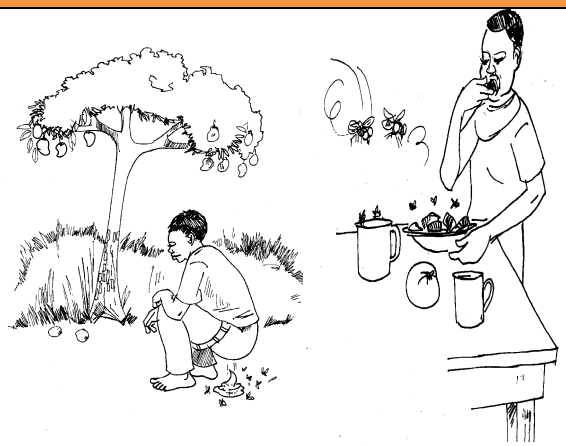
RISKS ASSOCIATED WITH HUMAN EXCRETA FROM COMPOSTING TOILETS

The main cause of disease is the entry of disease causing pathogens into some one's body. When a person excretes a pathogen which is not contained or destroyed, it contaminates the environment through fingers, fluids, food and flies, which become pathways of disease transmission. Uncontained pathogens also contaminate crops, soil, surface water and ground water.

Feaces collected from composting toilets have a higher moisture content, which makes pathogen die- off slower. The products pose a higher health risk and need to be handled with more care than products from facilities with urine diversion.

Some of the human illnesses that arise from using untreated or poorly treated feaces include inflammation of the intestines, diarrhoea, abdominal pain, fever, nausea; arthritis; Typhoid/paratyphoid fever - headache, dysentery, vomiting, Cholera, joint pains, Hepatitis and Poliomyelitis.

These illnesses may result in poor health, death or effects that last a lifetime.



One gram of feaces can contain:

- 10,000,000,000 viruses
- 10,000,000,000 bacterial pathogens
- 1,000,000,000 protozoan cysts
- 100,000 helminth eggs

SAFE HANDLING OF BY PRODUCTS FROM COMPOSTING TOILETS

Safe handling, using multi-barrier approaches, which involve treatment of the feaces, risk reduction during handling and in agricultural practices as well as the individual behavioral (hygiene) aspects minimizes the risks associated with reuse of excreta. Safe handling of Ecosan by products aims at maximizing the protection of human health and the beneficial use of important resources.

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The feaces are sanitized on the principle of predation and ample storage time that allow composting and soil composting. Composting feaces requires the addition of materials that provide structure and balance the nutrients.

Soil mixed with excreta

Composting is the microbiological degradation of the organic material to a humus-like stable product under aerobic, moist and self-heating conditions.

Primary processing of excreta from a fossa alterna toilet:

What to do	**Reason**
User interface at the toilet	
Place a sack of leaves to the bottom of the pit before using it.	To minimize feacal matter from sticking on the floor.
Stockpile carbon- rich materials such as leaves, straw, twigs, branches, paper (avoid glossy prints), cardboard and wood. Chop them to pieces not thicker and longer than our fingers for adding to excreta.	These materials are the energy source for compost microbes and provide structure to the compost. A good structure allows air to circulate through the compost and lets the microbes' breath (aerobic process).
Gather green materials. Fresh leafy green plant material, food waste (but not meat), peelings, garden refuse and rotten fruit for adding to excreta.	They are easy to digest and a nitrogen source for microbes. Sufficient green material is important in order to achieve initial high microbial activity and elevated temperatures.
Add a good amount of soil/ and or wood ash after each defecation. This is in addition to green and carbon-rich material. Adding ash and leaves helps make better compost	To increase the pH of the contents of the pit/vault. This will enable the presence of a variety of organisms that break down the solid into humus. Different types of organisms affect each other by predation, releasing antagonistic substances or competition for nutrients. The more soil added the better, but this must be offset against filling the pit too fast

