

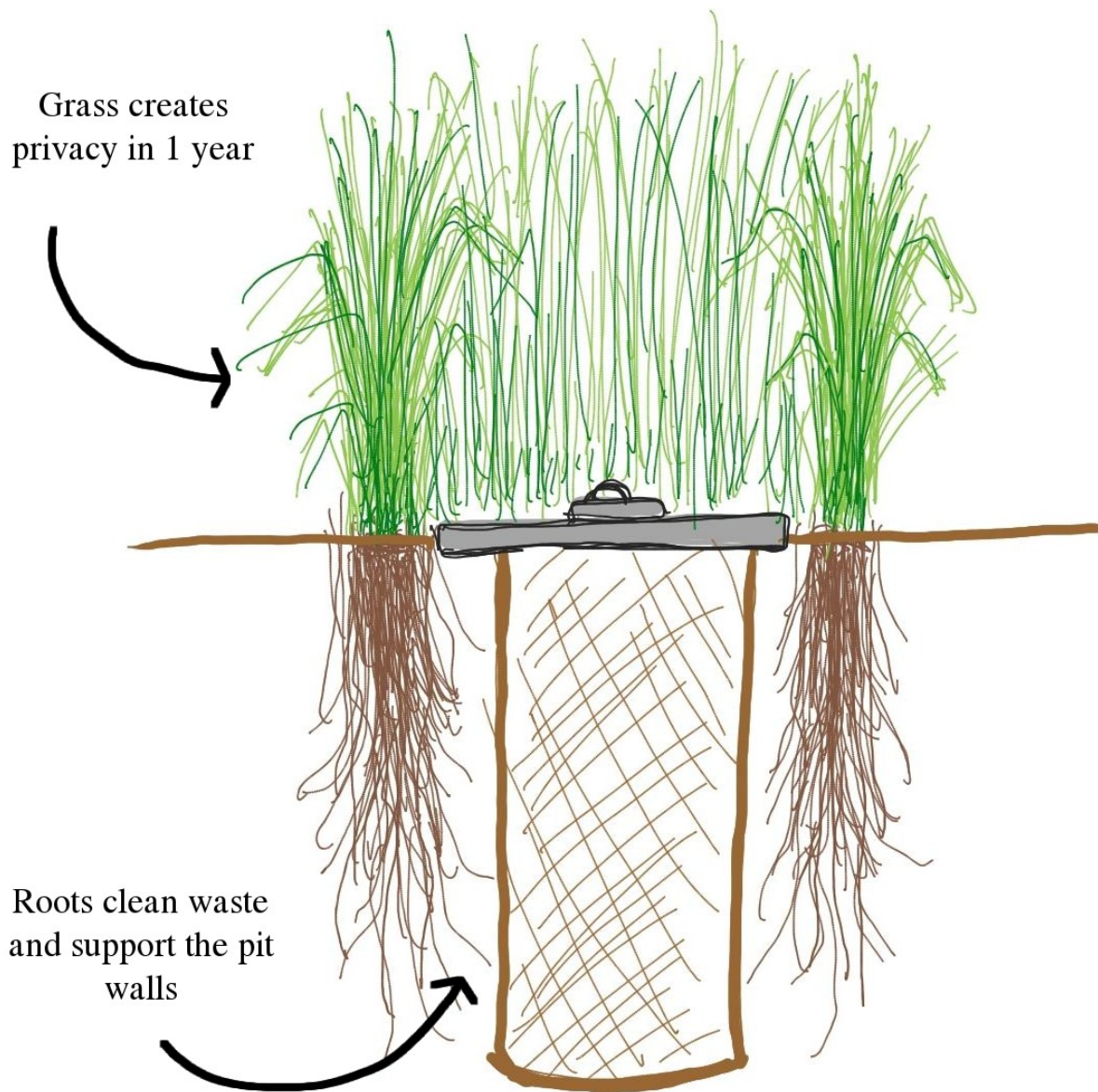
Vetiver Latrine Guide

A “how to” guide to successfully install a natural, sustainable latrine using vetiver grass



The use of vetiver grass (*Chrysopogon zizanioides*) replaces the need for a concrete block lined pit, creates privacy and actively helps decompose the waste. Jiji grass (*Achnatherum splendens*) can be used as an alternative in colder or harsh conditions where vetiver does not grow. Banana and papaya can be planted around the grass hedgerow to convert the waste into a healthy fruit harvest. Vetiver grass can be harvested and used for many purposes.

The most up-to-date version of this guide, in multiple translations, can be found at:
http://www.healthy-mind-body.com/humanitarian/vetiver_latrine.html





Benefits

- Less expensive than traditional latrines (\$25 instead of \$250 for materials to make the basic latrine).
- Easily upgraded so that an elevated toilet, ventilation pipe and a privacy shelter can be added if desired.
- Less materials needed making installation in remote regions possible.
- Vetiver roots reinforce pit walls effectively. No need for concrete block lined pit.
- Banana and papayas can be added to convert the waste into food.
- Greywater (waste water from kitchen, bath and laundry) can be used to water vetiver and bananas.

- Easily movable concrete slab allows for reuse of materials after latrine pit is full.
- Vetiver provides a privacy screen, but can be cut regularly and has multiple uses (fuel, animal feed, compost, crafts, thatch roofing, earth wall construction, etc).
- Vetiver roots actively help decomposition of the waste and reduce pollutants leaking from the pit.
- Easy to build, so that all in need can master the process and make latrines for themselves.
- Self cleaning and repairing, the slope of the slab allows rainwater to wash into the pit and clean the latrine and if the grass is damaged, it will grow back spontaneously.

Cons

- Vetiver grass has some minimal needs that must met: 1) watering if planted in the dry season; 2) at least a partially sunny location; 3) protection from grazing animals (until plants are established).
- Vetiver grass takes 1-2 growing seasons to reach full size, to enjoy the benefits of the privacy screen.
- Local sanitation laws may prohibit the use of a vetiver latrine.

