

Challenges and opportunities in managing agricultural waste in Ghana

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Abstract: - There has not been much research into the management of agricultural waste in Ghana. The most common solution is the utilization of agricultural waste for composting, as animal fodder and most often as a source of energy. The implementation of most of the solutions to agricultural waste management does not meet the basic elements of sustainability like environmental protection and social progression, technical and technological improvement as well as economic improvements.

This paper seeks to outline the major challenges to sustainable agricultural waste management in Ghana and the opportunities of effective utilization of agricultural waste.

Key-Words: - Agricultural waste, residue, waste management, manure, compost, environment

1 Background

Agriculture is Ghana's most important economic sector, employing more than half the population on a formal and informal basis and accounting for almost half of GDP as shown in figure 1 and also accounts for about 35 % of Ghana's export earnings since 2000 [1,2]. The country produces a variety of crops in various climatic zones which range from dry savanna to wet forest and which run in east west bands across the country. Agricultural crops, including yams, grains, cocoa, oil palms, kola nuts, and timber, forms the base of Ghana's economy

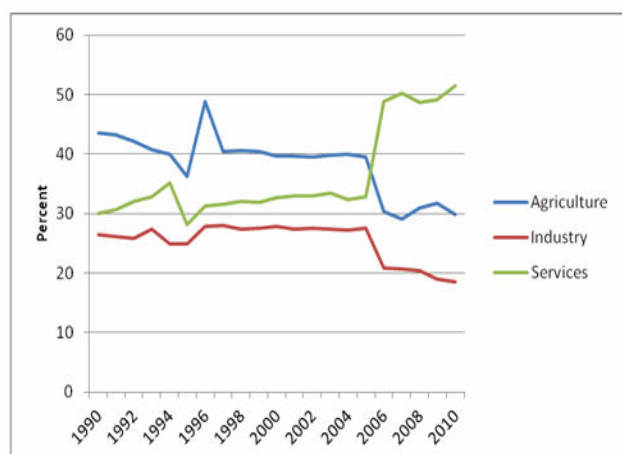


Fig.1 Contribution of agriculture to GDP (%), sources: [Nsem.com]

An interesting angle to Ghana's agriculture dilemma is the fact that only about 16% of Ghana's arable land is used for farming. Agriculture, which has about 70% of its population in the rural areas involved in agriculture, ironically imports over 40%

of its food needs. Furthermore, while agriculture contributes nearly half of Ghana's GDP, only 10% of the national budget is allocated to the sector [3]. Ghana's agriculture is largely rain-fed, with traditional systems of farming still prevailing in most parts of the country. Production levels vary according to weather conditions since Ghana's irrigation potential remains almost untapped. Poor technology and small production units prohibit economies of scale and lead to sub-optimal yields. For example, maize and rice are produced at a third of their potential yields per hectare [4].

Despite the efforts at improving agriculture in Ghana, overall, the agricultural sector has not changed much from its primitive practices. Specifically, food farming, fishing methods and effective utilization of waste from agricultural processes have remained the same for ages with little or minimal modernization. The private sector is still largely engaged in cocoa and cash crops production. In particular, the crops subsector has a large majority of small holders who are constrained by their inability to mechanize and increase productivity.

In order to achieve a sustainable agricultural sector, it is important to consider all area of agricultural activities and not only productivity. It is important to regard the following as interlinked determinants;

- An enabling environment for the smallholder farming sector,
- Income generation,
- Reversing soil fertility depletion,
- Protecting the environment, and
- Intensifying and diversifying land use with high-value products.

With the expansion also means there is an increase in the amount of agriculture waste generated and waste generated from agricultural process must be treated also as a by-product. The importance of agricultural waste as an alternative resource base has to be emphasized.

2 Status of Agro waste Use in Ghana

Agricultural waste can be defined as wastes normally associated with the production and processing of food and fiber on farms, feedlots, ranches, ranges, and forests which may include animal manure, crop residues, and dead animals; also agricultural chemicals and their residues and containers, which contribute contaminants to surface and subsurface water (ASAE S292.5)[2]. Agricultural activities leave considerable amounts of agricultural waste. Large quantities of agricultural wastes are produced, from farming systems in Ghana, in the form of crop residue. Some of it is recycled back into production as fertilizer (compost or manure) , use as animal fodder (figure 2), while large amounts remain unused and eventually burned on the field – and in many instances pose a problem. Uncontrolled burning in the fields is not only a hazardous disposal solution - it is also wasting useful energy. Burning of agricultural residue in the fields is a common practice in Ghana. It is used primarily to clear remaining straw and stubble after harvest and to prepare the field for the next cropping cycle.

