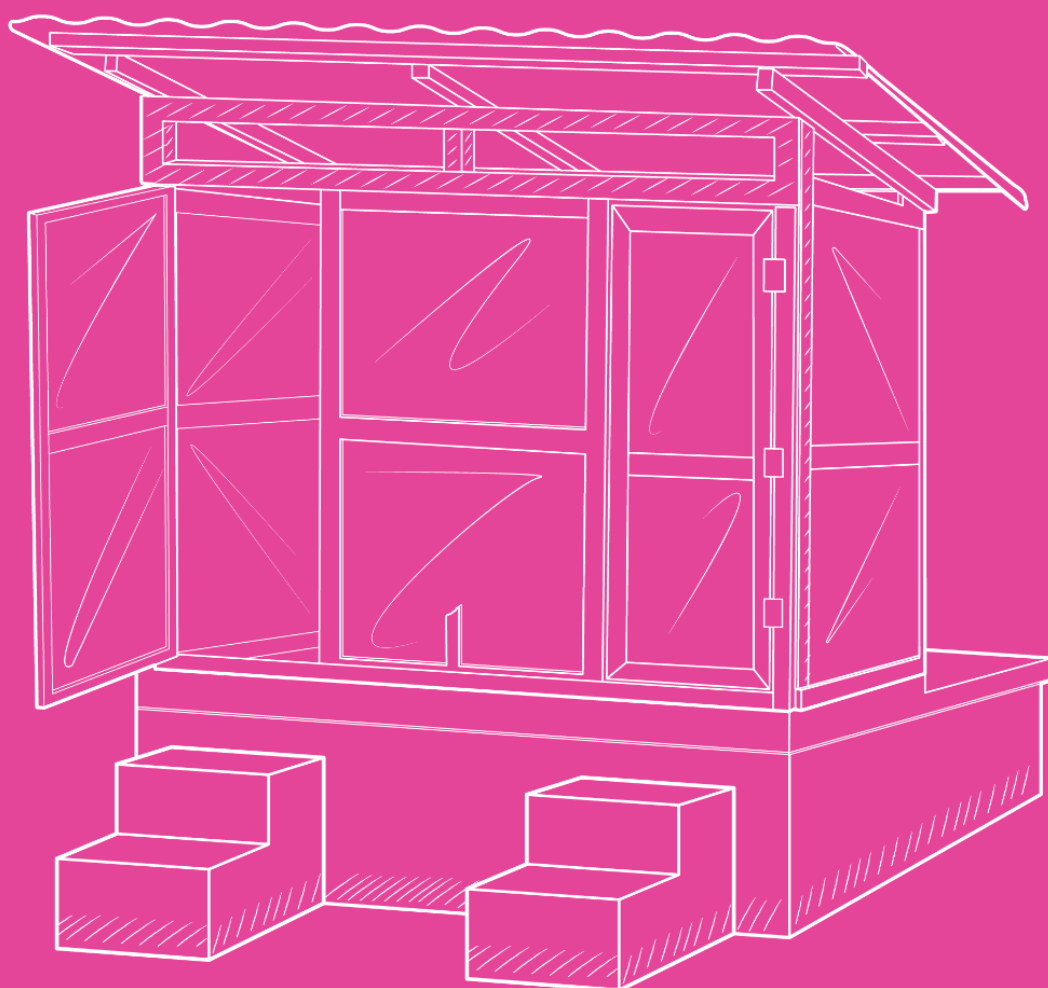


# TIGER WORM TOILET OPERATION MANUAL



OXFAM

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# Operation of Tiger worm Toilets

## How often to check a tiger worm toilet pit?

Tiger worm toilets should be checked at a similar frequency that traditional faecal sludge pits would be checked for sludge level, roughly **every 3-months**. Where potential problems are identified follow-up monitoring will be required after **2 to 4 weeks**.

## What to check and How do I know if it is working properly?

The monitoring form can be used to guide the routine monitoring checks. Fresh faeces should not be building up beyond 90% of the surface area, vermicompost should be building up around the sides and there should usually be worms visible under the surface.

