Turning Waste into Fertilisers:

A Rapid Response to Nitrogen Shortages for Low Income Households

A recent scientific paper has highlighted simple methods for recycling organic wastes in low-income countries[1]. Rising prices and limitations in supply of fertilisers are placing increasing pressures on smallholder farmers and threatening their ability to sustain productive and resilient cropping systems.

Recycling organic wastes offers a cost effective alternative source of nutrients, with potential to reduce dependency on imported synthetic fertilisers. However, labour availability can sometimes compel farmers to burn crop residues in the fields. Higher fuel costs can also drive increased use of crop residues and animal manures for household energy. These practices remove essential nutrients from agricultural soils and degrade air quality, posing serious risks to human health.

Therefore, low-cost and labour-efficient innovations are needed to improve recycling of organic wastes, while also meeting energy demands and reducing labour. These methods should stabilise residues so that soil organic matter can be managed with less inputs. They should also enhance the nutrient content of residues to produce more effective organic fertilisers.

Composting decomposes organic wastes in oxygen to make effective organic fertilisers.

Anaerobic digestion decomposes organic matter without oxygen to produce biogas for household energy, but also leaves behind bioslurry that can be used as an organic fertiliser.

Pyrolysis cookstoves burn organic wastes in the absence of oxygen to produce biochar that can be used to improve soils.

These are the key methods that can be used to recycle organic wastes; the best option for a particular household depends on the type of organic wastes and other resources available.

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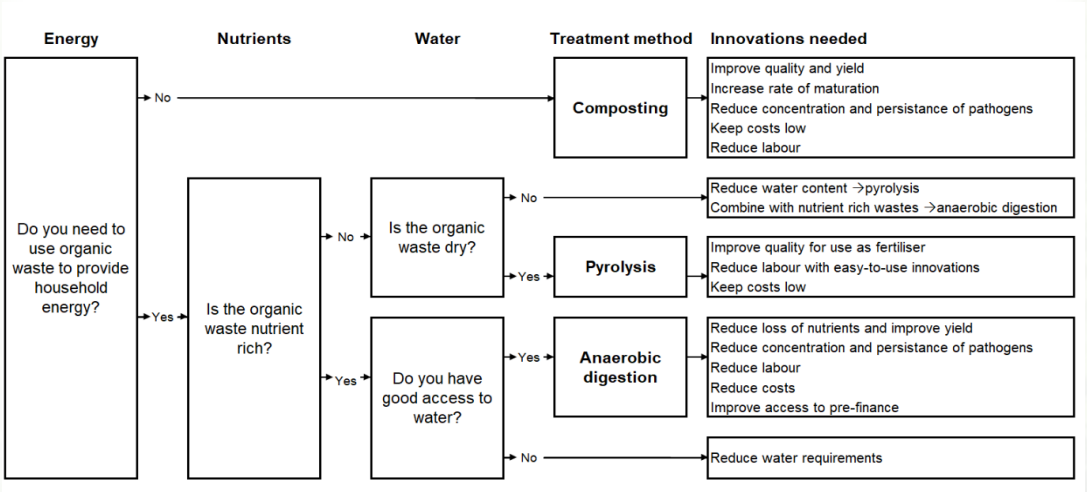
[1] *Smith et al., 2026. Environ. Res. Commun. 8, 042002* https://doi.org/10.1088/2515-7620/ae59f6

Key messages

- The most suitable way for a household to use organic wastes depends on household energy needs, the nutrient and water content of the waste, mechanization and the availability of labour, finance and water.
- If organic wastes are used to provide household energy, anaerobic digestion or pyrolysis are the better options; if energy is not needed, composting is a good choice as it requires less equipment and labour than the other methods.
- If the organic waste is high in nutrients, anaerobic digestion will provide biogas for cooking, while also allowing nutrients to be retained in bioslurry and applied to crops. However, dry materials will need to be mixed with wetter feedstocks or water, and digesters have relatively high startup costs.
- If the organic waste is dry and low in nutrients, a top lit updraft cookstove can be used for cooking, leaving behind pyrolysed carbon (biochar) that can be used to improve soil. Stoves are relatively cheap, and if biochar is used to soak up nutrients in animal urine, it becomes a convenient fertiliser that can be applied to crops.



With appropriate choice of technology and management, households can efficiently recycle nutrients to fertilise crops while also meeting energy needs.

Detailed technical notes on how to do this are given at

- Composting – https://www.abdn.ac.uk/media/site/sbs/documents/Technical-note---composting---V3.1.pdf
- Anaerobic Digestion – https://www.abdn.ac.uk/media/site/sbs/documents/Technical-note---anaerobic-digestion---V3.1.pdf
- Pyrolysis - https://www.abdn.ac.uk/media/site/sbs/documents/Technical-note---pyrolysis---V3.1.pdf

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