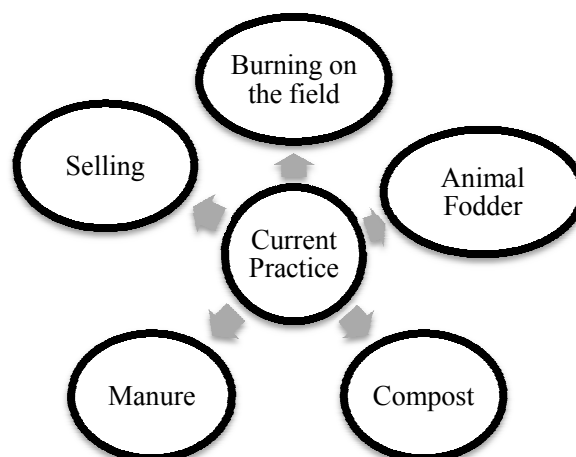


Fig.2, Use of agro waste in Ghana

Also due to the high post-harvest loses, a considerable part of Ghana's agricultural produce turn to waste due to decay (e.g. grains), pest infestations, rotten vegetable and many more. Agricultural wastes are widely available, renewable and virtually free, hence they can be an important resource. It is estimated that more than 4.2 million tons of Agricultural residue are generated yearly in Ghana[5] as seen in table 1 which shows the Production of different agricultural crops in Ghana for 2008 and estimated potential of residues (not inclusive of residues of other notable crops such as groundnut, cashew).

| Crop | Crop Production (x1000 tonnes) | Residue Type | Residue to Product ratio | Residue (wet,x1000 tonnes) | Residue (dry,x1000 tonnes) | Residues energy potential (PJ) |
|-----------------|--------------------------------|--------------|--------------------------|----------------------------|----------------------------|--------------------------------|
| Maize | 1,100 | Stalk | 1.5 | 1650 | 1402.5 | 25.76 |
| Sorghum | 350 | Stalk | 2.62 | 917 | 779.45 | 15.59 |
| Cocoa | 700 | Pods,husk | 1 | 700 | 595 | 10.84 |
| Millet | 160 | Stalk | 3 | 480 | 408 | 7.44 |
| Oil palm fruits | 1,900 | EFB | 0.25 | 475 | 190 | 7.37 |
| Rice | 242 | Straw | 1.5 | 363 | 308.55 | 5.65 |
| Coffee | 165 | Husk | 2.1 | 346.5 | 294.525 | 0.04 |
| Coconut | 316 | Shell | 0.6 | 189.6 | 170.64 | 2.01 |
| Sugarcane | 145 | Bagase | 0.3 | 43.5 | 10.875 | 0.58 |
| Total | | | | 5164.6 | 4159.54 | 75.28 |

Table 1, Production of different agricultural crops in Ghana for 2008 and estimated potential of residues [5]

3 Effect of agro waste on the environment

Not until recent times when the need to monitor the effect human activities on the environment was heightened due to global warming and its impacts, agricultural waste was subjected to the same control as other sectors. The impact of agricultural

waste on the environment does not depend necessary on the quantity generated but mostly on the effectiveness of the disposal methods employed. Some of the disposal practices if not properly done leads to polluting the environment [6, 7, 8].

Impacts to human health and the environment associated with the management of agricultural

wastes primarily involve release or emission of nutrients, such as nitrogen (N), phosphorus (P) and potassium (K), bacteria or contaminants into water courses, groundwater or the air. Nutrients are required for optimal growth of plants however; excessive nitrates, phosphates and bacteria or other contaminants in water resources can impact fish, wildlife and water quality [9].

