SMALLHOLDER ARABLE CROP FARMERS' PERCEPTION OF INTEGRATED SOIL FERTILITY MANAGEMENT IN EGBEDA LOCAL GOVERNMENT AREA OF OYO STATE

[*1]ADENIRAN A. A., [2]ATERE A. O., [1]OGUNTADE M. I., AND [1]IKUEJAWA I. I.

[1]*Department of Agricultural Extension and Management, Federal College of Agriculture, Ibadan, Oyo State*

[2]*Department of Agriculture and Bio-environmental Engineering, Federal College of Agriculture, Ibadan, Oyo State*

adeniranbayo@yahoo.com; 08063293197 or 08185585390

ABSTRACT

Soil fertility management is one of the key factors for sustainable food production in the agro-system. Fertile soil undoubtedly is required for the efficient performance of crops. The study examined the perception of smallholder arable crop farmers on Integrated Soil Fertility Management (ISFM) in Egbeda Local Government Area of Oyo State. Specifically, the study examined the socio-economic characteristics of the respondents; awareness of ISFM practices, techniques of ISFM adopted and perception of ISFM. One hundred and twenty respondents were drawn using a multistage sampling procedure. Data collection was made using structured and validated questionnaires and analysed with descriptive statistics. Results show that 58.3% of the respondents were male with a mean age of 42 years, having various forms of formal education (75.0%). Findings also show that 79.2% of smallholder arable crop farmers were aware of the combination of organic manure and inorganic fertilizer. Also, a combination of organic manure and inorganic fertilizer (87.5%) was widely adopted by the farmers. Findings further revealed that smallholder farmers (54.2%) were favourably disposed to integrated soil fertility management. Age ($r = -0.123$, $p = 0.181$), household size ($r = 0.073$, $p = 0.426$), year of farming experience ($r = -0.054$, $p = 0.556$), size of farmland ($r = 0.170$, $p = 0.064$) had no significant relationship with farmers' perception of ISFM. It was concluded that smallholder arable crop farmers were favourably disposed to integrated soil fertility management. There is a need for more information and training on ISFM to further enhance the perception of ISFM. This will go a long way to increase the productivity of the smallholder farming system.

Keywords: Arable crop, integrated soil fertility management, smallholder farmers

INTRODUCTION

Soil fertility management is one of the key factors for sustainable food production in the agrarian system. Fertile soil undoubtedly is required for the efficient performance of crops (Bayu, 2020) for human and livestock consumption as well as industrial usage. The agricultural system of many developing nations like Nigeria is widely dominated by smallholder farmers who are constrained by many factors that negatively affect their production output and income level (Mgbenka and Mbah, 2016). One of these factors is the degradation of soil fertility. Declining soil fertility and decreasing crop productivity have become serious threats and subjects of concern in the ability of the agricultural sector to feed the ever-increasing population. The major causes of most soil fertility reduction include nutrient removal through entire crop harvests, uncontrolled soil erosion, low soil organic matter, inherent soil infertility, limited application of appropriate types of fertilizers, and

inappropriate land management practices (Agegnehu *et al*., 2016).

Loss of soil nutrients through continuous cultivation of crops also contributes to declining soil fertility and subsequent reduction in the productivity of soils (Nakhumwa, 2004; Ande *et al*., 2017). It is evident that most smallholder farmers who are the main custodian of soil production resource base cultivate marginal soils with little or no nutrients for plant growth. The consequential effects are not limited to poor vegetative vigour but food insecurity and poverty at large. It is clear that good soil management considerably increases the value of soil (Lin *et al.,* 2006). The practices of traditional soil fertility management which include long-term fallows and crop rotations have been reducing over time because of population pressure on land and other external factors. Chemical fertilizer on the other hand was considered the main source of increasing soil fertility (Mahajan *et al.,* 2008). However, the concentration of efforts was on the type and amount of chemical fertilizer needed for optimum performance of crop with less consideration to smallholder farmers' affordability and effects on the environment. Empirical evidence indicates that the use of chemical fertilizers alone is not enough for reviving soil fertility (Shisanya *et al.,* 2009; Vanlauwe *et al.,* 2010).

