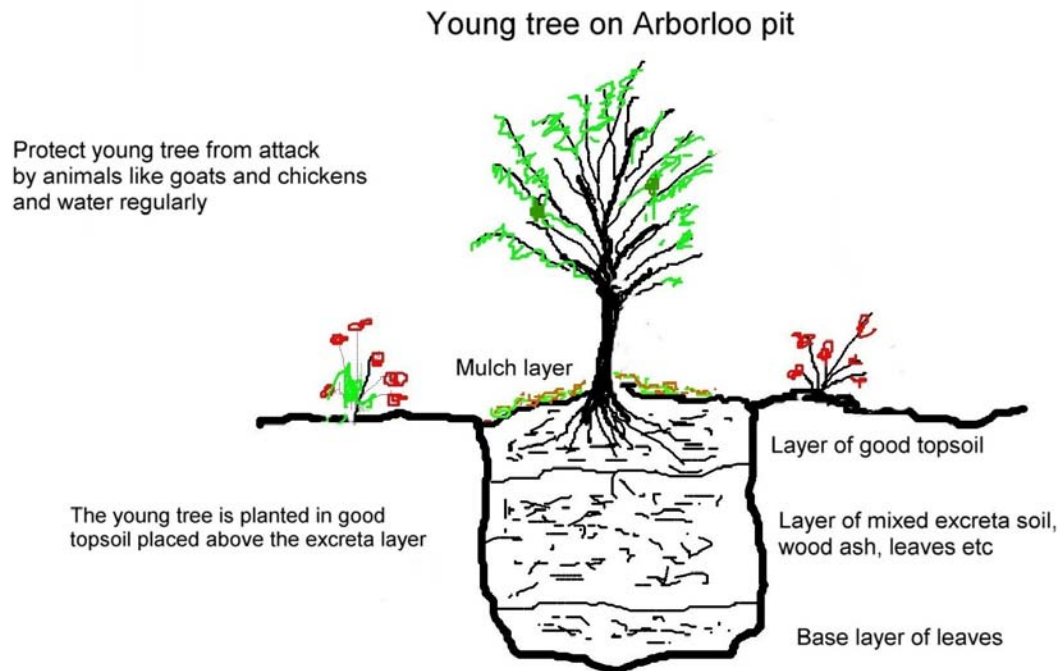


8. The *Arborloo* and growing trees

After a period which can vary from a few months to a few years, depending on the pit size and extent of use, the *Arborloo* eco-pit will be filled with a composting mix of ingredients. It is time to move the structure, including the concrete slab and any ring beam to a new site. The toilet itself moves on a “never ending” journey, through the “lands.” A new site will have been chosen and possibly a pit dug, but it is always wise to place the ring beam first and then dig the pit within the ring beam. This makes a much more stable unit.



Preparations for tree planting

The contents of the used pit (filled with excreta, soil/ash/leaves etc) are now levelled off and topped up with a generous layer of leaves followed by fertile soil, at least 150mm deep. This soil can come from old compost heaps, fertile soil/leaf litter found under trees or any other place where the soil looks good. The aim is to plant the young tree in topsoil so the roots are placed well above the composting excreta layer below.

What is important with the *Arborloo* is that a generous layer of soil (15cm) is laid over the excreta/soil layer in which the young tree is planted. If a good layer of leaves followed by topsoil is added to the excreta in the pit, the young tree can be added the same day as topping up with soil. But there is no reason to delay the movement of the latrine if no trees are available for planting. The latrine can be moved and the pit topped up with soil awaiting the arrival of a new young tree. In fact some may prefer this method, as it gives time for the excreta in the pit to partly convert into humus before the tree is planted. More topsoil can then be added before planting. If water is scarce, it is actually advisable to delay tree planting until the rains begin. Then the chances of the young tree dying as a result of a lack of water will be much less. Young trees need a lot of care, protection and water.



Left: Women from the Sanitation club in Epwengeni Village, Embangweni, Malawi, perform a play showing how trees are planted in *Arborloo pits*. The Village has large numbers of *Arborloos* in operation. Right: Young fruit tree being planted by children in Embangweni, Malawi. Right photo: Jim McGill.