## What does vermicompost look like?

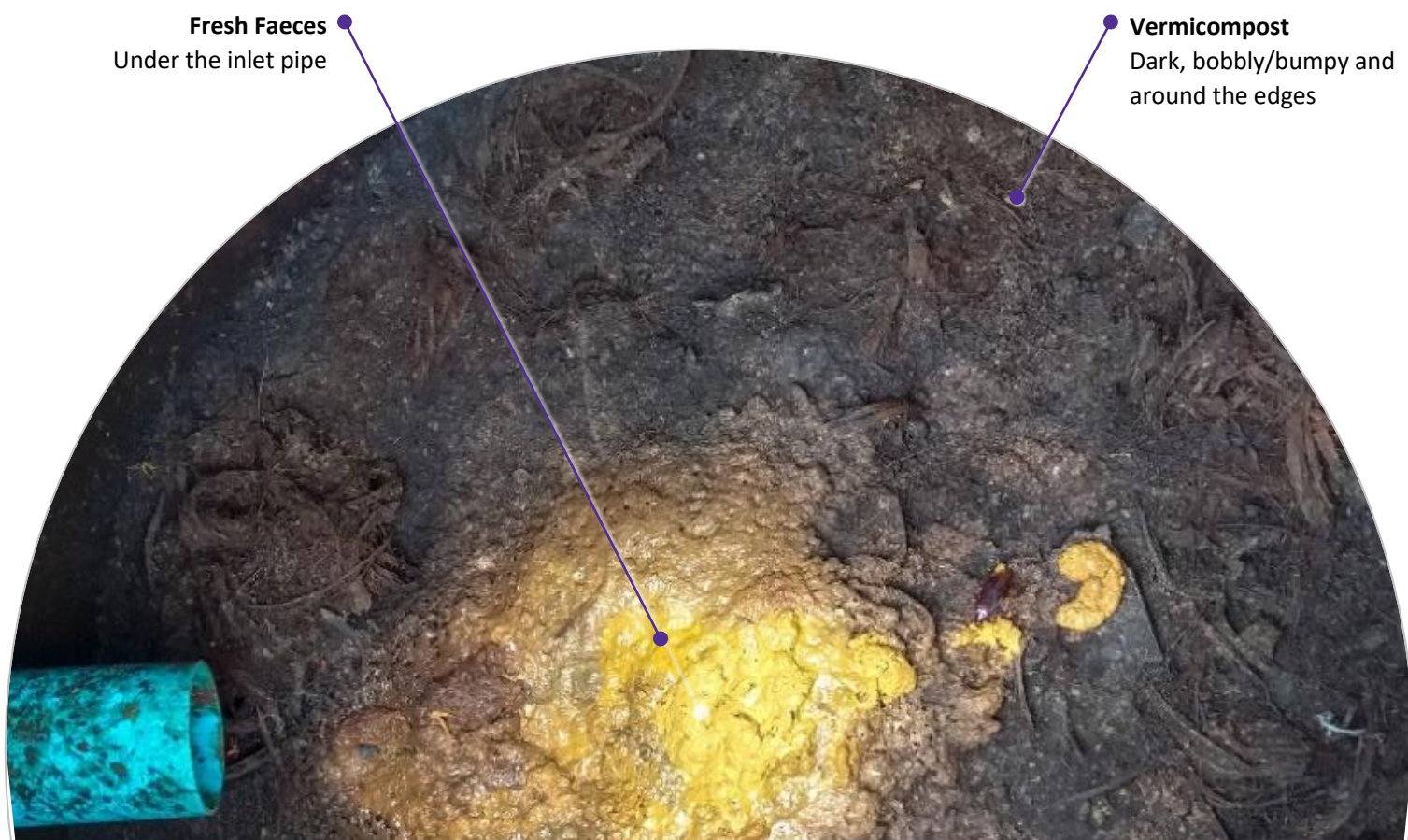
Vermicompost will be dark and bobbly (bumpy) and should be building up around the sides edges of the pit. When using a stick to look under the surface it should still be dark and a bit soil like. If it is a bright colour under the surface then it is not vermicompost but accumulating fresh faeces.

## How to know when to empty?

When the level of faeces raises up to the level of the inlet pipe it is time to empty the pit.

## How often will it need emptying?

Trails so far suggest that household TWTs will require desludging between every 3 to 5 years. In Rakhine camps, where traditional pits are desludged every 6-months, it is expected that TWTs will require emptying every 2 to 4 years.







