

Feeding Hungry Soils of Northern Ghana using Kitchen Waste as Compost

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Abstract

The soils of northern Ghana are mostly undeveloped and characterized by poor fertility and productivity especially towards the Sahara desert. The issue of climate change affecting rainfall patterns and high cost of fertilizers further exacerbates issues surrounding productive soils and food security. Waste separation is not a common practice in both rural and urban areas of the country. Domestic composting of kitchen waste is therefore not a popular practice amongst small holder farmers in the area, as they mostly rely on subsidized fertilizers and waste from livestock and other animals to improve their soils. The Regentropfen College of Applied Sciences in Ghana has however mapped out a research plan that sought to use kitchen waste from their students' hostel and model schools to promote nutrient cycling in their ecosystem to produce 100% organic food products to sustain its community. The intervention will eventually be scaled up in the immediate community (Bongo district) after implementation. The main ideology of this endeavour is to promote sustainable agriculture, reduce greenhouse gas emissions and promote sustainable livelihoods for all. This article is therefore a mini review on the subject matter.

Introduction

Climate change is a major threat when it comes to agricultural production in the tropics, the situation is apparently worse in semi-arid to arid areas. Northern Ghana is a drought prone farming area characterized by a unimodal rainfall pattern, savannah (Sudan and Guinea Savannah) vegetation as well as low to medium nutrient rich soils [1,2]. The soils have pH values between the ranges of 5.5- 6.0, which is ideal for producing grains, however, areas like the Bongo district in the Upper East region is characterised by acidic soils. The soils here are under continuous cropping and generally have organic matter ≥ 10 g/kg, a clear indicator that without soil amendments, soil productivity may decline adversely [1]. Most cereals grown include maize, millet, sorghum and rice, with rice mostly cultivated around irrigated dams across the various regions in northern Ghana. Northern Ghana has annual rainfall between 800mm to 1300mm.

The farming classification in northern Ghana is mainly subsistent although there is a gradual shift towards commercialization in some areas with the introduction of interventions and innovations from both government and non-governmental organizations. The main feature of subsistence farming here is a mixed farming system. Therefore, this implies the rearing of animals and cultivation of crops. Farmers obtain benefits from this system as some animals are used in land preparation, serve as insurance against crop failure [3] and their droppings are a source of soil amendment especially at the onset of the rainy season. In fact, a study by Herve and others [4] in 2016 indicated, 31% of farmers in Northern Region (not to be confused with northern Ghana) amend their soils using organic manure sources varying from animal droppings, crop residue and compost. However, 36% (of 31% farmers) apply naturally composted organic resources from refuse dumps. Making composted organic manures for use rare (i.e. only 7% of 31% farmers, when compared to assumed proportion). The use of organic matter from refuse dumps may have environmental repercussions as there is a poor culture of refuse separation in households of the in the country, which results in the presence of plastic and other non-degradable elements in the soil amendment. Some farmers however use potash/ wood ash as alternate or indigenous source of potassium especially in sweet potato production in the Bawku municipality of the Upper East region. The wood ash also possess insecticidal properties, hence reducing the incidence of sweet potato weevil (*Cylas spp*) infestation in developed storage roots. Kitchen waste as compost is therefore an important supplement for soil nutrients and an ideal way of reducing the carbon footprint, hence contributing to climate change mitigation.

Why the Need for Kitchen Waste as an Alternative Source of Soil Improvement?

Issaka and others reported in 2012 that, each year, an estimated 2 million metric tonnes of manure is produced in the northern part of Ghana [5] and the organic carbon contents of these manures vary from 27% to 32% [6] The recommended application rate of manure is 4-5 tonnes per hectare [6,7] (but farmers are able to supply 1.0-1.5 tonnes of organic carbon per hectare to cultivated fields. This reiterates the issue of insufficiency of organic matter in soil improvement, hence the need for alternative sources. Moreover, due the dominance of extensive system of rearing farm animals in these areas (particularly, the nomadic system), manures are not fully harnessed as a resource for soil amendment [4].

It has been reported by the International Fertilizer Development Centre (IFDC) [8] in 2019 that, from 2015-2017, the West African region saw a huge demand in fertilizer use, which was driven by 3 main factors

- favorable international commodity and fertilizer prices
- government interventions, including subsidy programs
- private sector investments in production, distribution, and marketing of fertilizers

The fertilizer subsidy programme by the government of Ghana (Planting for food and Jobs) enabled farmers, especially smallholder farmers to increase their yield. Sadly, the menace of corruption and smuggling of fertilizer into neighbouring countries crippled this intervention. Currently, inorganic fertilizer costs especially have soared due to economic variables in the country, which include inflation, the Russian-Ukrainian war and impacts of the COVID-19 pandemic.