Planting young trees

Young trees can be obtained from a nursery, or in some cases can be taken from cuttings from existing trees (mulberry, banana) or can be grown from seeds (guava, paw paw, mango, avocado etc). This is described in the chapter on gardening techniques. Mulberry, banana, gum, mango, guava, paw paw & avocado do well. In fact most trees will thrive if given the right opportunity. Citrus trees can also be grown, but need more care. Experiments in Harare have shown that when planted in a good layer of topsoil covering very organic pits, most trees will thrive, including a wide range of fruit trees, indigenous trees, ornamental trees and trees used for construction or fuel. At least three things are important for young trees.

1. Keep the young tree roots well away from the excreta layer.
2. Protect the young tree from goats, chickens etc with a protective basket
3. Water regularly. A mulch of leaves or grass helps to retain water in the soil.



Left: Right: In a programme in Kusa Village on the shores of Lake Victoria, Kenya, many young trees have been planted on *Arborloo pits*. This young citrus tree is being planted in the soil placed above the pit contents. Thanks to RELMA. Right: This *Arborloo* at the Eco-Ed Trust has just been moved onto a new site (rear right). The old pit has been topped up with soil, a tree planted and mulch added. Note substantial protection against animals. Thanks to Jim and Jill Latham, Eco-Ed Trust.

The growing roots of the young tree first invade the topsoil layer, whilst the excreta below is turning into humus. So the young tree does not immediately gain benefit from the formation of humus derived from human excreta. This benefit will be realised later on. Because of the highly rich nature of the pit contents, there may be invasions of the pit by roots already present in the soil. If the young tree for any reason begins to struggle, a new tree can be planted later. Also if the trees are very young it may better to allow them to establish themselves in buckets, pots or larger containers first, so the root system can grow more extensively and become more resilient before transplanting into the pit. Experimentation will be required. There will be a variation in local conditions - soils, climate, season etc. The most suitable tree type will vary with the area and altitude. Also the owner will choose some trees in preference to others. Some may choose trees for fruit, others for fuel, others for shade etc. The banana is perhaps the most widely grown fruit tree on traditional latrine pits. But the orange and tangerine are the most popular in more recent *Arborloo* programmes.

In some cases the tree may not grow fast at first, a condition known as “hesitancy.” Obviously a pit full of richly organic material may not be the most ideal environment in which young trees can grow. But with time, the conditions of the pit become favourable. Some trees are more tolerant of the richly organic conditions than others. Mulberry is a very good tree species to start. It makes tasty fruit and is very tolerant of the rich pit environment. It can also be grown from cuttings.

Looking after young trees

There are some trees which may fail to grow on the first attempt for various reasons. Sometimes these will have been attacked by goats or chickens or dug out or trodden on by children, or simply not watered. Sometimes a poor soil will have been chosen to cover the excreta layer or the soil layer may have been too thin (trees will die if placed in or very close to raw excreta!). And some trees are hardier than others. So some tree deaths can be expected. Try again with a new tree - replanting is the order of the day!

Common gardening practice must be applied to the planting of young trees. The soil should be fertile (that is the layer of soil placed on top of the excreta). The young tree should be healthy, protected against animals, children, possibly excess sun and it must be watered regularly. The soil should ideally be covered with a layer of mulch. Mulch is a very valuable addition to the topsoil. It is a layer of material, preferably organic material that is placed on the soil surface around the tree. It is a protector of the topsoil. The layer of mulch helps to conserve moisture in the soil and thus reduces the amount of water required. It holds down weeds and also protects the soil from the effects of sun and wind. The layer of mulch improves the soil structure and fertility. It can be made of leaves, leaf compost, grass cuttings, compost or other decomposing vegetable matter. Some animal manure, compost, etc or other suitable fertiliser might even be dug into the topsoil to assist the young plant once established. Here the local forestry or nursery people will know what to do. The aim is to help the tree to get established and stabilised in the layer of topsoil, in preparation for its penetration into the decomposing layer.

Hesitancy

For various reasons a young tree may hesitate to grow with maximum vigour at first. It may be stressed for a number of reasons and that is why every effort must be made to encourage the young tree in its first months after transplanting. If all other factors in the topsoil are ideal,

the tree should have a good start. But if the organic layer is too close to the roots the plant may hesitate or even die. The tree roots are actually quite sensitive to the soil beneath and the plant as a whole may wait until it senses the best time to start growing more rapidly. That is when the excreta is fully converted into a humus which can be tolerated by the roots. There is a balance between the rate of conversion from excreta to humus and the rate of growth of the roots into the deeper layers. One thing is certain, when the time is right, the young tree will certainly begin to grow vigorously.