	
<p>Vetiver prevents erosion even in severe conditions. This image shows a vetiver hedge holding a wall of soil in place despite the fact that the soil around it, without established grass, completely washed away.</p>	<p>Vetiver roots are massive, up to 4-5 meters deep. This image shows a clump of vetiver (leaves and stems have been cut back) after being dug up by three men using hand held hoes aided by a wood tripod to help lever the clump out of the ground.</p>

Pit Location

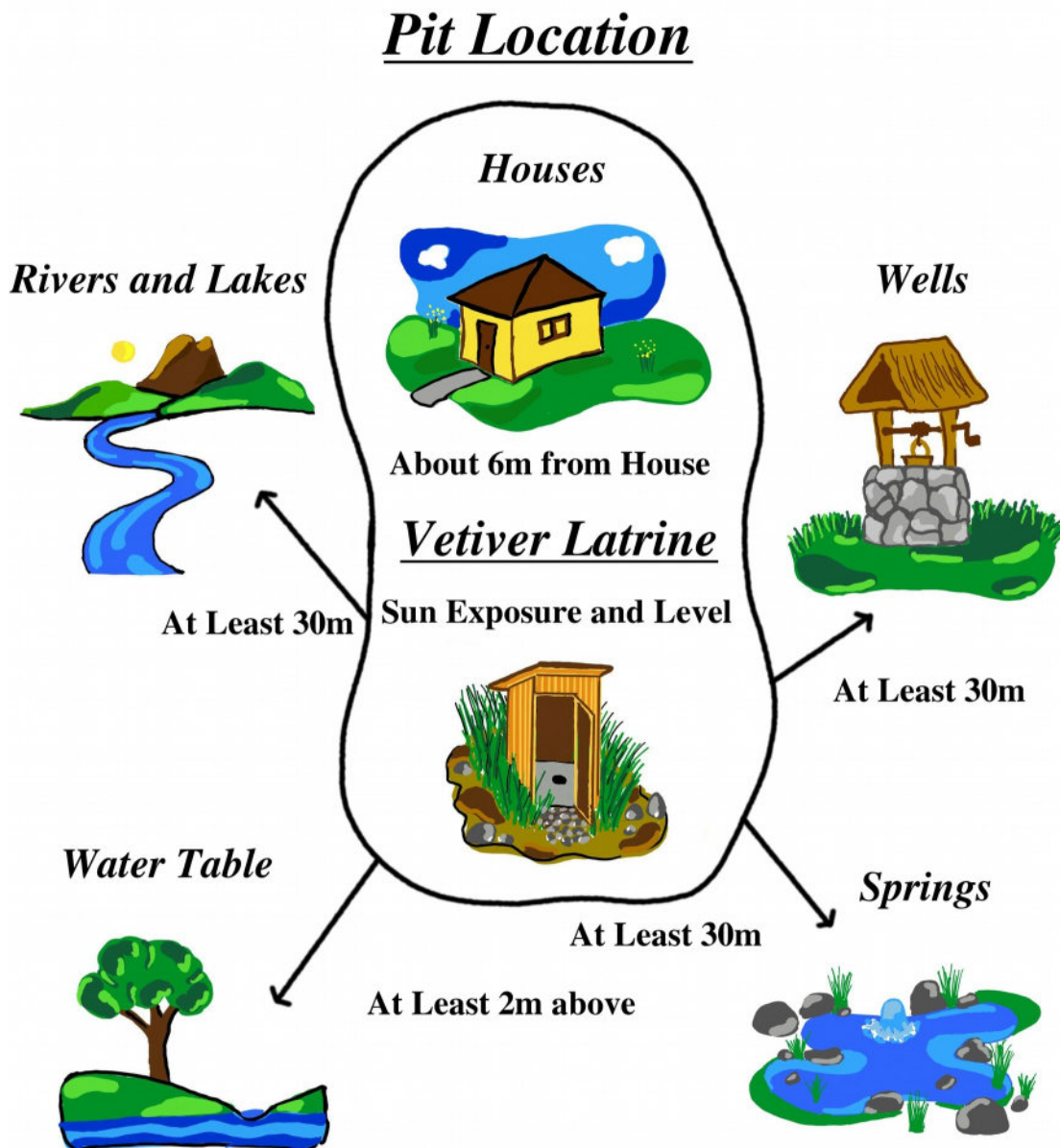
Four factors are important to consider when determining the best location for the vetiver latrine.

- 1. Sun:** Vetiver loves sun and at a minimum needs partial sun exposure throughout the day. If an area has dense overgrowth, then it is necessary to prune back the surrounding trees and shrubs.
- 2. Contamination:** It is important that the contents of the latrine pit stay safely in the pit. Simple precautions can be taken to prevent any effluent leaking from the pit (leachate) from contaminating

drinking water or local waterways. The pit should be located downhill from water sources whenever possible, especially sources of drinking water such as springs and wells. Even then, the pit should be 30 meters from water sources. The pit should be about 2 meters above the groundwater table and above flood level during the wet season. In some cases, the features of the site maybe more important than the distance.

3. Convenience: The latrine should be close to the family’s dwelling, so that a sick person can reach it in the middle of the night, but far enough away so that latrine odors cannot reach the house. Placing the latrine within 6 meters of any home, is a good rule of thumb.