OK

Wood shavings bedding layer. Fresh faeces in the centre with maggots. 25% coverage of fresh faeces. A bit dry around edges, but ok where the faeces is. Some dry vermicompost at the top and left, with white mould/fungus growing on top, which is ok.



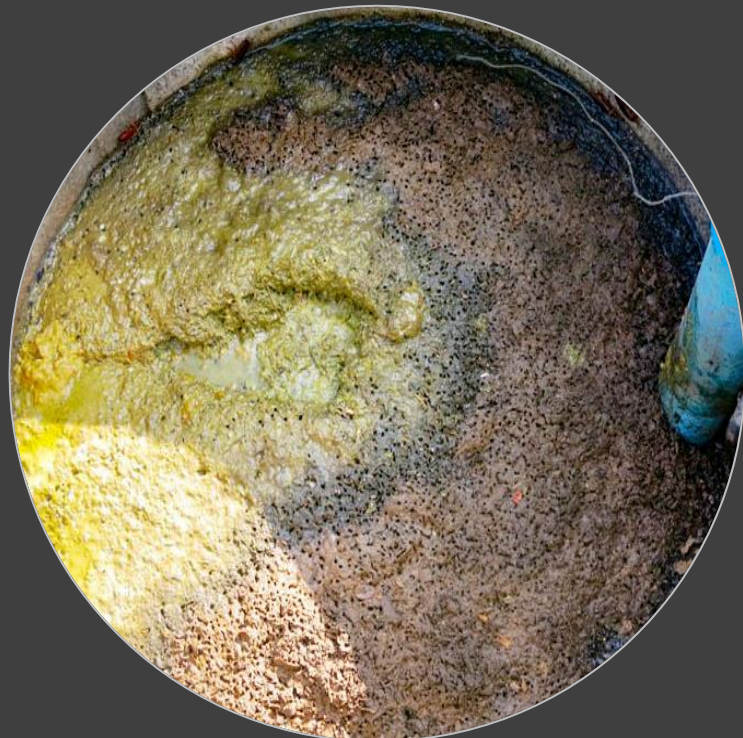
OK

Wood shavings bedding layer. Fresh faeces in the centre with maggots. 10% coverage of fresh faeces. A bit dry around edges, but ok where the faeces is. Dry vermicompost around the edges, with white mould/fungus growing on top, which is ok.



OK

Wood shavings bedding layer. Fresh faeces under the pipe but would be better in the centre. Suggests that the inlet pipe was not set up correctly. Patches of dry vermicompost with white mould/fungus growing on top, which is ok.



READY TO EMPTY

Fresh faeces is building up, showing that the pit is no longer functioning correctly. Dig under the brown area to see the colour and texture beneath. If it looks bright like fresh faeces, then the pit is not functioning, and it should be fully emptied. If dark and lumpy, it is vermicompost and should be emptied.





**Wait and see**

Fresh faeces is building up. The pit looks too wet, but it looks recent rather than chronic, as there appears to be vermicompost, which means that the pit has been working well. This could be a case of water infiltration after rains or high water table. Monitor in 1-3 weeks (depending on rain) to see if the pit is drying and fresh faeces reducing. Empty if the faeces reaches the pipe.



**OK, Ensure a proper pit seal**

Vermicompost around the edges shows that the pit is functioning. Fresh faeces appears to be building up a little. Check again in 1-3 weeks (depending on rain) if the amount of fresh faeces is reducing. The cockroaches are not harmful for the worms, but if the pit is not well sealed, they can leave and transmit diseases. Make sure the pit and latrine are well sealed.



**OK**

Coconut husk bedding layer. Fresh faeces in the centre, around 15% coverage. Vermicompost appears to be building up around the edges and looks like dark, bobbly soil. This pit is working well.