Over the years, efforts addressing soil fertility among smallholder farmers have focused on improving the nutrient balance and the bio-physical characteristics of the soil (Lunze, *et al.,* 2012) by encouraging the use of fertilizers (both organic and inorganic), improved varieties and incorporation of other improved farming practices, including planting legumes and diversified crop rotations within cropping systems (Nkonya *et al.,* 2008). ISFM involves a range of synergistic practices, adapted to local conditions, such as judicious application of chemical fertilizers, efficient management of available organic resources, wider integration of nitrogen-fixing legumes into cropping systems, and conservation of soils and their biota and organic matter (Sanginga and Woomer, 2009). Results of an increase in cereal farmers' productivity and income through the adoption of ISFM have been reported in West Africa (Vanlauwe and Zingore, 2011). Nhamo *et al.* (2014) also showed that both crop residues and FYM (farm-yard manure) are crucial for enhancing the fertility of rice fields under ISFM. Integrating semi-perennial legumes has been shown to improve productivity and reduce maize yield variability in specific cases (Ollenburger, 2012).

ISFM therefore is about expanding the choice set of farmers by increasing their awareness of the variety of options available and how to complement or substitute the available soil fertility management resources. Considering the potential benefits of ISFM, its perception among smallholder farmers becomes very necessary for this study.

OBJECTIVES OF THE STUDY

Broadly, the study examined smallholder arable crop farmers' perception of Integrated Soil fertility Management in Egbeda Local Government Area of Oyo State. Specifically, the study:

1. described the socio-economic characteristics of the respondents;

2. examined the awareness of Integrated soil fertility management techniques by the respondents;
3. ascertained the ISFM techniques adopted by smallholder arable crop farmers;
4. examined smallholder arable crop famers' perception of ISFM.

Hypothesis of the study

Ho_1: There is no significant relationship between selected socio-economic characteristics of the farmers and their perception of ISFM.

METHODOLOGY

The study was conducted in Egbeda Local Government Area of Oyo State, Nigeria. Egbeda LGA is one of the 33 LGAs in Oyo State. It is also one of the eleven (11) LGAs that make up Ibadan Metropolis. Egbeda LGA is located on latitude 7^0 21'-80N and longitude 40^0 2' - 40 28'E with a total land area of approximately 191km^2. Egbeda LGA was carved out of the old Lagelu LGA in 1989 (Lawal, *et al.*, 2011) and subdivided into 11 wards (four urban and seven rural wards): Erunmu, Ayede/Alugbo/Koloko, OwoBaale/Kasumu, Olodan/Ajiwogbo, Olodo/Kumapayi I, Olodo II, Olodo III, Osegere/Awaye, Egbeda, Olode/Alakia, and Olubadan Estate. It is bounded in the East by Osun River, in the North by Lagelu Local Government, in the South by Ona-Ara Local Government Area and in the West by the Lagos-Ibadan Express Road. The Local Government Area currently has four (4) urban political wards and seven (7) rural wards covering a total of 136.83km^2. It is located in the rain-forest agro-ecological zone of sub-Sahara Africa. The mean annual rainfall and temperature of the area are about 2500 – 2600mm and 27.5^{0}C with fertile soil that support arable crop production.

A multistage sampling procedure was used to select the respondents. At the first stage, four wards were randomly selected from the existing eleven wards. Three villages were randomly selected in stage two from each of the selected wards to arrive at twelve villages. In the third stage, ten smallholder farmers were randomly selected from each of the selected villages using the list of registered smallholder arable crop farmers to arrive at a total of one hundred and twenty respondents. Primary data elucidating the objectives of the study were collected with the aid of structured questionnaire and interview schedule. To ascertain the perception of ISFM, list of positive and negative statements were presented using a four point Likert scale and responses scored as strongly agree = 4, agree = 3, disagree = 2 and strongly disagree = 1 for positive statements while reverse order was for the negative statements. Also, the index of respondents' perception towards ISFM was obtained from the statements used to ascertain the perception. Eleven statements were used with a maximum score of 44 and a minimum score of 11 based on the Likert scale. This gave a mid-point value of 27.5. All scores below this mid-point (11 – 27.49) were tagged as the percentage of farmers with unfavourable perception to ISFM while all scores above the mid-point (27.5 – 44.0) were tagged as the percentage of farmers with favourable perception to ISFM.

Data analysis was done using descriptive statistics such as frequency count and percentages while hypothesis was tested

using Pearson Product Moment Correlation.