Burning of agricultural waste is a common practice in Ghana, but it is a source of atmospheric pollution. Countless research has proven that agricultural waste burning releases pollutants such as carbon monoxide, nitrous oxide, nitrogen dioxide and particles (smoke carbon). These pollutants are accompanied by the formation of ozone and nitric acid, hence contributing to acid deposition thereby posing risk to human and ecological health. [8,10,11,12]

Waste from livestock productions (faeces, urine, and respiration and fermentation gases) all contribute a lot to environmental pollution if not properly managed and it is a global concern and is much more acute and serious in developing countries where a greater of the animals are kept on free range system. Agriculture waste is also a source of air pollution. It is the dominant anthropogenic source of ammonia. Livestock account for about 40 percent of global emissions, mineral fertilizers for 16 percent and biomass burning and crop residues for about 18 percent [13]. Animal wastes are excreted in solid, liquid, and gaseous forms. Respiration and fermentation gases are lost to the environment soon after being produced by the animal. After excretion, solid and liquid animal waste is subjected to microbial conversion (mainly anaerobic), which converts organic substrates into microbial biomass and soluble and gaseous products. Some of these products have an impact on the environment, as well as effects on water quality, soil deterioration, and air pollution as well as odour pollution [8].

The improper application and or excessive animal wastes on farm land as fertilizer and soil conditioner is subject to surface run-off and leaching that may contaminate ground or surface waters. For that reason, nitrate leaching is considered a major nitrogen (N) pollution concern on livestock farms [8, 14]. When phosphorus (P) enters the surface waters from land application of excessive animal manure it can stimulate the growth of algae and other aquatic plants. Their subsequent decomposition results in increased oxygen demand that interferes with the welfare of fish. Manure decomposition can be a major source of methane (CH₄), ammonia (NH₃) and nitrogen

oxides, which contribute to accumulation of greenhouse gases. Volatilization of ammonia causes acid deposition, which contributes to acid precipitation. Emissions of nitrous oxide (N₂O) during the nitrification-denitrification cycle contribute to ozone depletion [8, 15, 16,17].

4 Challenges to proper Management

Currently there is not much control of agricultural waste management in Ghana. There is a lack of detailed regulations on agricultural wastes management for human health and environmental protection, especially specific decree under Laws, circular to guide implementation. Generally the level of research and documentation of experiences in the management of agricultural waste is very low. In summary, an analysis of the current situation reveals key deficit of knowledge in the following areas:

- Research in alternative management streams preferably less labour intensive and environmental stable from the current trend.
- Proper resource mobilization (collection and transportation) of agricultural waste management within rural areas.
- Institutional capabilities in terms of monitoring and control of both organic and hazardous agricultural waste disposal by farmers. Specifically the lack of detailed regulations on agricultural wastes management for environmental protection, especially specific decree under Laws, circular to guide implementation.
- There is not yet detailed policy addressing advantages when investing into agricultural waste management. Already developed policies are known in many countries for handling variety of needs related to many different kinds of wastes, which also cover agricultural wastes to a certain extent. In addition, policy development is a continuous process, and yet may not be available to cite for every situation. In order to cater to development of technologies and utilization of wastes, additional policy needs should be developed and implemented as the necessity arises with time.
- Another challenge is the lack of interest by major stakeholders (fig 3.) in the management of agricultural waste. There is limited private sector involvement in the management of agricultural waste with the exception of some NGOs who are involved

in turning agricultural waste into useful resources. Some farmers sell their crop residues to livestock farmers and to other

entrepreneurs who market this useful waste.