**OK**

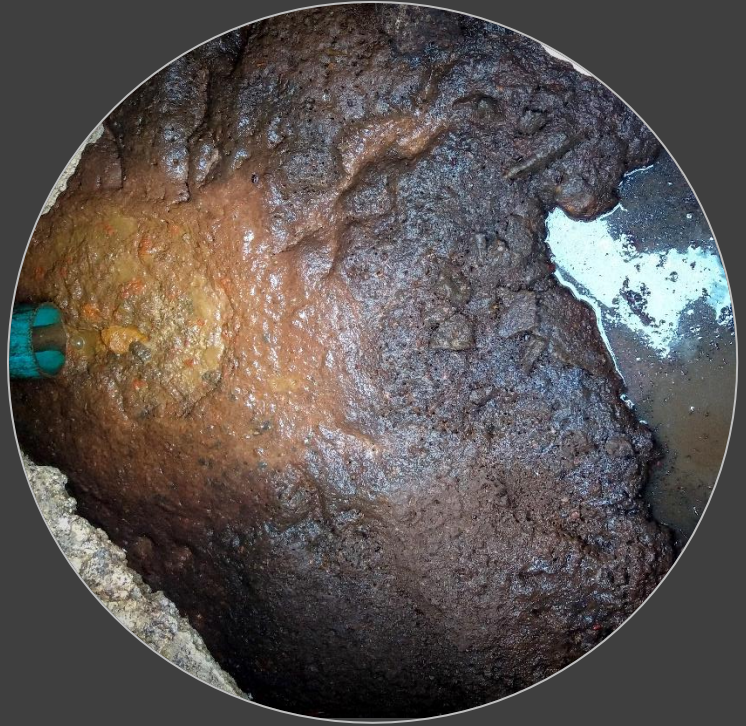
Looks ok. Fresh faeces building up a bit. Check under dark surface around edges. Looks like vermicompost, but if bright colour under the surface, then it is fresh faeces.





**Not in Use**

Some dark soil-like vermicompost but no fresh faeces and dry. Check under surface for worms or worm eggs. Find out why the toilet is not in use. If no worms or worm eggs, it will require re-seeding when the toilet starts being used again.



**Too Wet**

The pit is almost full, faeces is almost reaching the inlet pipe. The pit is too wet but there will probably be worms under the surface in the drier patches. Stop using for a week to see if the worms process the fresh faeces and the pit become less wet. Then empty the darker vermicompost at the edges.



**OK**

Coconut husk bedding layer. Slightly too dry at the edges but ok. Vermicompost can be seen building up like dark soil around the edges. Fresh faeces is building up a little. Try to not use for a few days and see if the fresh faeces reduces.



**Too Wet**

It doesn't look like fresh faeces, which suggests that the pit has been functioning but has recently become too wet. This means it is more likely due to infiltration from rains or rising water table rather than too much water from users. Check again after some days of no rain.





OK, but a bit wet

Vermicompost is being produced, it is bobbly and dark. The pit is a bit too wet, but worms can be seen. Some of the vermicompost areas could be emptied now.



OK

Lots of nice vermicompost building up. Fresh faeces can be seen in another part of the pit. The pit is functioning well.



Too Dry

Coconut husk bedding layer. Only a little fresh faeces and quite dry, suggesting that not enough people are using the toilet. Check how many users and that they are using at least 1.5 litres per time. Dark soil like vermicompost can be seen in the pit.



OK

Dark and bobbly vermicompost can be seen around the edges. The amount of fresh faeces is ok. The white colour is a fungus/mould and is ok. The water content is ok, not too dry and not too wet.

# EMPTYING

When the level of vermicompost and raw faeces in the pit reaches the inlet pipe, emptying is required. Ideally, the toilets are emptied after being left un-used for one week to allow the fresh faeces to be converted into vermicompost.

1. Vermicompost still contains pathogens, so health and safety precautions should be followed.
2. Dig a small disposal pit nearby to empty the vermicompost into. Ensure that it is deep enough for the vermicompost to be covered with 30cm of soil.
3. Remove the vermicompost from the edges of the pit using a small spade. Avoid any fresh faeces.
4. Try to not remove the vermicompost in the centre of the pit or the original bedding layer, as this is where many of the worms live.
5. Bury the removed vermicompost in the nearby disposal pit and cover with 30cm of soil.
6. The remaining vermicompost in the middle of the pit should then be spread across the surface to create a new bedding layer. Additional bedding material can be mixed in.

During the emptying process it is expected that some worms will be removed from the pit.

## Case Study: Lesson from Myanmar

**Pit Flooding:** In one of the project sites, where the individual household TWTs were located, many of the pits became very saturated during the rainy season and stopped working as TWTs. The field team reported that this location experiences a high ground water table during the rainy season and that in some areas the infiltration rate is very poor.

