Ghana Soil Health Consortium

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Prioritizing Integrated Soil Fertility Management for Increased Agricultural Productivity in Ghana

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Summary:

While substantially good results have been achieved in the area of crop improvement, pest and disease control, the low use of fertilizers to maintain and/or replenish agricultural soils and therefore declining soil fertility still remains a major concern for policy. Declining soil fertility and low use of fertilizers in the country explains the low agriculture production in the country and therefore requires a solution. A relatively new practice-integrated soil fertility management (ISFM) has been introduced as a stop gap measure in this direction. Studies on ISFM in Ghana, indicate that cropping improved maize variety with a combined fertilizer (inorganic and organic) resulted in yields higher than that obtained by applying fertilizers (organic or inorganic) alone. In spite of this, only a handful of farmers are employing the technology in the country. The need to improve research and delivery of this new practice for quicker adoption by smallholder farmers is crucial for the country. It is recommended that a deliberate effort by government and other stakeholders are required to improve research, delivery and advocacy on ISFM. Without this, the country is not likely to attain the green revolution that some countries attained in Asia.

Introduction

In recent years, research in agronomy and soil science have suggested that in sub Saharan Africa, including Ghana, the trending poor agricultural production and productivity are as a result of declining soil fertility. This may have been caused by the physical loss of soils nutrients resulting from erosion, leaching and nutrient mining, from continuous cropping. This usually results in loss of soil organic carbon, which may be fixed by applying a combination of inorganic and organic fertilizers. Generally, poorly managed soils undermines the ability of many agricultural households to produce enough food. In many cases, this has often led to food insecurity and persistent widespread poverty in many parts of rural farming communities in Africa.

The use of Integrated Soil Fertility Management* (ISFM) is being advocated since this soil management practice helps to maintain and improve soil fertility. While this has been observed to impart greatly on crop growth and yield, farmers' response to the practice are not encouraging. The adoption of the practice by farmers in Ghana, has been usually low and incomplete. This is in spite of its food security, farm income and environmental protection benefits.

**Integrated Soil Fertility Management (ISFM) is defined as the use of farming practices that involve the combined use of inorganic and organic inputs, improved germplasm and other planting materials combined with the knowledge on how to adapt these practices to local conditions so as to maximize the plant nutrient use efficiency while improving crop yields. All inputs need to be managed following sound farming principles.*

While this has been attributed to low awareness, limited access to agricultural information, the non-availability and non-affordability of the fertilizers has also played a role in the low rate of adoption. It has been observed that research and extension are not doing enough to support adoption due to lack of funding. Local investment in the production of the fertilizer is also a challenge. As a result of these, yield of staple crops (see Table 1) has remained far below the attainable yield. All things being equal, an ISFM practice as intervention is likely to increase yield levels of the crops.

Table 1: Yield of selected staple food crops in Ghana (2005-2010)

CROP	YIELD (Mt ha^{-1})					
	2005	2006	2007	2008	2009	2010
Maize	1.31	1.24	1.25	1.25	1.28	1.65
Rice	1.11	1.12	1.15	1.08	1.23	2.74
Cassava	9.95	9.51	9.86	10.2	10.62	15.33
Yam	9.83	9.8	10.27	10.58	11.73	13.94
Cocoyam	6.79	6.53	6.26	6.45	6.39	6.36
Plantain	9.38	9.45	9.67	10.1	10.28	9.93
Cowpea	0	0	0	0	0	0.58
Groundnut	0	0	0	0	0	1.42

(SRID, MOFA, 2011)

Table 2 shows achievable yields of selected crops in Ghana. The average yields in 2010 shows that most crops are produced at a range of 20%-60% of their achievable yields. Under Integrated Soil Fertility Management, not only will the achievable be produced but also sustained for longer period of cultivation without necessarily shifting to new fields.

Table 2. Average Yield of Selected Food Crops Under Rain fed Conditions in Ghana

CROP	AVERAGE YIELD (MT/HA) 2010	ACHIEVABLE YIELD (MT/HA)
Cassava	13.8	48.7
Plantain	11.0	20.0
Yam	15.3	49.0
Cocoyam	6.7	8.0
Maize	1.7	6.0
Rice (Paddy)	2.4	6.5
Cowpea	1.3	2.6
Groundnut	1.5	2.5
Tomato	7.5	15.0
Pepper	6.5	32.3

Source: SRID, MOFA, 2011

Note: Achievable yields indicate cases where more effective extension and use of recommended technologies and practices such as ISFM have been used. Data on achievable yields have been revised in line with findings by the CSIR-Crop Research Institute.

Field trials and experiments conducted on different soil fertility restoring practices have shown that a combination of inorganic and organic fertilization lead to substantial increases in crop yields, especially when the appropriate proportions of fertilizers and other agronomic practices are adhered to. This brief therefore presents some benefits likely to be accrued to farmers and other stakeholders, if the ISFM which involves the use of inorganic fertilizer combined with organic manure and an improved variety of a crop in a locally specific environment, is wholly adopted and implemented.

