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Deep Row Entrenchment:

A Simple Solution for Faecal Sludge Disposal

Context

The disposal (and treatment) of faecal sludge is often a challenge in the field. Most difficulties are linked to land acquisition and budget. It is hard to find host community members willing to rent/sell their land for the disposal of human excreta. And if a proper faecal sludge treatment plant is to be built, it is an important investment, requiring expert design and implementation, and long-term operation & maintenance costs. As a result, faecal sludge often tend to be discharged informally in open lands, with the risk of adverse environmental and public health impacts.

Deep row entrenchment, i.e. the disposal of faecal sludge in dedicated trenches, is a simple, low-cost solution that presents the following advantages:

- Faecal sludge is buried and contained.
- Trees can be planted on the closed trenches, and thus can be planned as a Livelihood activity or protection against wind or erosion.
- Flexible location: trenches can be placed where they are useful, without long-lasting impact on the land. This solution thus have a higher acceptance potential, and there is no need for a formal faecal sludge treatment plant.

The only condition for deep row entrenchment is to guarantee that there is no groundwater contamination potential. Provided that it is not the case, deep row entrenchment can be considered as both a treatment and end-use option.

This short guidance document aims to provide the basics for the design and implementation of deep row entrenchment for faecal sludge disposal, and to support advocacy for this option. It builds mostly on experience from South Africa (PiD, 2022; Still et al., 2012).

Design principles

Deep row entrenchment consists of digging trenches, filling them with sludge and covering them with soil. Trees can then be planted on top, which benefit from the organic matter and nutrients that are slowly released from the faecal sludge.

The trenches are best excavated with a backhoe. Dimensions are typically 0.8–1.5 m deep, about 0.6–1 m wide and with a length of several meters, depending of the space available. Space between rows can be 2 m or more edge-to-edge. The trench is filled with sludge up to 0.3 m from the surface and then backfilled with the previously excavated soil.

The volume of sludge should be estimated based on the sludge transport capacities (i.e. how many m^3 can be pumped and transported per day or per week?). Then, the volume of trench needed will depend on the sludge characteristics (more or less liquid) and the infiltration capacity of the soil. The latter can be estimated based on what happens in the first trench excavated. Based on the first experiences, you can estimate the number of trenches that you need for a given time.

These trenches full of sludge build an ideal ground for tree planting, especially in regions where soils are poor. Although not absolutely necessary, the concept is to plant trees or other vegetation on or between trenches (if edible crops, it is recommended as a precautionary measure to choose species whose product does not get in contact with the soil, such as mango or banana trees; not watermelons). While growing, trees will contribute to the transformation of the sludge into soil, while providing benefits to the community. Vegetation growth will highly benefit from the fertilising elements (nitrogen and phosphorus) present in the sludge.

Aspects to consider are trench dimensions, spacing, tree and plant species, composition and density of vegetation and end purpose. Deep row entrenchment can be considered where there is land available with adequate size and no groundwater contamination risk.

The decentralised entrenchment of faecal sludge near the source of the sludge has several advantages (PiD, 2022):

- Operations can be handled by a small business or community-led organisation
- Lower transport costs
- Minimal overhead and infrastructure required
- Minimal skills required for daily operation (no complex processes or machinery to manage)
- Timber or fruit can be grown to benefit the local community.

