

Ecological Sanitation in Malawi – putting recycling into practice



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The concept of ecological sanitation was first officially practiced in Malawi in 2001. It was introduced by WaterAid, and the first projects were undertaken in Salima and by the CCAP in Embangweni. Later it was taken up by COMWASH in Phalombe and Thyolo.



Recycling of nutrients present in human excreta has been practiced in Malawi for generations

The growing of fruit trees in filled and abandoned toilet pits is commonly practiced in Malawi in both rural and peri-urban areas.

This simple yet effective method is now used in low cost ecological sanitation programmes.



The concept of **ecological sanitation** embraces more than toilet provision alone.

It is a philosophy which attempts to provide sanitation where pollution of the environment is reduced, water is conserved, and where the nutrients available in processed excreta can be used in agriculture and growing trees.

Remarkable progress has been made in Malawi where a range of lower cost methods of practicing ecological sanitation have been put to use.



Types of eco-toilet

There are four types of toilet used in Malawi where processed human excreta can be recycled.

1. The **single pit composting toilet** or **Arborloo** – a shallow pit toilet where a tree is planted on the filled pit and the toilet moved to another location.



2. The **Children's toilet**. This is an Arborloo type toilet designed for children. Trees are also planted on filled pits.



Types of eco-toilet



3. The **double pit composting toilet** known as the ***Fossa alterna*** alternates the use of two shallow pits where compost is produced and dug out.



4. The **urine diverting toilet** where urine and faeces are separated.



Types of eco-toilet

Converting excreta to compost

In each case **soil** and **wood ash** are added to the toilet pit or vault to accelerate the conversion of human excreta into **compost**.

The addition of **leaves** also helps to make better compost.

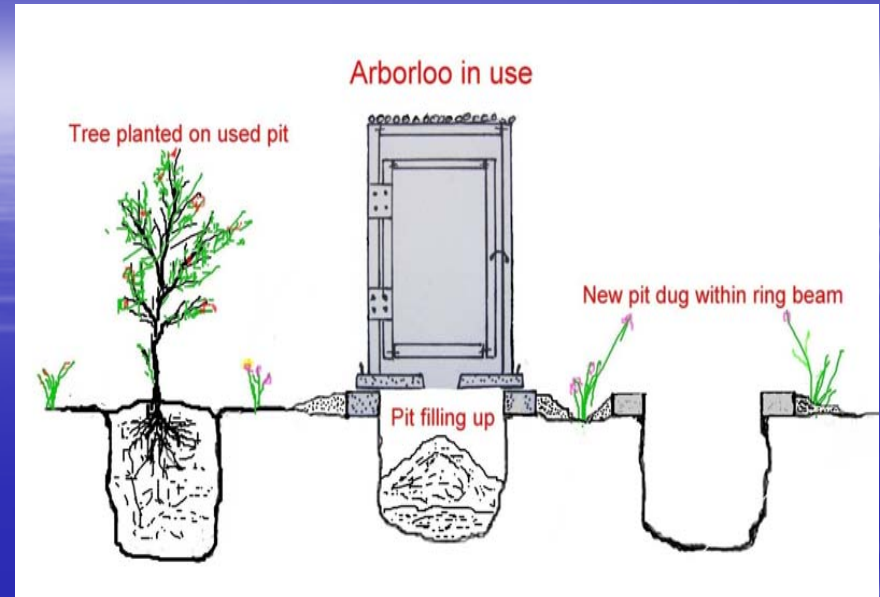
The regular addition of ash and soil also helps to reduce flies and odours in the toilet.



Types of eco-toilet

The Arborloo

This is the simplest eco-toilet. It consists of a shallow pit between 60cm and 80cm wide and 1 metre deep. The pit is covered with a concrete slab and superstructure. Soil and ash are added regularly to the pit as well as excreta. When nearly full the slab and structure are moved to a new site and a tree is planted in topsoil added to the pit.



The Arborloo

Many types of tree will grow in composting toilet pits. The banana is perhaps the most common, but citrus trees (lemon, orange and tangerine etc) will also grow and are popular. Also mango, mulberry, guava, avocado, gum and many others will grow.