**If the pit is found to be flooded, try to determine the likely cause:**

<b>Temporary due to rain entering the pit</b>	Re-seal the pit to prevent rainwater from entering again.
<b>Insufficient Infiltration</b>	Can a lower volume flush pan be fitted? Otherwise an infiltration trench, or similar, will need to be retrofitted or the number of users reduced to prevent continued flooding.
<b>High ground water table</b>	If this is unusual and temporary, wait for the pit to drain, check for worms and add new worms if needed.  If this is a long-term problem the TWT will not function properly and will need to be decommissioned and rebuilt with the base of the pit above the highest water table level.
<b>More users than expected</b>	Advise the TWT owner that the toilet only functions properly with up to the designed number of users.



# User Operation and Training

## Tiger Worm Toilet Kit

To facilitate the use of the toilet some items should be distributed with the toilet. These may include:

- a child's potty,
- toilet brush,
- broom or mop,
- a bucket or drum for storing water,
- a cup or small jug for flushing the toilet,
- handwashing container,
- soap for cleaning and handwashing – the cheapest locally available to increase the chance the user will replenish themselves.

## Key Messages

Simple messages should be given to the users about how to operate the toilet. A selection of these can be developed into a pictorial guide to be put inside the toilets as a reminder.

Key messages include:

Urinate, conduct anal cleansing, and defecate in the hole (not around it);

Use a cup of water to flush the toilet after every use;

Use the toilet brush to clean any faeces around the hole to avoid bad smell and flies;

Avoid using detergents that can kill worms - use plain water to clean the latrine;

Always store water in the toilet for flushing;

Dispose children's faeces into the toilet – use potties for children who are unable to use the toilet;

Wash hands with soap or ash after using the toilet;

Avoid using the toilets for bathing or showering because excess water isn't good for the worms;

Do not throw solid waste, such as disposable pads, bottles, dry cell batteries, broken glass, metal etc., into the toilet, as these will stop the toilet functioning properly.



# Monitoring of TWT

Monitoring of the Tiger Worm Toilets can check for:

1. User acceptance and problems users are facing.

To confirm that the number of users has not increased beyond the design capacity of the TWT

2. Are the toilets used correctly?

The superstructure observations give an indication if the correct toilet usage instructions are being followed, such as only using water for cleaning.

If the tank smells of bleach or cleaning products, the users need to be reminded that this can kill the worms.

If the tank smells of rotten eggs it suggests that the systems has become anaerobic and that that it is no longer functioning correctly

3. Filling rate, to check the worms are eating the faeces properly.

If the faeces is building up as a cone then it is not distributing properly and the worms are not able to access it.

There may be a problem with the inlet pipe.

If fresh faeces are building up and covering more surface area then the worms are not processing the faeces fast enough. If there is >90% coverage of fresh faeces then there may be a problem.

4. Conditions in the toilet, is the environment suitable for worms and how many are inside.

The monitoring system should consist of continuous surveillance of the toilets, a systematic survey and focus group discussions.

## Continuous surveillance

Community mobilisers will be on the ground continuously, and through their routine visits they will have a good understanding of how the latrines are being used. If the issues they identify can be captured and shared quickly then they can be dealt with in good time. They will regularly fill out monitoring forms for each of the toilets.

## Systematic Survey

Conducting a systematic survey every three months is useful to establish filling rates, trends and provide clear evidence of the performance of the toilets. Systematically sampling every second toilet can provide representative information. An example checklist that can be used is included in the **Annex 9**, pg.74. If the survey is installed on phones or tablets it is easier to track the data. The checklist does not ask any questions about the users as some people may not be home when the monitoring takes place.

During the survey photos can be taken inside a selection of the toilets to represent normal conditions and outliers. These can be used later to make a visual comparison of how things have changed.

Conducting a survey will typically require at least two people: one to fill in the forms whilst another checks inside the toilets and takes photos.

To understand what is happening inside the toilet, it is necessary to do more than just look inside; a stick can be used to disturb the surface of the toilet to check the worms are present. This stick needs to be safely disposed of inside the toilet.

## Focus Group Discussions

A sample focus group discussion template is in the **Annex 9**. Given the personal nature of toilet use, focus group discussions should be held in small homogenous groups (men, women, children). Initially focus groups should be held regularly as attitudes and understanding may change quickly and changes are likely to be made as a result.