Kitchen waste, especially uncooked residue from fruits and vegetables are a perfect recipe for compost that will possess organic matter and nutrients in varying proportions. This improves soil structure and microbial properties as well. This alternative is ideal for smallholder farmers especially immediately after the harvesting season. This is because, livestock owners usually free tethered animals which then feed on stubbles and crop residue over a period of time.

The only threat to this intervention is the use of kitchen waste to feed animals in a mixed farming system by some smallholder farmers especially in the dry season when vegetation is scanty. This is therefore one anticipated constraint when the idea of composting kitchen residue is introduced to smallholder farmers in rural areas. Those who rear pigs especially may prefer to use the kitchen waste in feeding their animals. According to Haydar and Mahood, [9] compost from kitchen waste has higher carbon to nitrogen content as compared to compost processed from solid waste produced in urban centres. This means compost from kitchen waste has higher organic content. They also stated that, composting of kitchen waste carried out in backyards of homes would reduce the amount of solid waste entering the system in a city like Lahore by 30%. This implies the need for the culture of sewage separation and the adoption of composting from kitchen waste both from urban and rural areas.

Challenges associated with Composting using Kitchen Waste

As mentioned earlier, areas where animal production is of equal importance or greater importance will pose a problem of adoption of kitchen waste as an alternative source of soil amendment. When composting site is in the backyard a few metres away from the household, odour from decomposing matter becomes a pollutant. In small households, composting can be achieved properly if there is another site the composting will be done. In fact, the by-products of kitchen waste composting, include some greenhouse gas (GHGs); and may include methane (CH₄), nitrous oxide (N₂O) and ammonia (NH₃) emissions which leads to environmental pollution. Since the composition of kitchen waste varies, there are some studies like that of Yang and others [10] that sort to reduce GHGs in kitchen waste composting though the use of additives. Mostly, there is a trade off when looking at reduction of environmental impacts of agricultural activities. Even though composting emits GHGs, so does improper disposal of waste and feeding this to livestock. The key is getting a more efficient way that serves both humanity and nature. Since some mineral additives are used to reduce GHG emissions, rural farmers may not be able to acquire some of these inputs, but further studies will suggest local materials or natural sources of these minerals that may reduce GHG emissions. Although the Ministry of Food and Agriculture and other non-governmental organizations support farmers and encourage them to use organic sources of soil amendments, their capacity building efforts yielded low adoption mainly due to a general lack of biomass in the area [11]. This can however be the case of the dry season which doesn't necessarily reflect information on annual biomass.

The Culture of Waste Separation and Related Environmental Concerns

The culture of separating waste is still primitive in the country. In support, it was reported by Danso and others [12] that, waste management and disposal in Ghana are inefficient and waste is usually unseparated. Sadly, most of the waste is biodegradable. This was even the case of municipal solid waste, which is of a larger quantity in comparison to what rural folks produce. The Regentropfen College of Applied Sciences intends to inculcate in its community, the urgency of social change that has positive outputs both for nature and man. Due to this, Waste bins that have been labelled as 'Kitchen waste only', has been provided at the students' hostel and the kitchen of their model school. Regular reminders and talk sessions have been held with students and the college community to separate their waste in order to have kitchen waste that enables composting easier. To motivate the community, the school garden provides a gift in the form of farm produce (mainly fresh vegetables) during the dry season to adhering students who separate waste to enable them understand how much their waste feeds the soil and back to them.

Conclusion and Recommendation

Nutrient cycling is important in crop production to consumption of agricultural products from cultivated fields. This reduces dependency on mineral or inorganic fertilizer and other sources of soil amendment which may have higher GHG emissions through their production, transportation and application. Kitchen waste as composting

material has economic benefits since it cuts down on soil amendment (input) cost as well as the cost of waste disposal by companies which is in the case of medium to high income dwellers of rural settlements as well as institutions like the Regentropfen College of Applied Sciences. Kitchen waste composting will have to be made at a site where the compost is distant from the main household. Waste separation is key in achieving pure compost devoid of non-biodegradable materials and this takes some social change. Further research will be conducted to provide indigenous alternative measures of reducing GHG emissions that emanate from kitchen waste composting.

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