4. Level Surface: Although the pit can be located on sloped ground, the concrete slab once in place needs to be level.





If water is encountered while digging a pit, then it is not a suitable location



A latrine can be installed on a slope, as long as the slab is level

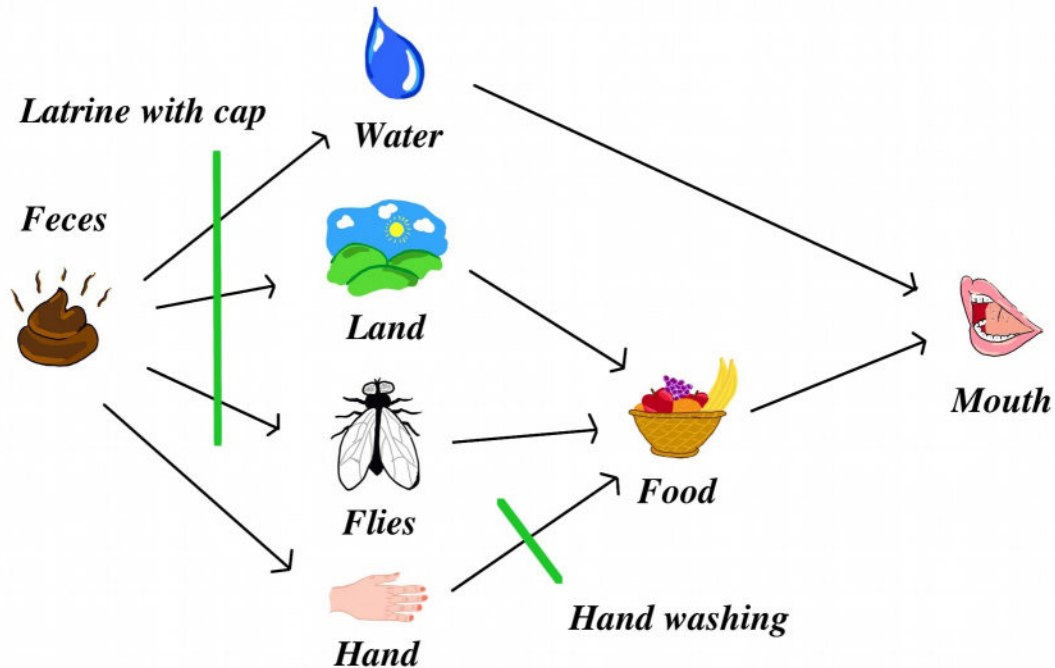


Use a level when installing the slab on slopes

Sanitation

Some diseases are caused by germs that live in feces and can only spread by if they make it into the mouth (fecal oral route). The common ways a disease can spread from feces to the mouth are contamination of: water, land, flies, hands and food. By using clean water, a well-built latrine and practicing hand washing, these routes of infection can be completely blocked.

Fecal Oral Route



Construction

The Pit:

Dig the pit in stable ground and make the sides directly vertical (as opposed to a funnel shape) to minimize the risk of pit collapse. The shape, width and depth of the pit can vary. Whichever shape is chosen, make sure the concrete slab matches the pit shape as well. For example, a round pit will have a round slab and a square pit a square slab. This way when the vetiver is planted next to the slab, the roots will be close to the vertical pit walls and capable of reinforcing them. In fact, it is best to use the slab form as a template for digging the pit. Just trace the form in the dirt and then measure in 10 cm from the line. This will be the area to excavate.

The table below outlines important factors to consider when choosing the pit shape. For example, if the slab needs to be transported short distances (100m or so), then a round pit will be a better choice. The slab can be rolled to its final location. Also if the latrine is installed in remote regions, then the

round slab is better. The plastic forms used to cast the round slab are much lighter and easier to transport. However it can be difficult to find the plastic lawn edging which is used as a form. In that case, the square pit may be better. It is much easier to find wood to build the square forms. Some cultures prefer privacy shelters that are either round or square. Choose a pit shape to match the shelter shape.

Round	Square
Pros: <ol style="list-style-type: none"> 1) A round pit has stronger walls 2) The forms used to cast the slab weigh less and are easier to carry. 3) It is easier to move the slab itself, as it can be rolled 	Pros: <ol style="list-style-type: none"> 1) The pit lifespan is a little longer because a square pit has a greater volume than a round one 2) The concrete slab is easier to make 3) The wood forms are easier to find
Cons: <ol style="list-style-type: none"> 1) The plastic forms used to cast the slab can be hard to find or not available in third world countries 2) A round pit has a little less volume than a square one, making the lifespan shorter 	Cons: <ol style="list-style-type: none"> 1) The concrete slab is harder to move, it weighs about 200kg 2) The wood forms are heavy to carry, especially a problem in remote regions 3) Square pit walls are a little less strong

The width and depth of the pit can be modified. The final volume of the pit will determine its lifespan. A square pit that is 1 meter wide and 2.3 meters deep, as shown in these designs, will serve a family of six for five years. This calculation accounts for the top ½ meter of the pit being filled with earth when it is retired. This is done to avoid contamination of the surface soil. To determine the lifespan of a pit expect to use a volume of at least 0.06 cubic meters per person per year. A greater volume, such as 0.1 cubic meters, should be expected if anal cleansing materials such as corn cobs or stones are used. This calculation is based on a conventional latrine. A vetiver latrine may last longer because the waste is at least partially decomposed by the vetiver roots. Research is in progress. Experience has shown that a pit less than 1.2 meters deep will last only about a year.

Calculation of Pit Size: Example
Expected Usage: 6 people x 0.06 cubic meters x 5 years = 1.8 cubic meters
Usable Pit Size: 1 meter x 1 meter x 1.8 meters (2.3 m – 0.5 m to fill top) = 1.8 cubic meters

If the width of the pit is altered, modify the size of the concrete slab and beams accordingly. The slab should be 20 cm wider than the pit and the concrete beams 70 cm wider than the pit.

The Slab:

A strong concrete slab can be made from the following mix: 3 parts sand, 3 parts gravel and 1 part cement. If the slab is made on-site in a remote location, the sand and gravel can be sourced locally. The sand should be free of dirt and debris. There are many other recipes for making strong concrete. For example, 2 parts sand, 4 parts gravel and 1 part cement will work. Alternatively, 4 parts sand, 2 parts gravel and 1 part cement will also work. In some regions of Haiti, the masons often use even

more sand in the ratio than that, but the sand actually contains some gravel mixed in. Following the local, tried and tested method is always advisable.



Reusable tools and supplies for constructing a vetiver latrine



Clean the ground of debris before mixing cement



6 buckets of gravel and 2 buckets of sand



Mix sand, gravel and cement



Add water gradually to the mix

The slab and beams can be shaped by using forms placed on level ground or by digging a depression into level ground. In either case, reinforce the concrete with 3/8" rebar (9.5 mm) as shown in the design. Once complete the rebar should be embedded inside the slab and beams, so that no metal is protruding out of the concrete. Before pouring the concrete, small stones can be used to elevate the rebar so that it is in the proper location. A wood cut form can be made as a template for the hole in the center of the slab. It is best to make it in a keyhole shape, as per the specifications shown in the designs later in this guide. A bucket can also be used to create the hole. This hole should be no larger than 25 cm in diameter, so that a small child will feel safe using the latrine. Remove the template when the slab starts to harden (about 3 hours) and then cover with damp cloths, cement bags, hay, sand or a sheet of plastic to allow the concrete to dry slowly. Although some masons use concrete within 6 days of pouring it, a curing time of 21 days will insure a strong slab. Once cured, move the beams and slab to cover the pit. Placing large stones under edges of the slab around the top of the pit, will help reduce the risk of pit collapse.