Evidence from the field

Some recent studies in Ghana on soil fertility and productivity of crops provides evidences that a combination of inorganic fertilizer and organic manure as soil nutrient amendment is able to improve yield of improved germplasms. This is especially so when the right amounts of the fertilizers is combined with local knowledge on how to adapt the practice to a particular local environment. For example, Yeboah, (2010), conducted a study on soil fertility amendments on selected crops in a suburb of Kumasi in the Ashanti Region of Ghana. The results confirmed that a combination of inorganic and organic fertilizers applied on an improved maize germplasm (mamaba) influenced maize crop yield significantly. The study showed that a higher application rate of 4 t C ha–l with no inorganic N fertilizer resulted in higher maize grain yield. This study observed that applications of cattle manure resulted in 27% more maize grain yield at the higher application rate of 4 t C ha–l. While the results differed based on the soil fertility amendments, the results of the field trial showed a general improvement in crop yield with the use of the combined fertilizers (inorganic and organic) as opposed to the use of only inorganic fertilizer.

Another study to characterize poultry manure and two composted materials (household waste plus poultry manure and market waste plus faecal sludge) was conducted at the Soil Research Institute of CSIR in Kumasi. The purpose of this study was to evaluate the influence of organic and inorganic fertilizers and their combination on the growth and yield of maize (Fening et al 2005). The results confirmed the superior performance of organic matter inclusion in crop production. The study revealed that combined treatments of organic and inorganic fertilizers gave higher yield values in the range of 8.9 tons ha-1. The evaluation showed that there was no significant difference employing sole treatment of inorganic or organic fertilizers. The results (8.9 tons/ha) was based on a poultry manure application rate of 60 kg ha-1 and inorganic NPK rate of 60-40-40 kg ha-1. The combined treatments had significantly higher nutrient uptake values than the sole organic and inorganic fertilizers alone. The superior maize yields obtained from the application of organic materials, irrespective of the quality, demonstrate the potential of organic materials to support maize grain yields in the country.

These and other evidence from research fields and others elsewhere in the sub region suggests that combining organic and inorganic fertilizers in the right proportions has the potential to improve crop yield significantly, while maximizing the plant nutrient use efficiency and soil sustainability. The right conditions of the crops should be provided for a maximum yield attainment. The results suggests that, in a country like Ghana, where waste has become a problem for the government, such waste could easily be turned into organic matter and be used in the farm in combination with inorganic fertilizer. Among other benefits, this practice has a potential for reducing costs of production thereby improving farmers' levels of income and thereby reducing poverty in the long term. Although this may create some challenges for some farmers, particularly those in areas where the manure will have to be transported over long distances to the farms, the practice cannot be discounted since it holds a good promise for farmers and the teeming youth, majority of whom are unemployed.

Conclusions

From the foregoing results from the experiments, application of ISFM reduces the amount of inorganic fertilizers to apply but does not necessarily reduce cost of fertilizer application of production. This is because of the cost of organic manure production, which presently is not for free. Yet, this practice has an added benefits of improve soil retention ability of the soil as well as improving on the yield of the crop in comparing with yield from application of inorganic fertilizers only. This is importantly significant to note, as continuous use of inorganic fertilizers only without proper management of the soil can cause some long term soil problems. The reduced amount of inorganic fertilizer used in the farm may translate into reduced costs of subsidies on inorganic fertilizers in the long term and thereby reducing the pressure on government budgets on inorganic fertilizer imports in the short term. This win-win situation brings benefits to the agricultural sector in particular and the national economy in general. Some added benefits of the acceptance and use of the new soil fertility management practice

is the creation of jobs among the teeming youth who are either unemployed or underemployed in rural communities. These jobs are created along the organic fertilizer value chain. With the commencement of production, some youth are expected to be involved in the operations of the organic fertilisers as well as its transportation and other services that may come up as local components of the production and distribution of organic fertilizers.

Recommendations

In the context of the impact of climate change and climate variations, there is an urgent need for government to build an enabling condition for the creation of awareness among farmers on the need to adopt the integrated soil fertility management as a way of conserving soil moisture and increasing the residual effects on the soil through regular campaigns and advocacy programmes

Since ISFM is a relatively new farm practice, there is the need for government to support the extension services by putting in place some mechanisms for the building of the technical capacity and the provision of the necessary material resource to extension officers to enable them train farmers about ISFM. Support to the extension service may result in increased adoption of ISFM and also compliment other policies such as the fertilizer subsidy programme.

Government should provide the needed incentive and create an enabling environment for the private sector to invest in conversion of the huge urban waste into organics fertilizers. This organic fertilizer therefore be sold alongside the inorganic fertilisers.

Government policy on subsidizing inorganic fertilizers should be made to include organic fertilizers. This is critical, especially when organic matter availability on a large scale is a challenge, making it expensive for farmers to produce their own organic fertilizers.

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