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Primary storage and treatment	
A period of 12 months of composting in shallow pits [without addition of fresh excreta] is recommended before application to gardens.	To allow further pathogen die-off due to UV radiation, dryness and competition with other soil organisms.
Most pathogenic bacteria are destroyed within 3-4 months due to competition with soil based organisms and unfavorable environmental conditions (very dry climate). In composting, several processes kill pathogens. These include competition between indigenous microorganisms and pathogens, antagonistic relationships between organisms, the action of some antibiotics produced by certain fungi and natural die-off in the compost environment.	Bacteria adapted to living in the gut are not always capable of competing with other organisms in the general environment for scarce nutrients. This may limit the ability of feacal bacteria to reproduce and survive in the environment.
Secondary processing	
To render human excreta safe for agricultural use, secondary treatment is recommended, regardless of the time the human excreta has been kept in the pits of a Fossa Alterna. Some pathogens (e.g. ascaris) may still be infective after six months of primary processing because it may not be adequate time to compost human feaces. In areas where ambient [surrounding] temperatures reach up to 20 °C, a total storage time of 1.5 to 2 years (including the time stored during primary treatment) will eliminate most bacterial pathogens. In areas where the ambient temperatures reach up to 35 °C, a total storage period of 1 year is ok. In areas with higher temperatures, the storage time is further reduced. The compost product is usually free of pathogens.	
What to do during secondary processing	**Reason**
Secondary treatment site should be fenced off.	To ensure no access for children, who can pick up pathogen infections.
Insulate large heaps of compost [garden compost pile or manure pile] using materials such as tarpaulin or heavy duty polyethylene to cover to the heap. Alternatively, application of a layer of soil or old compost will also act as an insulator. Grass can also be used for insulation though it allows heat loss through its voids via convection and radiation.	The high temperatures in the compost heap will kill pathogens because all pathogens have threshold temperatures beyond which their viability ceases.
Add more urea or lime.	To increase the pH (alkaline treatment).
Compost should be about as moist as a wrung out sponge. Squeeze a handful of compost to get a good indication of its water content.	To have optimum moisture and temperature. A dry compost pile will decompose slowly as all organisms need water for growth. If the pile is too wet, the air supply will be limited, and a bad odour will result, causing anaerobic decomposition

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Turn the compost inside out every ten days.	To make sure that all materials get exposed to the high temperatures in the centre. The more often you turn the compost, the quicker the compost will be ready because the material gets air. If the compost does not contain a sufficient amount of good quality structure material, turning improves aeration too.
Check the temperature inside the pile. Between the first and second turning, the inside of the pile should be too hot to keep your hand in the core for a prolonged time.	Optimum temperature will promote quick decomposition. High temperatures during the 2nd and 3rd week are usually sufficient to deactivate most pathogens and kill weed seeds.
In urban homesteads, transfer the feacal material into a cement jar or container.	This is done because of lack of space in urban homesteads and prevent ground water pollution.
Application Techniques	
After 12 months, the material can be directly spread in gardens and ploughed/ dug into existing soil in the family garden.	To reduce contact in the garden especially with the edible parts of plants.
Treated feaces should be incorporated in the soil before crop establishment.	A safety barrier to protect workers.
General safe handling practices of Ecosan byproducts from a Fossa Alterna: Safe handling of Ecosan byproducts operates on the principle of reducing contact with the material	
Wear gloves, rubber boots (shoes), and overalls when emptying processing chambers or pits. Careful hand washing with clean water and soap should be done after handling the Ecosan byproducts.	This is to avoid contact between people and the Ecosan by-product. To block the feacal-oral route.
Only adults and not children should empty the chambers/pits.	Children may fail to adhere to the hygiene rules.
Use proper handling tools.	Reduce contact with the Ecosan by-product.
Dig or plough the treated feacal material into the soil immediately upon application.	Reduce contact in the garden.
Clean the used equipment well afterwards.	Reduce contact with the Ecosan by-product.
Handling and transport systems should involve minimal contact with the Ecosan by-product.	This is to avoid contact between people and the Ecosan by-product thus limiting the secondary spread of pathogens through equipment.
Clean the used equipment well afterwards especially if they are to be used for other purposes.	
Hygienic food handling and food preparation practices e.g. washing and peeling (if possible) or	For disease vector intermediate control.

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cooking the harvested crops before consumption.	
Processing of excreta from an arborloo toilet The feaces in an arborloo are sanitized on the principle of predation, storage time and avoiding contact	
What to do	**Reason**
User interface at the toilet	
The pits should have a maximum depth of 1.5m.	To reduce the risk of contamination of underground water supplies.
Urine and feaces are deposited in the pit and covered with equal amounts of soil, ash and leaves after each defecation.	To encourage the presence of other microorganisms to destroy pathogens by predation. To aid efficient composting. To increase the pH of the contents of the pit/vault. Sufficient green material helps to achieve initial high microbial activity and elevated temperatures.
Measures at the site	
When the pit is almost full, top up with soil, and plant a tree or bananas directly in a shallow pit. When the arbor loo is full, a thick layer of soil (15cm deep) is placed over the filled pit	No further contact is made with the composted human excreta, so it is safe.
Wear gloves and rubber boots (shoes), when planting a tree/ banana in the pit. Careful hand washing with clean water and soap should be done afterwards.	This is to avoid contact between people and the Ecosan by-product. To block the feacal-oral route.
Clean the used equipment well afterwards.	Reduce contact with the Ecosan by-product.
Only adults and not children should plant the tree/ banana in the pit.	Children may fail to adhere to the hygiene rules.
Summary of safe factors in handling Ecosan by products	
Good pathogen reduction + Good post-latrine handling + Good hygienic behaviour = Safe (ecological) sanitation	

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