Once the toilets have been established for some time it is easier to include questions about toilets into other monitoring activities, for example into focus groups held as part of an annual knowledge, attitudes and practice study.




## Tiger Worm Toilet Education Materials.

The experienced WASH team (from Dire Dawa, Ethiopia) came up with the following ideas for tiger worm toilets education materials, these ideas have use to develop our IEC materials.

1. Tiger toilet is a flushing system (a water drainage system)
2. The worms in the pit transform the faecal matter into vermin-compost
3. The toilet does not smell & has no flies
4. Do not use any disinfectants & detergents (bleaching agent) during cleaning the toilet
5. Use only water when cleaning the toilet
6. Do not drop stone, plastics, and menstrual cleaning pads into the opening of the pit
7. Do not exceed the number of users that the toilet was designed for.
8. Flush the toilet with 1-2 litre of water after each use
9. Cover the hole with the lid after each use to avoid entrance of flies
10. The toilet is not designed for showering (don't use for showering)



# TROUBLESHOOTING of TWT

If	Then
 <p>No worms can be seen in the toilets</p>	<p>It can often be difficult to find the worms, so check again after a few weeks and monitor if the fresh faeces is building up. Empty the faeces if the build-up is too much and re-seed the pit with new worms. Try to determine the cause and therefore what may need to be changed or repaired.</p>
 <p>No vermicompost is being produced</p>	<p>If worms can be seen, but no vermicompost can be seen check all other factors that contribute to good operation; water quantity, aerobic bedding layer, no cleaning products etc.</p>
 <p>Fresh faeces is building up, covering 100% of the pit surface</p>	<p>Check the number of users is as expected. If too many users, advise the toilet owners. Otherwise, the pit may require more worms.</p>
 <p>The pit is flooded or has been flooded</p>	<p>Check for worm presence after the flooding event. If worms are no longer present, normally there will still be worm eggs which will hatch to re-seed the pit once conditions are correct. Due to the time for worms to grow, the pit may require additional new worms, check every 2-weeks. Investigate the cause of the flooding and remedy if possible.</p>
 <p>The pit looks too dry</p>	<p>Check if the numbers of users is as expected, are there too few? Advise the toilet users that they need to use more water to ensure the TWT benefits and keep it functioning correctly.</p>
 <p>The bedding looks too wet</p>	<p>Check if the numbers of users is as expected, are there too many? Are people using more water than expected and designed for? Could rainwater be coming in through cracks in the pit or gaps in the lid? If no, the infiltration rate may be less than expected and/or the drainage or bedding layer clogged. Check again after 1-week if the pit had drained. If no, check if bedding or drainage layer looks clogged by digging down. If no, an additional infiltration trench may need to be installed.</p>
 <p>You find rats or centipedes in the pits</p>	<p>Remove them from the pit. Check how they could have entered and repair the toilet to prevent them from entering again.</p>
 <p>You find cockroaches or maggots in the pit</p>	<p>Cockroaches and maggots are not harmful to the worms but can spread disease when they leave the pit. Check how they could have entered and repair the toilet to prevent them from entering again.</p>
 <p>There is a rotten egg smell when opening the pit</p>	<p>The pit has become anaerobic and the worms do not have an airy enough environment. Empty the sludge and vermicompost from the pit and add some new bedding layer.</p>

# Frequently Asked Questions - FAQs

## **What stops the worms from escaping either down into the soil or climbing out of the pit?**

When the environment in the pit is correct, the worms will stay present. They will not climb out of the pit.

## **How do you prevent the worms getting too hot or too cold?**

The optimal temperate range is from 5 to 35 degC. The construction of the pit helps keep the worm environment at a stable temperature.

## **Can medical drugs, alcohol or any disease in people harm the worms?**

No. Diseases in humans will not affect the worms. Drugs and alcohol would be in too low concentrations to affect the worms.

## **How do you know the maximum level of the water table?**

The local community will likely know this, particularly if there are dug well or handpumps. Local borehole and toilet contractors are also good sources of information.

## **How long can I wait between putting the worms in the pit and people starting to use the toilet?**

People should start using the toilet at the same time as the worms are placed in the toilet. If this is not possible, food should be placed in the pit for the worms, such as cow manure or organic food waste and water the pit each day to maintain the moisture until the toilet starts to be used.