Slab Tools List – Reusable items

- 4 – wood 5 cm X 10 cm (2X4's), for forms to cast the **square concrete slab**
- 1 – thin 6.3 cm (2.5") band fiberglass lawn edging, 400 cm long, to cast the **round concrete slab**
- 3 – wood 5 cm X 10 cm (2X4's), used for forms to cast support beams
- 4 – wood 5 cm X 10 cm (2X4's), for 45 cm X 30 cm template to cast the **square concrete cap**
- 1 – thin 6.3 cm (2.5") band fiberglass lawn edging, 140 cm long to cast the **round concrete cap**
- 1 – wood form cut to the shape of a keyhole for the slab hole. If not available a small bucket about 25cm in diameter can be used as a form.
- Trowel and shovel for handling cement
- Cleaning supplies, including ground sheet to prevent cement from being contaminated with dirt
- Saw or bolt cutters capable of cutting rebar
- Pliers or tool capable of cutting wire
- Short handled hoe, shovel and digging bar
- Fasteners to build the wood forms (nails and hammers or wood screws and screwdriver)

Materials List – One time use items

- 50 – Vetiver slips (small plants)
- 3 – 9.5 mm (3/8") rebar 6 meters long
- 1 – Rebar tie wire
- 1.5 – 50kg bag cement
- 4 – 5 gallon buckets water (for cement mix and cleaning)
- 6 – 5 gallon buckets sand (this ratio is based on sand from Haiti, which contains some gravel)
- 2 – 5 gallon buckets gravel



Round form with rebar layout and keyhole form



Stainless steel bolts, nuts and washers



Remove plastic ridge inside the form



Round slab, cap and beams



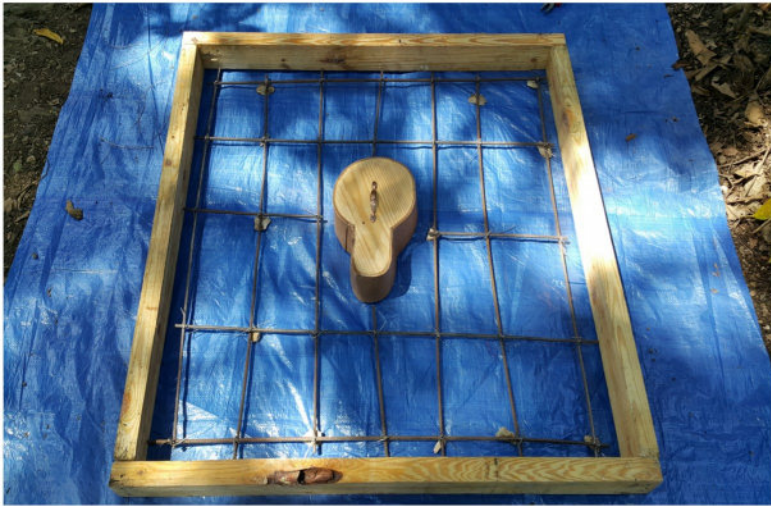
Round slab in final position



Round cap with rebar handle



Round pit dug to match round slab



Square slab with rebar layout and keyhole form



Beam rebar layout



Beam pour



Square slab, cap and beams poured and in forms



Cap rebar layout



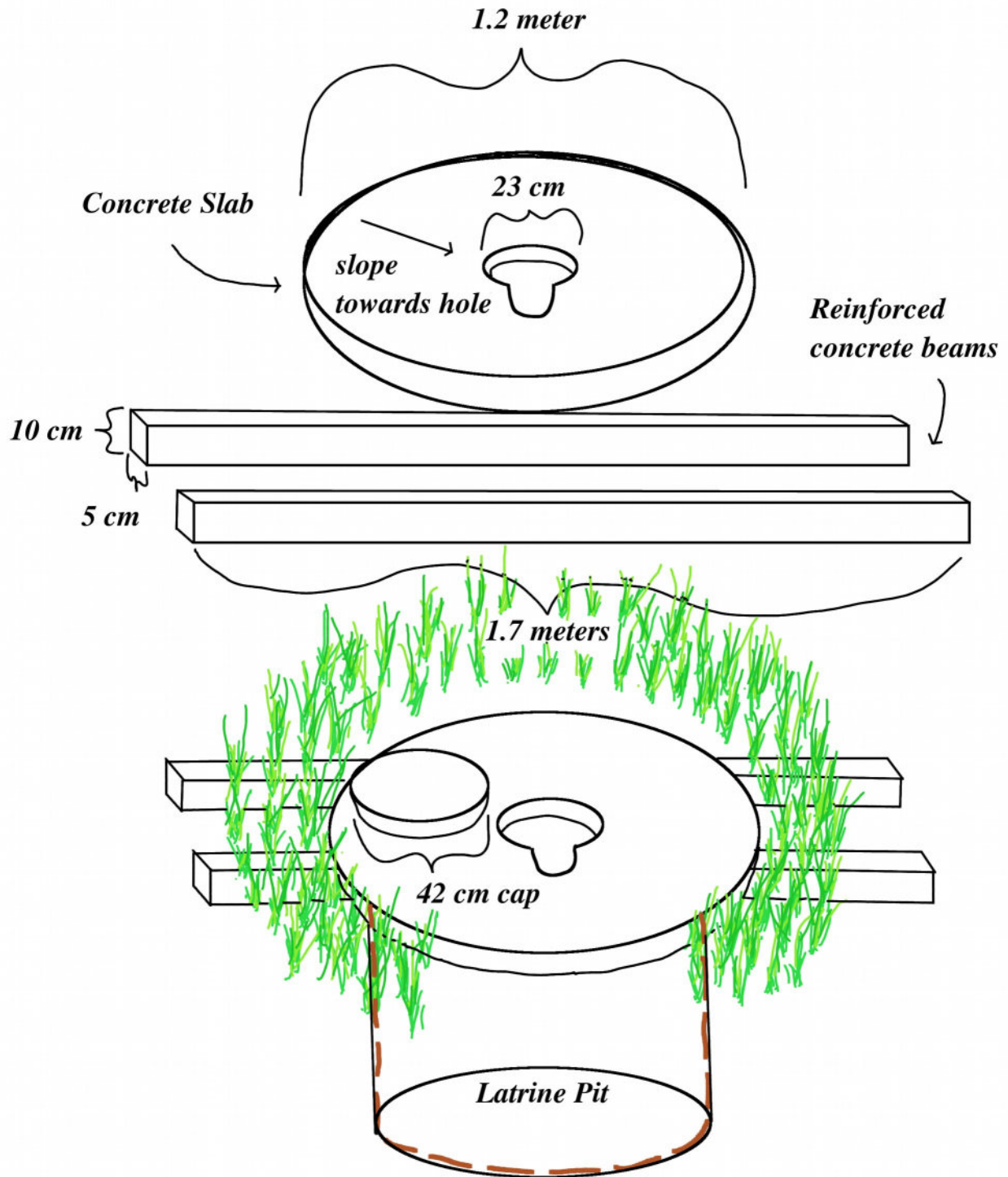
Square slab being moved to final position



