

# Best practices regarding bio-slurry and bio-slurry enriched compost application – a literature review

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Prepared by Biomass Research

## Introduction

African soils are threatened by overexploitation and the effects of climate change (more intense rains and prolonged drought). With declining soil carbon content and the immediate need for climate-smart agriculture, organic fertilizers are more important than ever. Bio-slurry application, either directly or as Bio-slurry Enriched Compost (BEC), can make production systems more robust and resilient. The OFVI project did literature research to assess the potential nutrient and fertilizer value of bio-slurry and BEC under prevailing conditions in some African countries.

## Method

Existing literature from online databases categorized by geographical region, and availability of data on bio-slurry and BEC. A first selection included nine studies for Kenya, nine for Uganda, five for Burkina Faso, two for Mali, and two for Niger. Other studies cover multiple countries in and outside the African continent. Data on the composition, fertilizer value and yield effects were analysed, making a distinction between short- and long-term effects. Short-term effects refer to the provision of nutrients needed for crop growth. Long-term effects include effects on soil structure, water holding capacity, organic matter, cation exchange capacity (CEC) and biology (bacteria, fungi).

## Yield effects

Data presented for Kenya (Rewe et al., 2021) and Uganda (Laban et al. 2017) suggest maize yield can be raised by 59%. Considerable yield effects are also reported for cabbage (70%) and coffee (66%; data by Laban et al., 2017), while eggplant yields in Uganda increased by 77% after bio-slurry application (Nanyanzi et al.; 2018).

Table 1: Short term yield effects of bio-slurry application

	Cereals	Grasses	Vegetables	Coffee
Compared to unfertilized plots	31%	27%	31%	44%
Compared to plots receiving mineral fertilizers	-4%	-1%	-3%	17%

Variations in crop varieties, cultivation practices, soils, and application levels make it very difficult to provide balanced yield assessments. Generalized yield effects for major crop groups (Table 1) suggest bio-slurry application increases yields by 27 to 44% in comparison to unfertilized plots. Yield effects were almost similar to those reported for chemical fertilizers. For coffee, bio-slurry is reported to be superior to mineral fertilizers, but this figure is based on one study only.

Short term yield effects for BEC application could not be assessed due to lack of suitable data. A first analysis suggests short term yield impacts for cereals and coffee may be superior to those of bio-slurry or mineral fertilizers. No difference was found for vegetable yields.

Long-term yield effects could not be quantified. Following van der Wurff et al. (2016), chemical fertilizers perform extremely well for short term nutrient availability. They are expected to, however, have a negative effect on soil life. Fresh bio-slurry is slightly less favourable for nutrient availability but has a positive effect on soil structure and soil life. BEC seems to combine positive effects of bio-slurry and ordinary compost, improving short- and long-term nutrient availability while stimulating soil composition and soil life.

Table 2: Long term effects of different types of fertilizers

Effect	Chemical fertilizer	Farmyard manure	Bio-slurry fresh	Bio-slurry dried	Compost	BEC fresh
Immediate - chemical	Highly positive	Slightly positive	Positive	Slightly positive	Slightly positive	Positive
Long term - chemical	Negative	Slightly positive	Slightly positive	Slightly positive	Slightly positive	Slightly positive
Long term - physical	Moderate negative	Positive	Slightly positive	Slightly positive	Highly positive	Highly positive
Long term - biological	Negative	Positive	Positive	Positive	Highly positive	Highly positive

Source: adapted from van der Wurff et al. (2016)

## Gender

After installation of anaerobic digestion systems on their farms, one third of the women report they spent extra time elsewhere, for example in participating in community and social activities. Biogas saved the women up to three hours each day, time that otherwise may have been spent on searching for firewood (Gautam et al. 2009). However, when it comes to preparing and applying compost, women – who do most of the work (Laban et al., 2017) may face increased time constraints.

## Safety

Although bio-slurry is promoted as a cheap and environmentally friendly alternative to chemical fertilizers, there are still many farmers who are unfamiliar with its potential risks. No toxic or harmful effects on soils or crops have been reported, and the concentration of heavy metals is very low compared to synthetic fertilizers (Kumar et al., 2015). Actual risks depend on the content of potentially toxic metals, pathogens, and viruses, retention time, and temperature of the digestion process. Also, spraying bio-slurry directly on crop leaves to increase yields brings risks, as anaerobic digestion does not necessarily kill all pathogens and parasites. This is especially relevant for application on vegetables.

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## Conclusion

The results from this study suggest bio-slurry and BEC are potentially strong organic fertilizers with high relevance to replace or complement chemical fertilizers in many cases. Long term effects, to be determined elsewhere, are expected to be superior to those of chemical fertilizers which makes them a crucial element of attempts to maintain or improve soil structure, soil life and soil production capacity. However, more data on local application practices and long term effect evaluations are needed.

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