RESULTS AND DISCUSSION

Socio-economic characteristic of respondents

Distribution of respondents based on sex (Table 1) shows that very little above half (58.3%) were male. This is an indication that arable crop production was dominated by male smallholder farmers. The finding is in agreement with Ashagidigbi *et al.* (2019) that arable farming in Nigeria is male dominated. It is believed that male farmers are strong enough to withstand the tedious production activities of arable crops while the female folks usually engaged in some less tedious processing activities. Findings further revealed that mean age of the respondents was 42years. This implies that smallholder arable crop farmers were still energetic and in their productive age. About 25.8% of the respondents had no formal education while 75.0% had various forms of education with secondary school education accounting for about 43.0%. The result shows that high level of literacy among the smallholder arable crop farmers. The educational attainment among the famers is an important factor that will positively influence improved technology adoption on arable crop production. Findings further revealed a mean household size of 4 members. The household size can be a pointer for farmers to meet the nutritional need of the household members which thus necessitates production of arable crops. The mean year of farming experience (6years) is an indication that smallholder arable crop farmers have considerable years of experience in arable crop production. Therefore, knowledge and skills acquired over period of farming undoubtedly contributed to their production of arable crops. It was further found that 64.2% of the respondents did not have access to credit. Thus, poor access to credit undoubtedly lowers the capacity of the farmers to procure necessary inputs needed for the production of arable crops thereby limiting the production output and productivity. Maize (28.4%) constituted the modal arable crop produced in the study area and closely to it was cassava (26.9%). The production of maize and cassava as the modal arable crops can be traced to their acceptability and wider usage for food and non-food products compare to all other arable crops.

Awareness of Integrated soil fertility management techniques

Data in Figure 2 show that 79.2% of the smallholder arable crop farmers were aware of the usage of both organic manure and inorganic fertilizer while 62.5% of the farmers were aware of the combined usage of organic manure and cover crop. Awareness of the combined usage of organic manure, cover crop and inorganic fertilizer accounted for 49.2%. The findings revealed that smallholder arable crop farmers were very much aware of ISFM techniques which thus implies the possibility for adoption. This is because awareness of a technology is usually the first stage in the adoption process (Agbarevo and Obinne, 2010), leading to other stages of adoption (Okunlola, 2010; Abdoulaye *et al.*, 2014).

Table 1: Socio-economic characteristics of the respondents (n=120)

Socio-economic Characteristics	Freq. (%)	Mean
Sex		
Male	85(58.3)	
Female	35(41.7)	
Age(year)		
21 - 30	28(23.3)	
31 - 40	36(30.0)	
41 - 50	26(21.7)	42 years (SD = ± 0. 247)
51years and above	30(25.0)	
Educational status		
Primary education	33(27.5)	
Secondary education	51(42.5)	
Tertiary Education	5(4.17)	
No formal Education	31(25.8)	
Household size		
1 - 10	116(96.7)	4 members (SD = ± 1. 042)
11 – 20	4(3.3)	
Year of farming experience		
1 - 10	104(86.7)	6 years (SD = ± 0. 638)
11 – 20	16(13.8)	
Access to credit		
Yes	43(35.8)	
No	77(64.2)	
Major arable crop grown†		
Maize	91(28.4)	
Cowpea	68(21.3)	
Yam	48(15.0)	
Cassava	86(26.9)	
Rice	27(8.4)	

Source: Field survey 2019

† Multiple responses

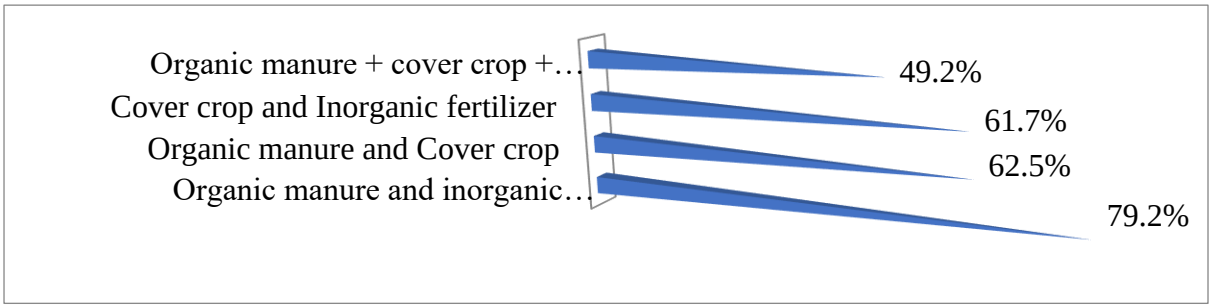

Figure 2: Awareness of ISFM techniques

Integrated Soil Fertility Management techniques adopted

The distribution of respondents' adoption of ISFM techniques in Figure 2 showed that the combined application of organic manure and inorganic fertilizer (87.5%) was widely adopted by the farmers. The result shows that smallholder arable crop farmers are becoming aware of the complementary advantage of using both organic and inorganic fertilizer to enrich their soils which necessitates the adoption. Engel (2010) opined that integrated plant nutrition involving the combined usage of organic and mineral fertilizers increases crop yields more than either used alone. Also, the complimentary usage of organic and inorganic fertilizer according to Ande *et al.* (2010), Ayoola *et al.* (2012), and