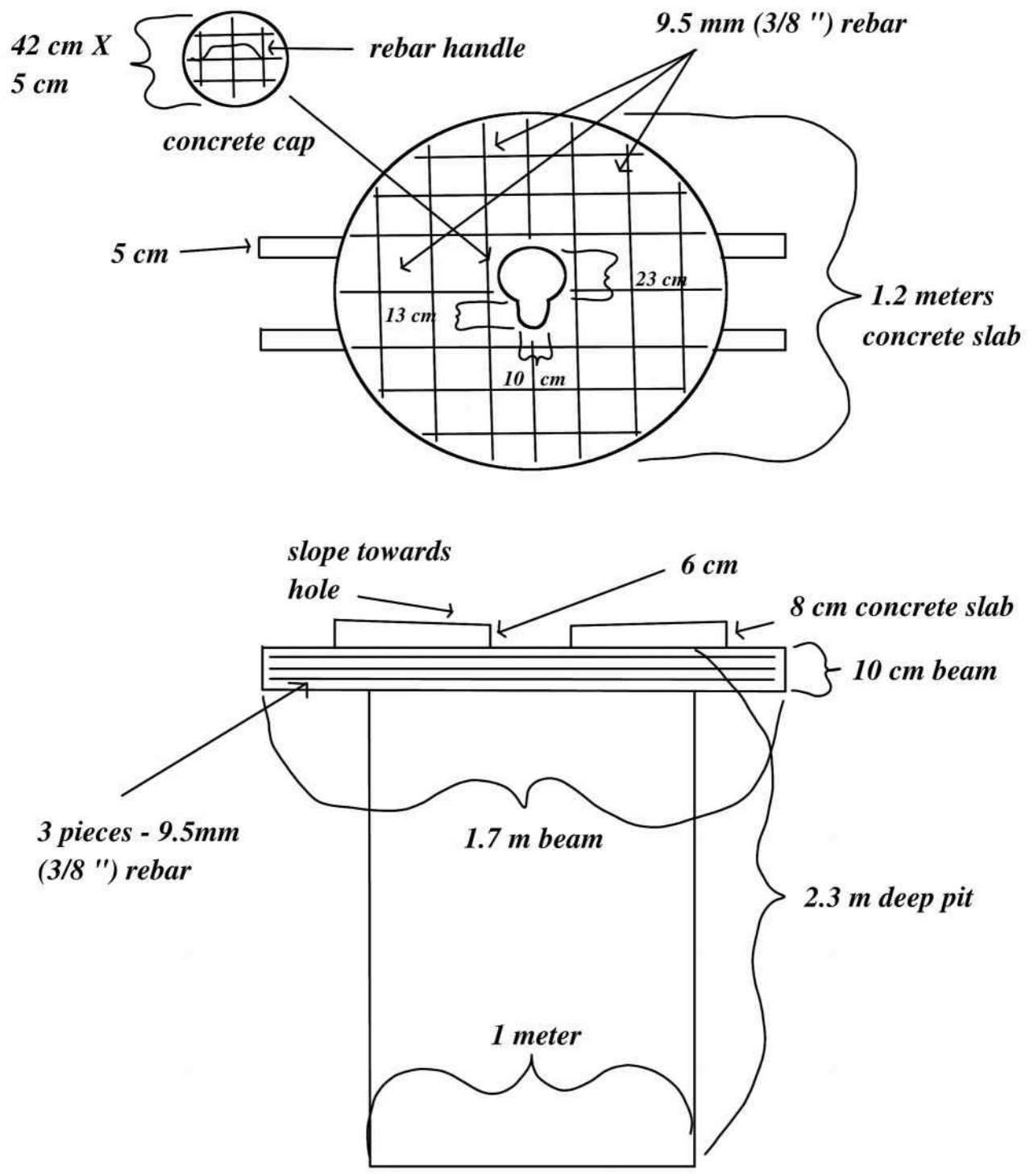
Square pit dug to match square slab

© Roger Gietzen

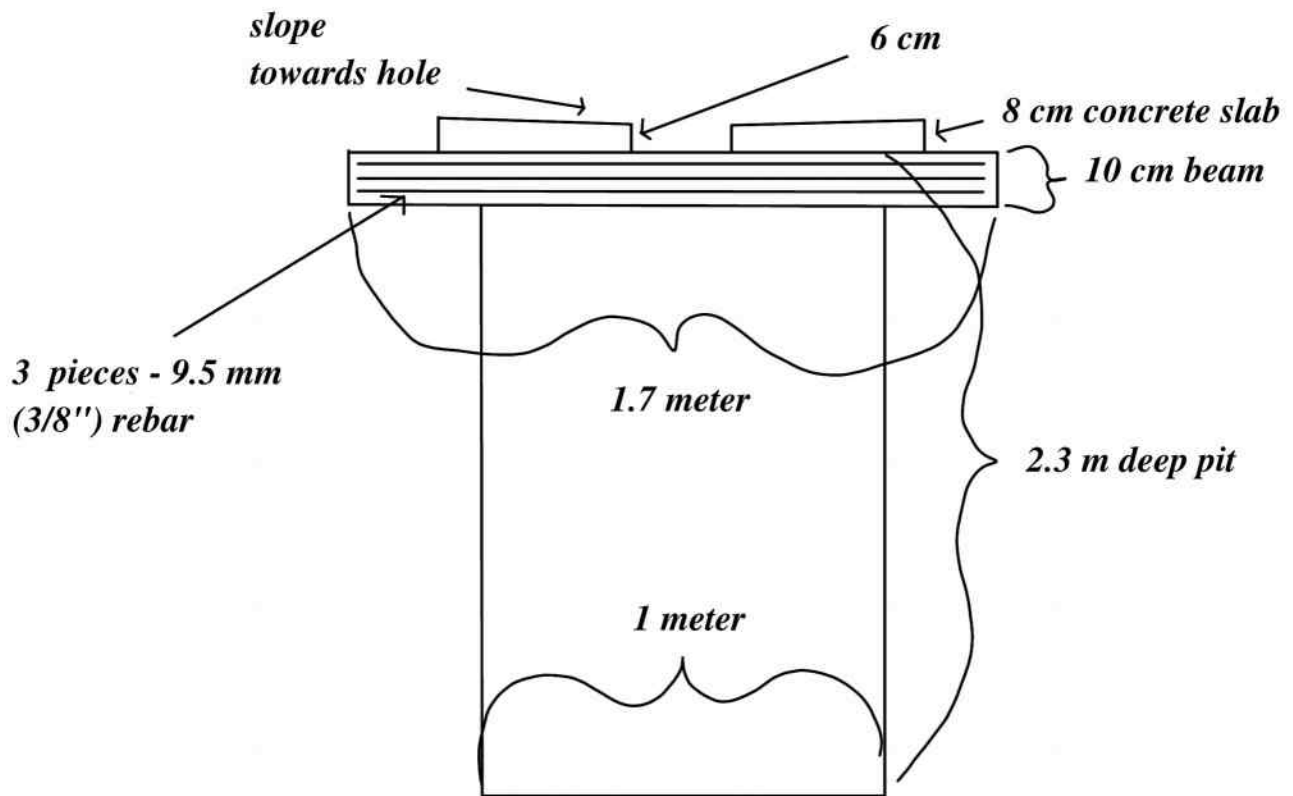
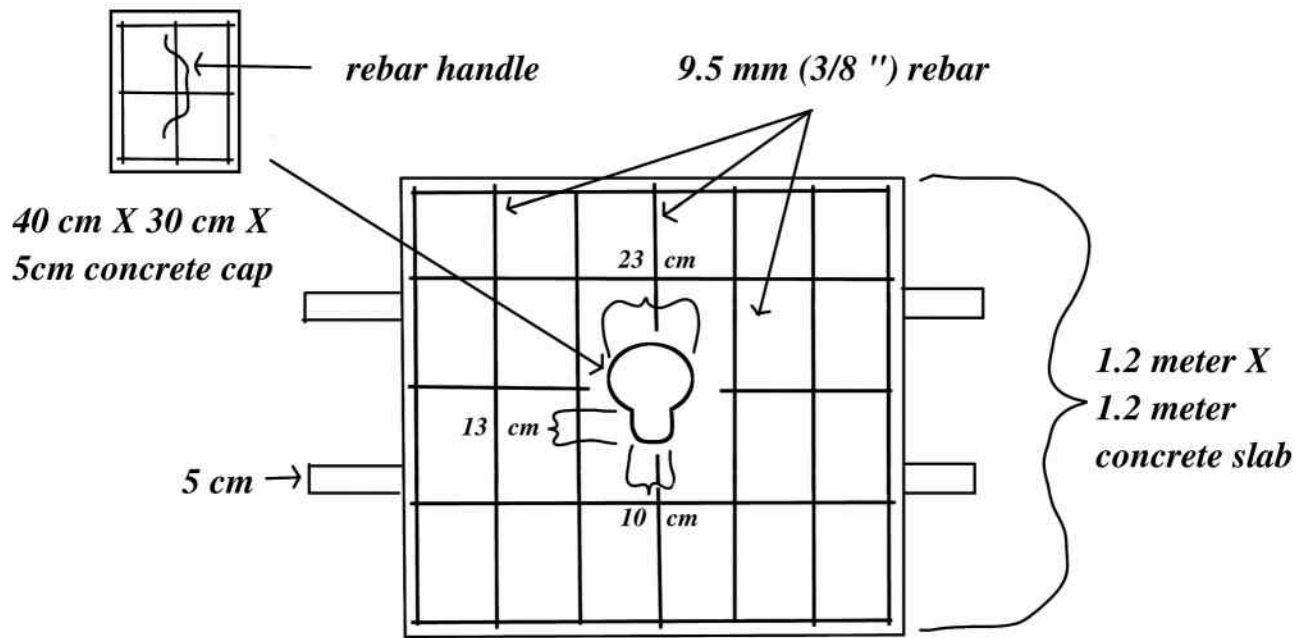
Vetiver Latrine Design



Round Vetiver Latrine



Square Vetiver Latrine



Vetiver Planting

Plant the vetiver slips at 10-15 cm spacing (about the width of your fist) in three separate rows around the latrine with 30-40 cm between the rows. Leave an opening on one side for an entrance to the concrete slab. The row of vetiver plants closest to the latrine, must be within 30 cm of the pit wall (20 cm from the edge of the concrete slab) so that roots can easily reach the pit wall. Vetiver roots develop vertically, not horizontally. Plan on purchasing about 50 vetiver slips when making a latrine the size depicted in the designs here. It is best to plant the grass in the rainy season as they will not require manual watering as they develop. If it is planted shortly before dry season, water the grass every four to five days if there is a lull in the rain until new shoots at the base of the plant are growing well. Greywater (from laundry, kitchen and bath) can be used to water the plants. They may look dry and gray the first few months after planting but keep watering them and know that they are just concentrating their energy to form roots. Cover the bare soil with organic matter or mulch. The vetiver grass can be cut to provide mulch as it grows. Leaves, wood chips, other grass clippings, plant prunings and even cardboard or paper can be used to cover the soil. This is important as it prevents weeds and helps the soil retain moisture. While the vetiver is developing it should be protected from grazing animals. Goats can eat the grass down to the ground if given a chance, but if the plants are already established (more than 4-6 months old) then they will spring back easily within a few weeks of being eaten.



Vetiver latrine with newly planted slips, notice that the slips are planted right next to the slab and will not interfere with the slab as the roots grow down vertically and not horizontally.

Vetiver Care

Over the first year, the vetiver will grow together to form a solid hedgerow. The hedgerow will remain as such for several decades and the three rows will ultimately look like a solid planting after a year of growth. It should be cut back annually at the end of the dry season to promote new growth. It can be cut more often (3 times a year) and will grow back more vigorously each time. When pruning, leave about 30 cm of grass at the base. The grass clippings can be used for many purposes. They make excellent animal feed when freshly cut. They can be composted. They can be pressed into bricks manually with a Byrant Press and used as a clean, smokeless fuel. It can also be used for handicrafts, thatch roofs and to reinforce earthen walls. After the first growing season, the plants will flower sending up very stiff flower stems that can be 1-2 meters tall. These can be cut and serve as reeds to provide a stiff backing for crafts such as woven mats.



