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Adoption of Local Organic Resources for Soil Fertility Improvement in Crop Production: Ghana

Rich Kofituo[a], Daniel Sarpong[a] and Godfred Ofosu-Budu[b]

[a]*University of Ghana, Dept. of Agricultural Economics and Agribusiness, Ghana*
[b]*University of Ghana, Forest and Horticultural Research Center, Ghana*

Abstract

The Organic Resource Management for the improvement of Soil Fertility (ORM4SOIL: www.orm4soil.net) Project funded by SDC and SNFS as part of the Swiss Program for Research on Global Issues for Development (r4d programme) in the University of Ghana aims at improving soil fertility with concentration on adoption of local organic resources and cost-effective ways of improving soil fertility. This study sought to determine factors that influence intensity of adoption of local organic resources for soil fertility improvement in Ada West District of Ghana. Preliminary data analyzed using descriptive statistics, Tobit model, partial budget and break-even analysis show that about 88.7% of crop farmers use organic materials out of which 49.5% use animal dropping other than cow dung and 39.2% use matured cow dung only as their local organic resource. Looking at the two-main local organic resources, the intensity (scale of 0-1) of use of other animal manure is 0.43 and the intensity of use of matured cow dung is 0.65. The factors that influence intensity of adoption of matured cow dung or animal manure are their cost, access to credit by farmers, educational level of farmers, farmers membership of Farmer Based Organizations and ownership of farmland. The partial budget shows that, crop farmers who produced pepper recorded a net loss when they initially replaced inorganic fertilizer with matured cow dung. The break-even point for pepper farmers using matured cow dung in soil fertility improvement is approximately 48 kg of pepper at a selling price of GHS 1200. The most pressing constraint of crop farmers in the use of matured cow dung and other animal manure for soil fertility improvement is its labour intensiveness. It is recommended that extension agents concentrate on training farmers on how to combine the use of matured cow dung and other animal manure with inorganic fertilizer in the right quantity to maximize production. Both cattle farmers and crop farmers should be given technical training in compost preparation to reduce the bulkiness and labour intensiveness of dealing with cow dung and other animal manure in soil fertility improvement.

Keywords: Adoption, Crop farmers, Ghana, Local Organic Resources, soil Fertility Improvement

*Corresponding author Email: kofikofituo@gmail.com

Introduction

Unlike most soils in sub-Saharan Africa, the ones in the coastal arid savannah of the Ada West District of Ghana are deposits of sand, with poor levels of soil organic matter, water holding capacity, low base saturation and high salinity with low fertility level as characterized by most Ghanaian soils (IFPRI *et al.* 2015). Soils in this area have been used for farming without much attention paid to replenishing their nutrient and organic matter content especially as most farmers in Africa are engaged in poor soil management practices (Vanlauwe *et al.* 2017). The scientific community is now engaged in research geared towards practices targeted at Soil management to provide improved soil fertility and support crop nutrition sufficiently avoiding the adverse impact it can have on the environment (Tamm *et al.* 2016). Smallholder farmers in Ghana largely depend on rain-fed agriculture and this is restricted to two rainy seasons with short but heavy rains. Under the above conditions farmers in the Ada West District of Ghana are growing vegetables for the local and urban markets. In the presented study, opportunities for an improved soil management by the use of locally available organic resources are evaluated. The farmers' needs and intentions are taken into consideration while analyzing the experiences and chances for adopting land and crop management options to improve soil fertility, which in the long run helps to improve yields and yield stability. The issues raised here are; What are the locally available organic resources for soil fertility improvement in Ada West district and which factors influence the intensity of their adoption?

Material and Methods

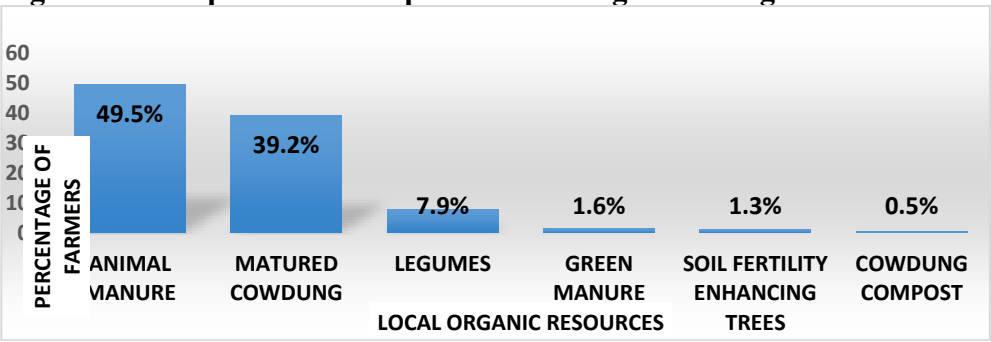
Data was collected in six selected communities in the district based on their location on the map of the district with Sege (District capital) as reference point and other towns within 10 Km radius. Two towns were selected at the upper region of the district, two within the middle region and the last two at the lower or bottom region of the district. Random-walk sampling technique was used to locate farming households for interview and in the case of multiple household within a compound the kish grid was used to select the appropriate household head to interview. Primary data on household/farm characteristics and the use of local organic resources for soil fertility improvement was collected from 317 vegetable farmers using a semi-structured questionnaire across the upper, middle and lower zones of the district. Bar graphs projecting proportions, ratios, partial budget, break-even analysis and the Tobit regression model were used in analysis of the objectives