The Children's toilet

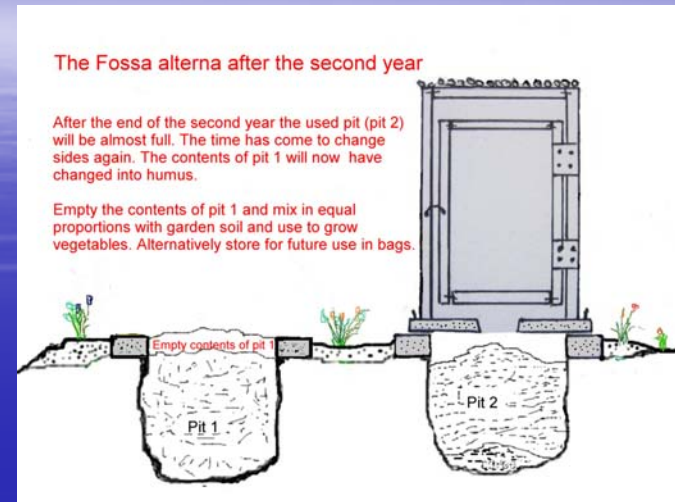
This is a very smart idea introduced by WaterAid (Malawi). It uses a small concrete slab placed over a small hole dug in the ground without a superstructure. It is used by children and helps them to get used to using toilets. Trees are planted on filled pits.



Types of eco-toilet

The Fossa alterna

This toilet uses 2 permanently sited shallow pits (about 1m in diameter and 1m – 1.2m deep). The pits are normally housed within a single superstructure. Use of the pits alternates. Only one pit is used at one time. Soil and ash are added after each use to accelerate composting. The compost is dug out at 9 -12 month intervals and used as fertiliser to grow maize vegetables and trees etc..



Types of eco-toilet

The Fossa alterna – the structure



Types of eco-toilet

The Fossa alterna – - the interior-

The two pits are placed about a half metre apart. They are 1 metre in diameter at the base and corbelled in slightly at the top to allow for the fitting of a slab which is 0.8m to 1m in diameter. In firm soil it may be unnecessary to line pits with bricks. But if bricks are available and the structure is made of bricks, it is best to line the pits with bricks to make the substructure more permanent.



Types of eco-toilet

The Fossa alterna

- *Digging out compost and applying to garden. Not all Fossa alterna toilets are housed in a single structure. Some use portable structures. Here the compost is being dug out and applied to the vegetable garden.*



Types of eco-toilet

The urine diverting system

This system separates urine and faeces in a pedestal or squat plate. Urine and faeces are collected separately.

How the urine diverting toilet works

SIDE VIEW

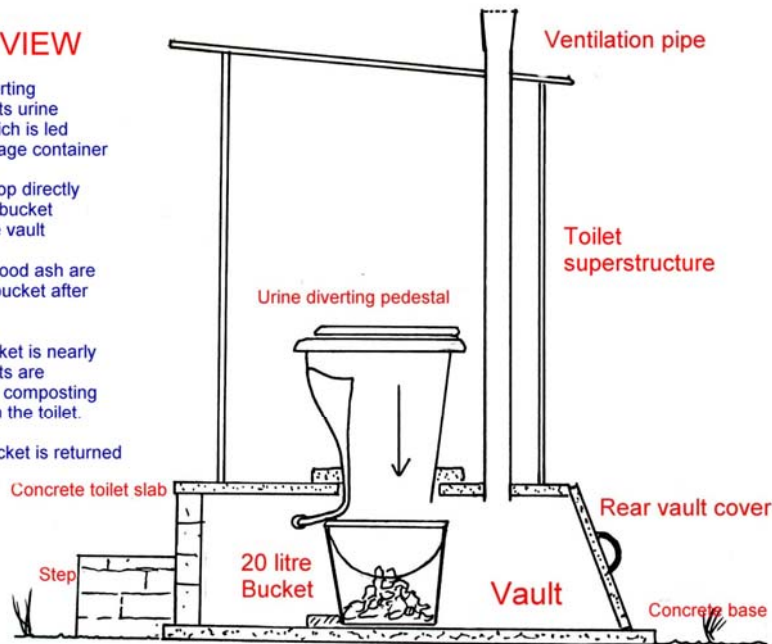
The urine diverting pedestal directs urine into a pipe which is led to a urine storage container

The faeces drop directly down into the bucket held within the vault

Dry soil and wood ash are added to the bucket after every visit

When the bucket is nearly full the contents are deposited in a composting site away from the toilet.

The empty bucket is returned to the vault.



Types of eco-toilet

The urine diverting system



Recycling nutrients held in excreta

- Being able to recycle nutrients held in human excreta is one of the most important benefits of ecological sanitation.
- Studies undertaken in Malawi show that the compost produced in toilets is highly valued by the users and can often be used in place of commercial fertiliser.