Senjobi, *et al.* (2013) has resulted in higher soil quality. The result can be attributed to the fact that organic fertilizers improve soil fertility without leaving any residual effects in the soil and are much more inexpensive while inorganic fertilizers though expensive and mostly unavailable, ensure quick availability of nutrients to crops. These complimentary advantages, therefore, provide the solution to soil management and crop productivity problems among smallholder arable crop-producing farmers. It was also found that combined application of organic manure, cover crop and inorganic fertilizer (64.2%) was adopted for the production of arable crops while adoption of organic manure and cover crop accounted for 56.7%. The results, therefore, imply that smallholder arable crop farmers adopted various ISFM practices. This is expected to enhance productivity as well as eliminate rural poverty and natural resource degradation (Vanlauwe *et al.*, 2015).

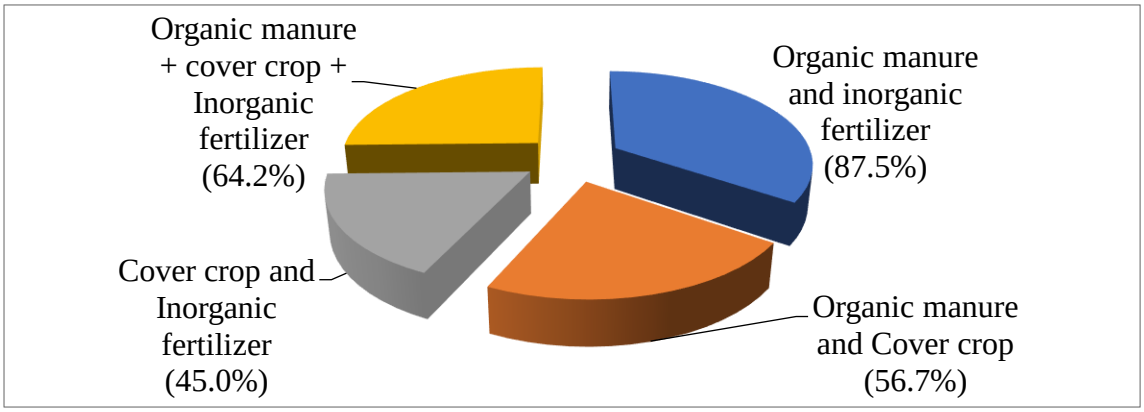

Figure 3: Integrated Soil Fertility Management techniques adopted
Source: Field survey: 2019

Smallholder arable crop farmers' perception of ISFM

The result of smallholder arable crop farmers' perception of ISFM in Table 2 indicates that ISFM can boost crop yield (w = 405), soil productivity can be enhanced by ISFM (w = 368), the impact of ISFM is mild on soil organic matter (w = 346), and weed can be controlled through the application of ISFM (w = 344). The result is expected because ISFM was built on the premise of enhancing soil nutrients for optimum crop yield. According to Séhouéto, (2006), farmers' perception and knowledge about soil fertility have been identified as key aspects that facilitate decision-making processes in the adoption of ISFM. The results in Figure 4 showed that 55.0% of the respondents were favourably disposed to ISFM. It is, therefore, evident that smallholder arable crop farmers would be willing to adopt ISFM techniques because of their perception.

Test of hypothesis

The results of test of hypothesis in Table 3 reveals that there was no significant relationship between age (r = -0.123, p = 0.181), household size (r = 0.073, p = 0.426), year of farming experience (r = -0.054, p = 0.556), size of farmland (r = 0.170, p = 0.064) and farmers perception of ISFM. This implies that the socio-economic characteristics of the smallholder arable crop farmers had no influence on their perception of ISFM in the study area.

