your local fertilizer solution

Bioslurry Factsheet

Background

Bioslurry is a nutritious organic fertilizer produced through anaerobic breakdown of organic matter in a biodigester. It is characterized by a high organic matter content and contains the macronutrients nitrogen, phosphorus and potassium, and the micronutrients calcium, magnesium and iron required for crop growth (de Groot & Bogdanski, 2013). Generally, bioslurry consists of 93% water and 7% dry matter, of which 4.5% is organic and 2.5% inorganic matter (Warnars, 2014).

During anaerobic digestion, instable compounds composed of carbon, hydrogen and oxygen bonds are released as biogas and removed from the bioslurry. As nutrients are no longer locked up in these organic bonds, nutrients become plant available.

As a result of anaerobic breakdown, bioslurry has different characteristics than its substrate (Bonten et al., 2014). In bioslurry, the organic matter content is lower, more stable and has a lower C/N ratio. Moreover, the nutrient concentration, measured as the percentage share of organic matter, is higher in bioslurry. Especially nitrogen is affected by anaerobic digestion, as between 45-80% of total organic nitrogen in the substrate is converted to its mineral form ammonium, depending on substrate C/N ratio.

Bioslurry has a variety of benfits for the farm, as it can be used as a pesticide, to improve the soil structure and to introduce new forms of nutrients. As such, bioslurry can be used as a holistic solution to improve agricutlural systems and encourage organic crop production.

Improving soil structure

Generally, organic matter like animal manure and crop residues are removed for construction, feed and fuel purposes. As a result, soils are degrading and contain little organic matter. Bioslurry, a source of organic matter can be used to replenish soils and to improve the soil structure when applied over a longer period of time (Fulford, 2015). As volatile solids are removed, a strong carbon rich material is left over. This material acts like a sponge, able to absorb water and retain nutrients in plant root area. Consequently, the water- and nutrient holding capacity improves, allowing a more favourable environment for plant growth. As the remaining carbon rich material undergoes further decomposition when applied to the soil, nutrients are released throughout the growing season. Plants therefore have access to nutrients through their entire growth cycle.

Provision of nutrients

The fertilizer value, measured as the share of nutrients in plant available form, is higher in bioslurry than other organic fertilizers due to previous anaerobic digestion (Bonten et al., 2014). In organic fertilizers, nitrogen is typically present in its organic form, while in bioslurry a large quantity is transformed to the plant available form ammonium. The nutrient content in bioslurry is equal to the nutrient content of the susbtrate, as little is lost during the digestion process. The farmer can thus easily influence the nutrient content of bioslurry by chosing the substrate to use for the biodigester. Although compared to alternative fertilizers like inorganic fertilizers bioslurry cannot compete with yields (de Groot & Bogdanski, 2013), the use of bioslurry is particular useful for farmers that otherwise do not have access to fertilizers. As bioslurry sustainably replenishes soils through the addition of organic matter and nutrients, bioslurry can also sustain long term crop productivity.

Bioslurry as a pesticide

A few studies have mentioned the use of bioslurry as a pesticide and fungicide (de Groot & Bogdanski, 2013). Fulford (2015) has attributed this effect to indirect processes. Microbes surviving the anaerobic digestion process reduce pathogens through competition for resources like nutrients. Moreover, the release of nutrients throughout the growing season results in stronger crop growth, improving plants mechanism against pests. Hence, the addition of bioslurry encourages the establishment of a natural system, allowing a balanced population of pests and beneficial organisms. The biocidal properties can also be explained by the high

volatile fatty acid content, as pathogens cannot strive in an acidic environment (De Groot and Bogdanksi, 2013).

Bioslurry storage

As bioslurry is continuously produced, but crops only require nutrients at specific times during the growing season, adequate storage facilities are crucial to avoid nutrient losses through volatilization and leaching (Bonten et al., 2014). Bioslurry has a high water content when it leaves the biodigester, which makes it more difficult to store and transport it to areas where the bioslurry is needed. Moreover, at a liquid state, the risk of nturient losses is higher. One option is to use farm storage facilities, but these often require high investments. Two other possibilities are to transport the bioslurry to other farms who can directly apply bioslurry, or to convert bioslurry to compost. Converting bioslurry to its solid form will simplify storage and handling, and also reduce the risk of nutrient losses. To compost, organic matter like straw is added to the liquid bioslurry in layers. The organic matter soaks up the water, while microorganisms use the nutrients in bioslurry to speed up the composting process (Kossmann et al., 1999). In composted bioslurry, nutrients are present in its biological form, increasing its long term benefits. Sun drying bioslurry will lead to heavy nitrogen losses and should be avoided.

Bioslurry application

Bioslurry can be applied in its liquid or solid state using a variety of methods, depending on access to transportation and availability of storage facilities. Liquid bioslurry can be applied through a furrow system, foliar application, and application around a standing crop like coffee or ensete during the growing season. Composted bioslurry can be icnroporated into the soil during soil preperation or also applied around a standing crop. These methods are further explained in the (B)energy bioslurry manual.

Further reading

Bonten, L. T. C., Zwart, K. B., Rietra, R. P. J. J., Postma, R., De Haas, M., & Nysingh, S. (2014). Bio-slurry as fertilizer: is bio-slurry from household digesters a better fertilizer than manure?: a literature review (1566-7197).

Fulford, D. (2015). Small-scale rural biogas programmes: A handbook: Practical Action Publishing.

de Groot, L., & Bogdanski, A. (2013). Bioslurry= brown gold? A review of scientific literature on the co-product of biogas production: Food and Agriculture Organization of the United Nations (FAO).

Kossmann, W., Pönitz, U., Habermehl, S., Hoerz, T., Krämer, B. et. al (1999). Biogas Digest, Volume II–Biogas–Application and Product Development. Information and Advisory Service on Appropriate Technology, Eschborn.

Warnars, L. (2014). Bioslurry: a supreme fertilizer. Positive effects of bioslurry on crops.