Three basic methods of recycling the nutrients obtained from human excreta

- 1 - **Growing trees** in shallow latrine pits filled with toilet compost
- 2 – Using **compost** produced in ecological toilets to enrich soil to enhance vegetable growth
- 3 – Using **urine** as a plant liquid feed



Where the soil is poor and fertilisers are expensive there is considerable potential for the recycling of nutrients derived from human excreta

- Being able to recycle nutrients held in human excreta is one of the most important benefits of ecological sanitation.
- There are many ways of doing it.
- Using compost derived from ecological toilets and also urine collected in urine diverting toilets or in containers is a good way of obtaining valuable nutrients at little cost.



Recycling

Method 1.

Plant a tree!

- Trees will grow in composted human excreta held in toilet pits.
- They will even grow in well composted deep pit latrine humus
- But trees grow better if the pit contents is a mix of excreta, soil, leaves and wood ash.
- The simple toilet known as an **Arborloo** is designed to recycle human excreta in this way



Method 2

Use toilet compost

Compost from shallow pit composting toilets or urine diverting toilets can be used to aid the growth of vegetables.

- Fertile compost can be made in shallow pits by adding a mix of soil and wood ash regularly to the excreta.
- It can also be made by combining faeces with top soil and wood ash in urine diverting toilets. This material is then transferred to a “secondary composting site” and more soil and leaves are added. In both cases the texture of the final product is greatly improved by adding leaves.
- This humus contains valuable nutrients and when mixed in equal proportions with poor top soil can greatly enhance vegetable production.



The **backyard gardening** scenario is particularly suitable for recycling human excreta. In countries like Malawi, Mozambique, Zambia and Zimbabwe, backyard vegetable and maize production is commonly practiced, even in urban and peri-urban areas.



Nutrient levels in toilet compost taken from Fossa alterna pits compared to local top soils

Soil	Nitrogen	Phosphorus	Potassium
Top soils (Harare area) (N = 9)	38 ppm	44 ppm	0.94 ME/100 gms
Toilet compost (<i>Fossa alterna</i>) (N = 10)	275 ppm	292 ppm	4.51 ME/100 gms
Toilet compost (Urine diverting)	232 ppm	297ppm	3.06 ME/100 gms

Toilet compost from the Fossa alterna

*When fully processed the toilet compost is safe,
fertile and smells good!*

Pathogenic bacteria die out within a few months in composting excreta. Parasitic worms eggs persist for longer but after a year most will be non viable. It is wise to assess the extent of worm infections in the proposed eco-san area by examining hospital records. It may be insignificant and no cause for concern. Good health education programmes coupled with eco-san programmes help to overcome any potential health problems related to the recycling of composted human excreta.



Toilet compost from the Fossa alterna

On the left a mix of composted faeces, urine and sandy soil. On the right a mix of composted faeces, urine, red soil and leaves. The appearance and texture of the final product depends to a large extent on what ingredients are placed down the pit.



Leaves make a big difference to the efficiency of composting human excreta. They add a greater diversity of micro-organisms useful to composting than soil alone, and also add air into the compost. They also improve the final texture of the compost.



Enhanced vegetable growth using “pit toilet compost”

Lettuce (left) is shown growing on poor local topsoil (left bucket) and a 50/50 mix of local top soil and humus taken from Fossa alterna pit (right bucket) after 30 days growth. Similar increases in production were observed on the right (spinach) above and (covo) below.



Use of toilet compost on vegetable gardens

Toilet compost can be dug out of shallow pit composting toilets and applied to existing vegetable gardens nearby. In this case an vegetable garden measuring 5m X 3.5m was prepared on an existing garden site. Toilet compost was added to some sections of the garden whilst other sections were not treated. Treated sections were more productive. For green vegetables the addition of diluted urine also helps production.



Use of toilet compost on the maize field

This photo shows a double vault urine diverting toilet in Malawi.

Once the dehydrated faeces have been processed for about 12 months, they are taken out and applied to the soil at the site where the maize seed will be grown. A large double handful of compost is applied to each planting station. The seed is planted in the compost



Effect of Urine

Urine is an excellent source of nitrogen and when applied to green vegetables and maize growth can be enhanced significantly. It is normally best to dilute the urine with water before application (1:3 to 1:5). Leafy green vegetables like spinach are particularly responsive to urine application. Maize also responds very well to urine application.