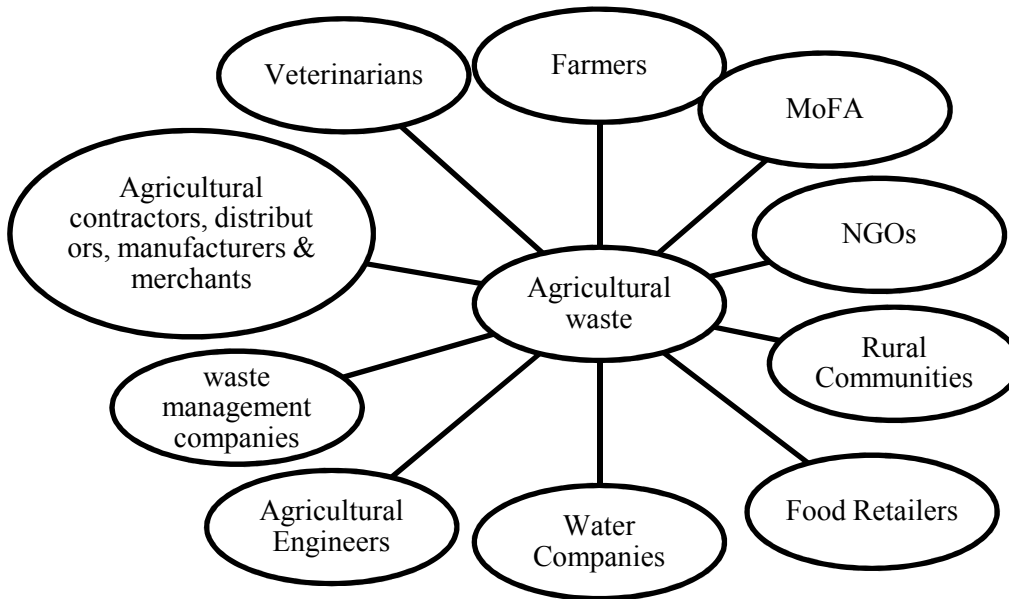


Fig.3. Stakeholders in the management of agricultural waste in Ghana

5 Potential for agricultural waste

There are enormous potential of agricultural wastes in Ghana like crop residues, animal wastes and post-harvest wastes which are mostly organic in nature. They form the potential renewable energy source as biomass. Agricultural biomass waste converted to energy can substantially displace fossil fuel, reduce emissions of greenhouse gases and provide renewable energy to people in developing countries, which still lack access to electricity [2]. There are several methods that have been developed for the better exploitation of agricultural wastes. Agricultural residue (grass, dry leaves, sugarcane trash, etc.) which are produced in huge quantities in Ghana is put to little use. The conversion of agricultural wastes to char, by an environment friendly, continuous batch process, briquetting of the char into a solid fuel form and use as an efficient, clean source of fuel [2].

These can be classified into **conventional methods** and **entrepreneurial methods**. Conventional methods recycle and reuse agricultural waste in a simplest manner most often on the farm using traditional knowledge, while entrepreneurial methods often look for a novel use, increased efficiency, and enhancement of profits. However, the type of waste management varies from country to country and farm to farm. Although agricultural wastes are recycled and reused in many ways in Ghana, documentation of such information is very scarce.

Therefore, this compilation contains information provided in literature and many of the methods as per long term observation.

The target should be to make agricultural wastes a resource that can be utilized and not just discarded. Agricultural wastes can be used to enhance food security mainly through their use as bio-fertilizer and soil amendment, use as animal feed, and energy. Turning these agricultural wastes (crop residues and animal manures) into organic fertilizers (through composting) is one of the waste treatment technologies that make it possible to use organic waste as a fertilizer.

The production of energy from agricultural waste has been utilized to varying degrees in different parts of the world [2]. Besides generating revenue from the energy produced, waste-to-energy schemes offer an alternative and environmentally acceptable means of waste disposal. Additionally, the schemes also provide a valuable by-product: a good quality, agricultural fertilizer that is nearly odourless. With the concern over future energy shortages and increasing costs of conventional fuels and electricity derived from them, there is increasing interest in using anaerobic digestion as a source of renewable energy while providing acceptable waste management. For instance, in Uganda, the basic source of fuel is wood used in the form of charcoal or firewood for heating and cooking. This dependence on traditional charcoal and

firewood is responsible for the prevailing deforestation and soil degradation, the effects of which have manifested in irregular rainfall, floods and violent storms [2,8,18].

6 Conclusions

Agricultural wastes can be a valuable resource for improving food security; however, if not treated, kept or disposed of properly, agricultural wastes are likely to cause pollution to the environment or even harm to human health. This calls for increased public awareness on the benefits and potential hazards of agricultural wastes, especially in developing countries like Ghana. There is the need to increase the awareness and interest of all the stakeholders in fig.3. Ghana has to develop specific policies and specific guidelines for the management of Agricultural waste.

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