## **Can people start using the toilet before the worms are placed in the pit?**

People can start using the pit up to a month before the worms are added to the pit.

## **How much do worms cost?**

This varies significantly by country. Identify and contact possible worm suppliers to confirm the cost and available quantity before deciding to use TWTs.

## **How to transport worms from the supplier to the site?**

See the worm transportation guide in the annex.

## **How does desludging frequency compare to a normal toilet?**

This depends on the number of users and size of a normal toilet pit. In the Rakhine camps the TWTs did not require emptying in more than one-year, whereas the normal camp toilets normally require desludging every 6-months. Single household TWTs have been shown in other countries to only require emptying after 5-years. A traditional pit latrine with a 1.5m<sup>3</sup> pit and serving 5 users would also be expected to only require emptying after 5-years.

## **Can we use the vermicompost as a fertilizer?**

There is not yet enough evidence to support using vermicompost as fertiliser on crops or fruit trees. Therefore, this should not be done.

## **How many kg of worms do we need for 1m x 1m x1.2m deep?**

Note that 60% of the Biodigester volume is occupied by the coconut coir, filtration material and diverse structures (porous slabs) and compartment (effluent transit chambers). However, the 2Kg E.Eugenia still have the 1m<sup>2</sup> surface \* 0.4 cm deep available to freely move inside the Biodigester.

## **What are the typical environmental conditions for tiger worms to survive?**



E. Eugenia enjoys tropical condition. 3 main factors: aeration, temperature between 25-30Deg, the moisture 60-80%.

### **How effective are the worms?**

1 Kg of E.Eugenia can breakdown up to 700-800g of the volume of faeces / day

### **Do we need to separate the solid waste from the Urine before entering the Biodigester?**

There is no need to separate the urine.... the urine is not harm to the worm and considering how the biodigester is designed, HRT is enough good to allow effluent percolate out of the biodigester. The urine component is even important if the effluent is to be used as fertilizer.

### **Do the worms produce their own waste? If yes, is it considerable?**

E.Eugenia is used in vermicomposting. Vermicomposting, a mesophilic process carried out by earthworms, involves ingestion, digestion and absorption of organic waste followed by excretion of castings through the worm's metabolic system, enhancing the levels of plant-nutrients of organic waste during their biological activities.

### **Is the effluent flow rate the same as how much water is being used to flush the toilet?**

Definitely not, the flow rate will most probably depend on the filtration materials and layers tightness. It may also depend on the balance volume of waste cumulated in the biodigester.

### **Does the owner have to aerate the biodigester to prevent anaerobic conditions?**

No aeration is needed. Flushing the toilet is one of the aeration sources. The biodigester is also designed not to allow the system to go anaerobic.

### **What is the lifespan of worms in specific tanks?**

Scientists predict that the average lifespan under field conditions is four to eight years; still most garden varieties live only one to two years.

### **How do you see the management of tiger toilets at a larger scale? How will they be managed?**

At larger scale, the bio-toilet needs to be associated to the greening or agricultural business. This could be a real entry point for household food /revenue generating activities. Community small enterprises could be set up to manage such project therefore reinforce the local entrepreneurship.

### **What are the challenges so far in terms of management of tiger toilet from the users' perspective?**

Minor challenges registered are incorporated to make sure that the design fits with the number of user, prevent the use of detergent in the toilet, prevent inorganic material to get into the biodigester, protect the worms against predator (insects), the effluent disposal or its effective use as soil conditioner.

### **What are the main challenges to scale up?**

There is no major challenge for scaling up so far. However, the toilet needs to be constructed by skilled and trained masons.

### **Around the community acceptance, what are the lessons learnt so far? What did we do, change and adapt so far?**

Communities are reluctant at the beginning (simply because they can't understand the concept). But after some training, they like the system due to the benefits of no desludging needs and the composting advantages.

# Acknowledgements

Oxfam has been working on Tiger Worm Toilets (TWT) for over a decade. Many Oxfam staff, consultants, private companies, have been involved in the gathering the information outlined in the manual. Numerous country programmes have implemented Tiger Worm toilet projects, Myanmar, Sierra Leone, Ethiopia, Liberia, Bangladesh and India. The experience gained and lessons learnt about design, operation and implementation are outlined in this manual.

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