Results and Discussion

Proportion of Crop Farmers using Local Organic Resources

All farmers use one form or the other of local organic resources in improving the fertility of their soil. However, the use of animal manure and matured cow dung proved to be dominant. Among the 317 farmers interviewed, 49.5% use animal manure whiles 39.2% use matured cow dung in improving the fertility of their soil. Altogether 88.7% of smallholder farmers in Ada use both animal manure (swine droppings, duck droppings, and other poultry droppings combined) and matured cow dung in improving the fertility of their soil. The availability of animal manure within the locality coupled with the fact that it is not being purchased for use by the farmers is an influential factor in majority of them using it. The use of matured cow dung which comes second is also as a result of the fact that the Ada West District and its neighbouring Districts and communities are into cattle rearing. Unlike the animal manure, they usually buy the cow dung from the cattle farmers at determined prices. This is consistent with the assertion of Ajewole (2010) and Lavison (2013) that, the proximity of a raw material has a positive influence on its use by farmers.

Figure 1.1: Proportion of Crop Farmers using Local Organic Resources



Intensity of Use of Local Organic Resources by Crop Farmers in Soil Fertility Improvement
The mean intensity of use of animal manure is 0.43. This implies that smallholder farmers who use animal manure in improving the fertility of their soil, apply it to about 43% of their farmland in total. The mean intensity of matured cow dung is 0.65. This implies that smallholder farmers who use matured cow dung in improving the fertility of their soil, apply it to about 65% of their farmland in total. In relative comparison, even though higher percentage of farmers (49.5%) are using animal manure as compared to matured cow dung (39.2%) in terms of proportional representation of usage, the farmers who use matured cow dung use it more intensely as compared to the farmers who use animal manure. This can be related to the fact that the matured cow dung has a better structured market in the locality hence a more reliable source of supplier for use. The animal manure however does not have a structured market as compared to the matured cow dung hence its supply is not dependable and this can influence negatively its availability and hence contribute to its relatively low intensity of use. Most users of animal mature depend on the benevolence of neighbours who keep it and supply to them.

Factors that Influence the Intensity of Adoption of Animal Manure and Matured Cow dung
Results from the Tobit model analysis showed that, factors that influence the intensity of adoption of both animal manure and matured cow dung are; farmers access to credit, farmers ownership of land and farmers ownership of a means of transport. Also, factors having positive relation with the adoption of these two organic resources are; farmers' perception of the infertility of their soil, off-income, farmers' membership of FBO and farmers access to information on soil fertility enhancing local materials. These factors are very much consistent with earlier studies of (Abubakari et al,2014**)** and (Djokoto et al, 2016) whose results stated that socio-economic, institutional and technical factors influence farmers adoption of new technologies.

Estimating the Cost and Benefit of Using Local Organic Resources for Soil Fertility Improvement by Crop Farmers
Replacing inorganic fertilizer with matured cow dung in soil fertility improvement results in a net loss of GHS 699.50 per hectare. The break-even point of production for pepper farmers is 3.252 bags of pepper at a selling price of GHS 400.00. Averagely, pepper farmers who are currently using matured cow dung for soil fertility improvement are making a profit of GHS 1309.79 per hectare of production. This is much in line with literature reviewed by IFOAM (2013) on organic agriculture which shows its profitability but however makes reservation about how it is unstructured in Africa.

Analyses of the Constraints of Crop Farmers in Using Local Organic Resources for Soil Fertility Improvement
The most pressing challenge of using animal manure for soil fertility improvement in the Ada West District is labor intensive, followed by its expensiveness, transportation difficulty, insufficiency, lack of equipment to adequately handle animal manure and finally non-availability of animal

manure in that order respectively, which are consistent with constraints identified by previous study in the area (Mutala et al, 2016) and the use of organic materials in soil fertility enhancement (Ajewole, 2010**)**.

Conclusions and Outlook

Despite the widely anticipated use of a variety of local organic resources for soil fertility improvement by crop farmers in Ada West District, majority of them use animal manure and matured cow dung. Farmers who use matured cow dung use it more intensely as compared to those who use animal manure for soil fertility improvement. The factors that influence the intensity of adoption of matured cow dung or animal manure are their cost, access to credit by farmers, educational level of farmers, farmers membership of FBOs and farmers ownership of their own lands. The use of local organic resources for soil fertility improvement in the short term is not comparatively profitable to farmers as compared to inorganic fertilizer use. The most pressing challenge in using local organic resources by farmers in soil fertility improvement is its labor intensiveness which encompasses the process of its mobilization, processing and preparation for use and finally its application to the soil. Further research work can be done on the efficient standard quantity of local organic resources to use for soil fertility improvement.

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