A vetiver hedgerow, if properly cultivated with full sun exposure, will mature to form a full privacy screen in 1 year

Latrine Care

It is important to keep the concrete slab clean on a regular basis using soap and water. Do not use chlorine or bleach products to clean the latrine. This is harmful to the roots of the vetiver and can arrest its natural cleaning process. If a shelter is not constructed over the slab, then rain will help the cleaning process because the water will naturally run down the slope of the concrete slab into the pit.

Maintenance is important to prevent the rare possibility of pit collapse. In Haiti, of 365 vetiver latrines installed in a rural sanitation project, only 2 (0.5%) of the pits had collapsed during a survey performed 2.5 years later. ***The single most important measure that can be taken to prevent pit collapse, beyond locating it in stable ground, is to cultivate a healthy vetiver hedgerow.*** The second most important measure is to watch for early signs of unstable ground. Normally signs of pit failure will show long

before collapse and with proper maintenance the process can be halted. If the latrine pit shows signs of collapse, such as a hole forming near the slab's edge, fill the hole with wood, then cover with earth and plant vetiver on top. The vetiver roots will stabilize the hole and prevent further collapse. Alternatively, large rocks can be used to prop up an unstable slab. If the collar of the pit has opened to the point where it cannot be repaired, then a new pit should be dug and the vetiver and slab transferred over.

Reuse

When the latrine pit is full, the concrete slab and vetiver grass can be moved to the new pit location. Dig down along the side of a vetiver clump about 30 cm. Then cut horizontally and pull the clump out of the ground. Do not worry about the roots being cut. New roots will begin to form from the root crown (the woody heart of the clump just below the surface of the ground). The clump should have about 15 cm of roots intact as well as the crown. Trim the leaves to a height of 15-20 cm and divide it into slips containing about 3-5 individual tillers using a machete, hoe or axe. A tiller is a single shoot of grass and its roots. Replant these as they were planted when latrine was first built. The old pit should be covered by ½ meter of earth. In two years this space can be gardened or alternatively a fruit tree can be planted immediately.



Vetiver slips planted in row

Vetiver slips with root crown at the base

Modifications

Upgrades:

The basic vetiver latrine shown in this tutorial is easily upgraded. Adaptations may be important for the latrine to be accepted in different cultures depending on the local norms. A shelter can be built on the concrete slab for more privacy. However care must be taken to insure that the vetiver grass receives proper sun exposure. Also, an elevated toilet seat can be constructed directly above the hole in the concrete slab. A 4-inch diameter ventilation pipe (PVC pipe is an ideal material) can be cast into the concrete slab. If there is a shelter, the pipe extends ½ meter above the peak of the roof to carry odors away. It is important to place a screen or mesh over the pipe to prevent insects from accessing the pit. An excellent “how to guide” for the design and construction of privacy shelters, fitting for various cultures and budgets, can be found at: <http://www.clean-water-for-laymen.com/privy-privacy-shelter.html>.



Ventilation pipe and a seat made of a plastic bucket. Notice the pipe is covered with mesh.



The same latrine 1 year later has a poor hedgerow because of shaded conditions



This family built a shelter to enjoy privacy from day 1. Be sure the vetiver grass is not covered by the shelter. Notice here an elevated seat made of concrete.

Jiji Grass:

In regions where vetiver cannot grow, the latrine can be modified by using jiji grass (*Achnatherum splendens*) instead. Vetiver is a warm weather plant and only grows in tropical and subtropical zones (USDA hardiness zones 9 and above). Jiji grass however, is tolerant of extreme winters, hot summers and poor, saline soil conditions. The root structure of the grass is extensive and like vetiver stabilizes the soil. Jiji grass is an ideal alternative to vetiver grass if needed.