Replanting

If for any one of a number of reasons the young tree does not grow, it should be replaced. If the plant struggles for a period of 3 - 4 months then it is best to take the tree out and replant with a new tree. It may be wise to take out the composted soil from the pit, loosen and mix up and reapply to the pit and replant the same tree or preferably a new tree and water etc. Some trees are stronger and more tolerant than others, even when they come from a nursery. Some people who dig out the tree pit prefer to use the humus on their vegetables. That choice is of course optional. Many people may decide the humus is more important on vegetables. But opinions vary greatly.

Feeding the trees

All trees require a good supply of nutrients if they are to grow well. This is particularly true for fruit trees which are planted to produce fruit. The amount of fruit produced will eventually depend on how much nutrient the tree can gain from the soil. The early growth of trees can certainly be sustained from the nutrients held in the composted pit soil. But during heavy rain, part of the nitrogen will be lost from the topsoil, although phosphorus is normally held in place far better by the soil. Also trees use up much of the nutrients held in the soil and their root systems search wider and wider for a supply of food. So for the best results, particularly with fruit trees, extra feeding will be required.

Each type of tree has its own very specific requirements for feeding. Avocado pears, for instance, require more phosphate and potash and very little nitrogen. Banana trees require large amounts of nitrogen and potash. Citrus trees require more of a balanced diet. When fed with compound fertilisers, fruit trees require between 250 – 500gms of fertiliser per year for each year of life if they are to produce good yields. This is normally given in 2 or 3 doses over the year. However, all trees require the most phosphorus at an early stage of root growth and shoot formation. Then they require more nitrogen for vegetative growth. But the final stage is critical. The trees require generous amounts of potassium to produce fruit in abundance.

It is wise to dig in compost or manure around the tree from time to time. For most trees, about 10 kg manure or compost (a wheel barrow full) will be required each year for the first two years. The amount required increases by about 5kg for every successive year, so apply about 15kg in year 3, 20 kg in year 4, 25 kg in year 6 and so on. In eco-san, one option for feeding will be diluted urine. Since urine contains a lot of nitrogen and much less potassium, it is wise to dilute the urine first, and then add a source of potassium. The source of potassium most commonly available is wood ash. As a rule of thumb, most trees, once they have been growing for two years, respond well to a monthly application of a mix of 2 litres urine to 10 litres water (5:1) to which has been added a mug full of dry wood ash and well stirred. This can be applied with a watering can. Several charges of this mix can be added to more mature trees, especially during the rainy season. It helps if the soil around the tree is well mulched.

Feeding trees with diluted urine and wood ash



The mixture is made of wood ash (a mug full), urine (2 litres), and water (10 litres). For a smaller tree a single change of 2 litres of urine, 10 litres of water mixed with a mug full of dry wood ash is prepared and applied to the soil around the tree. A monthly treatment helps. The ash is added first, followed by the urine, then water.



The water is added next. After stirring, the mix is applied to the soil around the tree. A single application for smaller trees and several applications for larger trees like the mulberry.



This mulberry was planted on a pit filled with human excreta and soil at Woodhall Road, Harare, in August 1989. The photo on the left was taken in December 1989. The tree was fed a 5:1 water urine mix (6 X 12 litres) in May 2002 and 3 X 12 litres (5:1) with wood ash in February 2004. In February 2004 the tree was over 6 metres high. Mulberry trees are perfect for starting an *Arborloo* orchard.

Influence of urine/water/ash treatment of fruit trees



Photo of mango tree, which had not shown much sign of growth for more than a year. Photo taken 4th February 2004. The application of a mix of urine (2 litres), water (10 litres) and wood ash (one mug full – approx 100 gms) started on 4th February and continued every 2 weeks during the rainy season, with effective results.



Photos taken of the same tree on 21st February (left), showing considerable new growth in response to the urine/water/ash treatment and on 26th March (right) where most of the visible growth is in response to the treatment.



New growth of leaf and fruit on mulberry tree (left) and lemon tree (right) following urine/water/ash treatment. The ash increases the proportion of potassium in the mix and helps fruit formation.

Propagating mulberry trees for use in the Compost Toilet Starter Kit

Mulberry is an excellent tree to start growing on an *Arborloo* pit. It is hardy, can easily be grown from cuttings (in large numbers for distribution) and is tolerant of a lack of watering. It also provides an excellent fruit rich in iron and vitamins A, B and C.