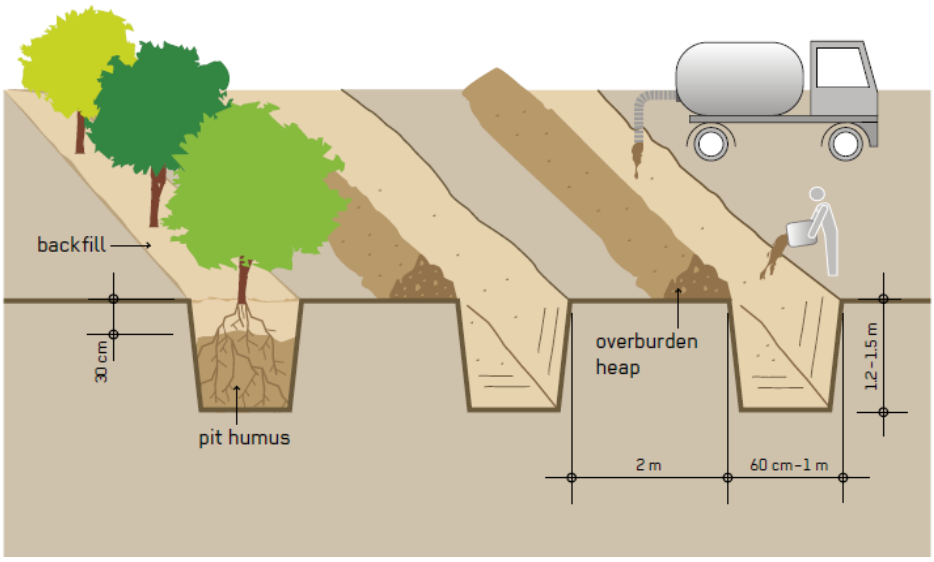

Figure 1: An example of deep row entrenchment (source: Gensch et al, 2018)

Siting and inclusion in settlement planning

Trenches can be dug flexibly wherever trees would be of added value, provided that the authorities and host communities agree. As a rule of thumb, they should not be implemented where the groundwater table is less than 10 meter deep, or where the soil is cracked. The distance to the source of sludge and access for vehicles transporting the sludge are also critical parameters. Trenches should be dug parallel to the ground contours. Trench spacing and dimensions will depend on the spacing of trees.

When siting the trenches, it is recommended to check which opportunities could be created for future community benefits. Such opportunities are:

- Creating planted wind barriers
- Stabilise soils against erosion: in that case, the trenches should be parallel to site contours.
- Create agroforestry zones as livelihood activity.

Such future benefits will increase acceptance while fostering protection of the trees.

Operation & maintenance

Deep row entrenchment requires little O&M. Most tasks aim at minimizing potential nuisance and health risks, as highlighted in the following paragraph. If a trench is not full at the end of the day, the sludge may be covered with a bit of excavated soil in order to prevent odour and attraction of vectors. The site should be fenced/taped in all case.

When the sludge in the trench reaches 30 cm below the surface, the trench should be backfilled with the soil excavated. The backfill over the trenches should be left heaped or ridged until planting to allow the backfill to settle and prevent erosion. Once planted, the young trees should be protected against animals.

Health and safety

The main requirement regarding public health is to locate the trenches where there is no risk of groundwater contamination. Then, there is minimal risk of infection if the filled trench is properly covered and clearly marked.

Personal protective equipment is required during sludge collection and disposal into the trench. This includes heavy duty gloves, masks, gumboots and work uniforms. Provision should be made for cleaning, disinfection and storage of equipment and protective gear, which may have come into contact with pathogens in the sludge, in a centralized location. Facilities should be provided for workers to shower and disinfect their hands as needed during and at the end of their workday.

Deep row entrenchment does not produce visible or olfactory nuisance, except during sludge transport and disposal until the trench is closed. Any spillage outside of the trench during disposal should be cleaned with a shovel and covered with lime powder. That means that no untreated excreta should remain at the soil surface.

Trenches should be fenced while in use. Later, the small trees should be protected (or the overall zone in case of agroforestry) in order to prevent access to animals.

Institutional aspects

Deep row entrenchment is not clearly regulated in each country. The plans should be discussed with local authorities. The advantages of deep row entrenchment over surface disposal and permanent treatment infrastructure should be clearly explained.

Example from South Africa (PiD, 2022)

In this pilot, trenches of 80 cm depth and 60 cm width were excavated, spaced 2.4 m apart edge to edge. Considering the local sludge characteristics and soil infiltration capacity, it allows an application rate of 990 m^3 per hectare with 300 mm backfill covering the sludge.

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Acknowledgements

Author: Philippe Reymond, Geneva Technical Hub, UNHCR-SDC/HA.

Funding: The Geneva Technical Hub is funded by the Swiss Agency for Cooperation and Development (SDC).