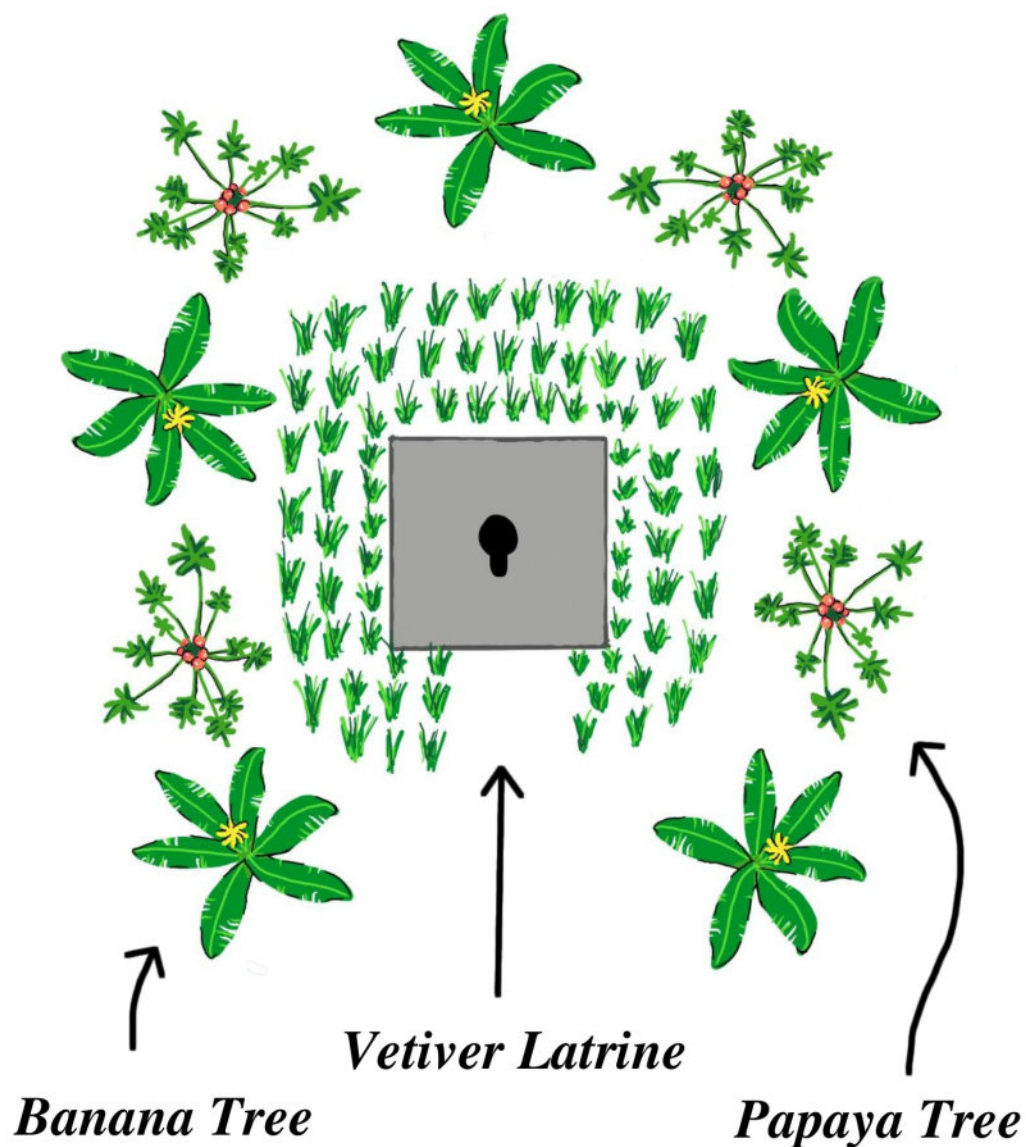


Jiji grass roots prevent erosion, similar to vetiver

Banana Circle:

Another important modification is the addition of a banana circle around the basic vetiver latrine. Communities are more likely to accept and care for the vetiver latrine if there are fruiting trees providing immediate, tangible benefit. Plant five banana trees, evenly spaced, just beyond the vetiver hedgerow. Papaya trees can be planted between each pair of banana trees, but leave one space open to access the latrine. Greywater can be used to water the banana circle as well as the vetiver during dry season, until the plants are established. Although it is safe to eat fruits from these trees, low growing fruits and vegetables should not be grown near the latrine due to risk of human waste contamination.

Vetiver Latrine With Banana Circle



Latrine Project Logistics

The building of the vetiver latrine normally occurs in two stages. First make the concrete slab, beams and cap. Once they have cured, then proceed with the second stage: Dig the pit, move the concrete pieces into place and finally plant the vetiver grass around the edges.

For those installing vetiver latrines as part of a humanitarian project, it is advisable to encourage the recipients of the latrine to participate as much as possible. The more efforts they put forth, the more they will care for and value the latrine. Also, it's important for the new owners of the latrine to understand how it was built, so they can copy the technique if needed. Lastly, there is a sense of accomplishment that comes from knowing they built their own latrine. The recipients of the latrines built in Haiti participated in several ways. They helped by gathering the sand, gravel and water needed during the first stage. In fact, construction of the concrete pieces did not begin until the materials were ready. Although a technician helped the new owners choose a proper location for the pit, they dug the 2.3 meter pit themselves. During the second stage, they also helped to move the concrete pieces into place and to plant the vetiver slips. There were some exceptions to this rule. For example, some recipients were not physically capable of this work because of disability or advanced age.

It is also advisable to teach the new owners the importance of using the latrine for all defecation, keeping the hole covered and washing the hands. The "fecal oral route" diagram found earlier in this document can be used as a visual aid. The best time to teach is while the latrine is being installed.

Papaya Seed Antiparasitic Treatment

Intestinal parasites are more common than generally believed, even in first world countries. In addition to causing stomach symptoms and weight loss, they can also affect an individual's mental concentration and emotions. If papaya trees are grown around the latrine, or the fruits are available locally, the seeds can be used as a powerful antiparasitic. One study found papaya seeds (*Carica papaya*) to have medicinal properties effective against intestinal parasites, and with minimal to no side effects¹.

In this study a single dose of papaya seeds was given by mouth to children 3 to 6 years old. Two rounded teaspoons of dry, crushed seeds were mixed with honey. For those not familiar with the seed, it has a strong bitter flavor that many cannot tolerate. The honey helps, but doesn't fully hide the bad flavor. Peanut butter is much better at hiding the flavor, but it is unknown if it influences the effectiveness of the seed remedy. The study used only one treatment, but if an infection is highly suspected consider repeating the dose daily for 1 week, take 2 weeks off, then repeat the week long treatment a second time.

Common sense suggests that fresh, ground seeds will have the strongest antiparasitic effect. If there is access to a blender, the fresh seeds can be blended with a fruit drink to make a medicinal smoothie. Four teaspoons of fresh seeds are equivalent to the dose of dried seeds used in the study. If there is no access to a blender, then consider taking fresh, whole papaya seeds. Although the study did not test whole, fresh seeds, they have been used this way for generations in various cultures to kill parasites. The fresh seeds have a slippery coating, and can easily be swallowed without chewing and rinsed with water.

There are some precautions that need to be taken when using these seeds. The most common side effect is an upset stomach. If this is a problem, the dose can be decreased until tolerated. Remember an upset stomach can also be caused by parasites and parasite death. Infertility in both men and women is possible with daily doses of papaya seeds taken over a long period of time, possibly months. The infertility is temporary and fears of this should not stop an individual from using the treatment for parasites. However, ***pregnant women should not take the papaya seeds*** for this reason. Rarely people can have an allergic reaction to the seeds. The allergy may present with a rash, itchiness of the skin, or swelling of the lips and mouth. It is best to take a small test dose the first time using the seeds to avoid this.

Papaya seed remedy dosing

Same dose for adults and children: 4 rounded teaspoons whole, fresh seeds or 2 rounded teaspoons dry, crushed seeds. Rounded not heaping.

Prevention: Take dose one time

Treatment: Take dose daily for 1 week, then 2 weeks no seeds, then take dose daily again for 1 week.



A papaya this size yields about 3 antiparasitic treatments (12 tsp of fresh seeds or 6 tsp of dried seed)

References

1. Okeniyi J, Ogunlesi T, Oyelami O, Adeyemi L; 2007; Effectiveness of dried Carica papaya seeds against human intestinal parasitosis; Journal of Medicinal Food; 10(1): 194-196.

Credits

1) Owen Lee (www.vetiverlatrine.org); Creator of the basic vetiver latrine, guide editor and owner some of the vetiver latrine photos.

2) TVNI (The Vetiver Network International, www.vetiver.com); Owner of the vetiver and jiji grass photos.

3) Dale Rachmeler, PhD (drachmeler@mac.com); Guide editor.

4) Roger Gietzen, MD (www.global-freedom-project.org & roger@healthy-mind-body.com); Guide creator, illustrator, inspiration for many of the vetiver modifications and owner of some of the vetiver latrine photos.

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