Effects of regular application of diluted urine on Rape production in containers



Plant	Liquid plant food	Frequency of application	Weight harvested
Rape (9)	Water only	Normal watering	160 gms
Rape (9)	3:1 water/urine	0.5li X 2 per week per basin	822 gms

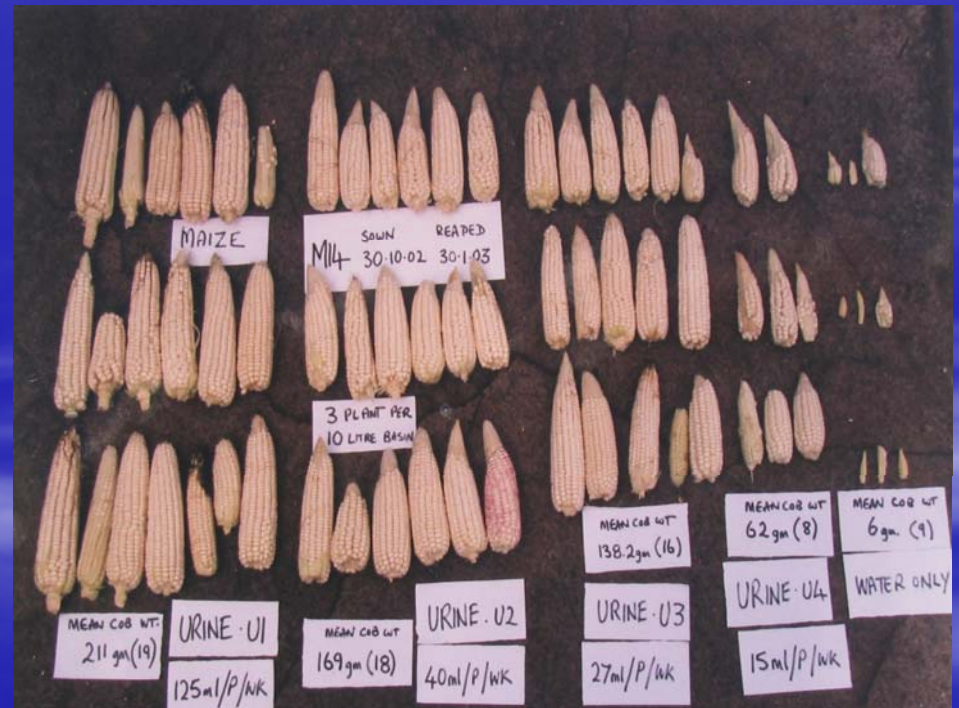
Effects of regular application of diluted urine on **spinach** production in containers



Plant	Liquid plant food	Frequency of application	Weight harvested
Spinach (22)	Water only	Normal watering	741 gms
Spinach (22)	3:1 water/urine	0.5li X 2 per week per basin	2522 gms

Urine can also have a significant effect on the growth of maize.

Here maize plants have been fed with different quantities of urine in 10 litre basins. The nearest basin has been irrigated with water only, others with increasing concentrations of urine and water



Enhancing maize growth with toilet compost and urine in Epworth peri-urban settlement near Harare, Zimbabwe

Maize seeds were planted in 500 mls of toilet compost and allowed to germinate. Undiluted urine was applied to 200 maize plants at the rate of 1 litre per plant over the growing season. This was applied in 8 smaller lots at the rate of 125mls per plant per week from a small dispenser. A further 40 plants were not treated with urine.



Maize trial on poor sandy soils

*The application of one litre of urine per maize plant spread over the growing season (8 applications of 125mls of neat urine) lead a a **doubling of the yield of grain produced** compared to untreated plants.*



Hygiene and hand washing

Improved health cannot be fully realised in sanitation programmes unless a strong component of personal hygiene is included. Many low cost and effective hand washing devices have been developed in Malawi.



Excellent progress in Malawi

An estimated 10 000 low cost ecological toilets have now been built in Malawi in the WaterAid, CCAP and COMWASH programmes. These programmes can provide a huge amount of valuable information on all aspects of low cost sanitation provision for future programmes, not only in Malawi but also for most countries on the African continent.



Overall conclusions

- Malawi has made remarkable progress in the construction of low cost ecological toilets with 10 000 being built since 2002.
- Ecological toilets can be simple and cheap to construct and can provide safe sanitation as well as valuable compost which is useful for enhancing the growth of maize, vegetables and trees.
- The effect of toilet compost can be enhanced considerably by the application of urine.
- The simplest ecological toilets have the potential to be upgraded to more sophisticated units over time.
- Ecological sanitation forms vital links between health, sanitation and agriculture.