It is also an excellent tree to transport as a cutting in leaf, as part of the **Compost Toilet Starter Kit** (No. 1) which is now being used to promote the simple *Arborloo* concept. This kit is made up of an 8 litre bag of cement (value approx USD 2) one or two mulberry cuttings in leaf and also instructions on slab and *Arborloo* construction and how to plant and look after the tree, first in a pot and subsequently on transferral to the *Arborloo* pit.

The cuttings are taken from an established mulberry tree known for its vigour and tasty fruit, about the size and length of a pencil (see Garden techniques chapter). They are planted in containers or pots so the proximal part of the cutting (nearest the tree trunk) is placed in the soil. The cuttings are then watered and left to grow. The cuttings grow new roots and leaves and also fruits. The cuttings can be grown in individual containers or in basins or larger pots



Mulberry cuttings grown in small individual containers or in larger containers (ten in each)



After two or three months the mulberry twig will grow new leaves and roots and even fruits!



For transit in the COMPOST TOILET STARTER KIT the cuttings can be first wrapped in wet newspaper and then enclosed in a thin plastic bag to retain moisture



The young trees are further protected by rolling them in a cardboard tube for transit. The tube can be placed alongside other parts of the Starter Kit.



The Compost Toilet Starter Kit is made up of 8 litres of cement packed in its own bag which will make a one metre diameter concrete slab when mixed with river sand and water. The Kit also includes simple instructions for making the concrete slab and an instruction manual for the construction and use of the *Arborloo* and care for trees. The two young trees are also included.



The final Compost Toilet Starter Kit has the name of the NGO who provided it or the individual who received it attached to the label. Starter Kit No.1. Kit requires one fifth of a bag of cement, instructions for slab and *Arborloo* construction and use and two small trees. It offers a neat and interesting low cost material incentive for villagers to start off the process of home toilet construction and recycling of the human excreta (in this case by growing trees). Starter Kit No. 2. describes how to build the *Fossa alterna* and make compost for the vegetable garden. This uses one quarter bag of cement.



On arrival at the village or homestead the recipient of the Kit plants the trees in pots or buckets in preparation for later planting in the filled *Arborloo* pit.



Meanwhile the slab and *Arborloo* are constructed following the instructions supplied in the Kit.

Photo gallery of trees growing on *Arborloo* or organic pits



Mr and Mrs Phiri and Mr Twitty Mukundia of CCAP in Embangweni inspect a paw paw planted on an *Arborloo* pit and well protected against animals. Several fruit trees are growing on a series of *Arborloo* pits in Chiputa Village, Embangweni. Thanks to WaterAid and CCAP.



Citrus trees (orange) growing on *Arborloo* pit in Kusa Village near Kisumu, Kenya (left photo). Note the banana in the background. Bananas flourish on old latrine pits and also *Arborloo* pits.



Trees are amongst Nature's greatest wonders.



A guava tree at Eco-Ed Trust on *Arborloo* pit, Mutorashanga, Zimbabwe.



Planting Variety of trees growing in a sanitary orchard at the Friend Foundation in Harare, Zimbabwe. Indigenous trees of many species will grow on *Arborloo* and other organic pits like this *Swartzia sp* (right photo).



On the left a rampant banana growing on an *Arborloo* pit. In this case the timber structure alternates as an *Arborloo* and a *Fossa alterna*. Earlier in its life the structure was placed at ground level over a shallow pit protected with a ring beam. A banana was planted on the used pit which filled. Later, after a period of flooding, the structure was elevated onto an above-the-ground vault. The vault contents later turned into humus. Banana is planted on old latrine pits in several African countries like Malawi, Mozambique, Kenya and Rwanda. On the right a huge banana plant grows on an old latrine pit in Epworth, close to Harare.



On the left a healthy gum tree grows on an organic pit at the Friend Foundation in Harare. On the right a healthy paw paw tree is growing. In both cases the trees are growing on a mix of dog manure and soil. As with the *Arborloo*, the pit is filled first with a mix of “manure” and soil, and when nearly full is topped up with a good layer of topsoil. The young tree is planted in the topsoil layer. Mulch is added and the tree is protected from animals. It is then watered thoroughly.



Mulberry growing on an *Arborloo* pit at Kafunda Village, Ruwa, Zimbabwe. On the left at the time of planting during an eco-san course for students. On the right about a year later. Mulberry is a versatile fruit tree to grow on *Arborloo* pits. It rarely fails to do well. The fruit is both nutritious and tasty. Young trees can be grown from cuttings, making them easy to multiply.



Trees in all their splendour