Table 2: Perception of smallholder arable crop farmers on ISFM (n=120)

Perception statement	Weighted score (w)
ISFM can boost crop yield	405
Soil productivity can be enhanced by ISFM	368
Adoption of ISFM requires special skills	315
Only educated farmers can adopt ISFM	339
Impact of ISFM is mild on soil organic matter	346
Weed can be controlled through application of ISFM	344
ISFM is not time-consuming	328
ISFM is not cost-effective for farmers	261
ISFM is labour intensive	288
ISFM is not environmentally friendly	292
Application of ISFM is too complex	324

Source: Field survey, 2019

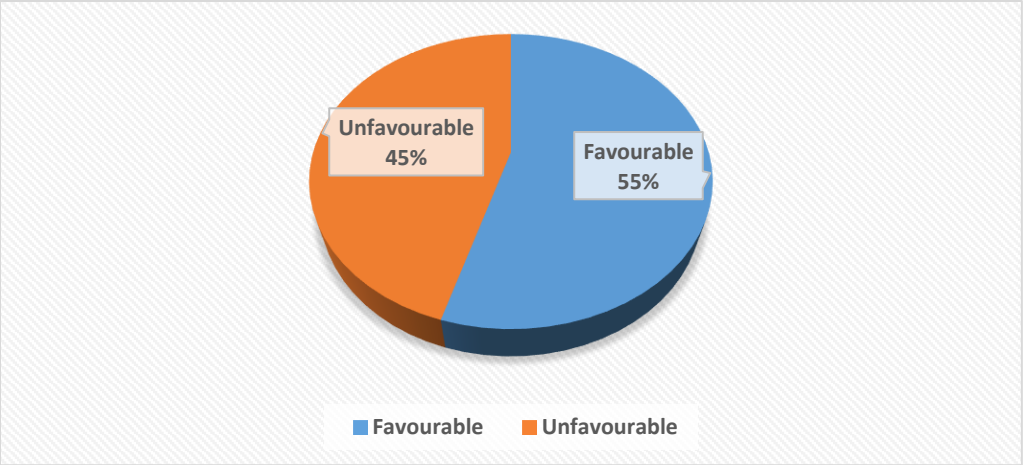

Figure 4: Overall perception of smallholder arable crop farmers on ISFM
Source: Field survey, 2019

Table 3: Test of the relationship between some socio-economic characteristics of farmers and perception of ISFM

Socio-economic variables	r-value	p-value	Decision
Age	-0.123	0.181	Not Significant
Household size	0.073	0.426	Not Significant
Year of farming experience	-0.054	0.556	Not Significant
Size of farmland	0.170	0.064	Not Significant

CONCLUSION AND RECOMMENDATION

The study established the smallholder arable crop farmers' perception of integrated soil fertility management ISFM. It was shown that smallholder arable crop farmers had a favourable perception of ISFM because of its positive impact on soil health and crop yield. The perception has undoubtedly contributed to the adoption of different ISFM techniques such as the combined application of organic manure and inorganic fertilizer as well as the planning of cover crops. It is therefore recommended that smallholder arable crop

farmers should be kept abreast of relevant information/training on ISFM to increase the productivity of their farming system.

REFERENCES

Abdoulaye, T., Abass, A., Maziya-Dixon, B., Tarawali, G., Okechukwu, R., Rusike, J., Alene, A., Manyong, V. and Ayedun, B. (2014). Awareness and adoption of improved cassava varieties and processing technologies in Nigeria. *Journal of Development Agricultural Economics*, 6(2): 67 – 75.

Agbarevo, M. N. B. and Obinne, C. P. O. (2010). *Elements of rural sociology and agricultural extension*. Enugu, Teo Publishers. Pp 118 – 124.

Agegnehu, G., Bass A. M., Nelson P. N. and Bird M. I. (2016). Benefits of biochar, compost and biochar– compost for soil quality, maize yield and greenhouse gas emissions in a tropical agricultural soil. *Journal of Science of the Total Environment*, 543: 295 – 306.

Ande, O. T., Ayoola, O. T., Senjobi, B.A. and Adediran, J.A. (2010). Increasing maize yield on a degraded soil using organic and inorganic fertilizers. *Proceeding of the 34th Annual Conference of the Soil Science Society of Nigeria, March 22 – 26 Institute of Agricultural Research and Training, Ibadan, Nigeria*. Nigeria. pp: 144 – 148.

Ande, O. T., Huising, J., Ojo, A. O., Azeez, J., Are, K. S., Olakojo, S. A., Fademi, I. O. and Ojeniyi, S. O. (2017). Status of Integrated Soil Fertility Management (ISFM) in Southwestern Nigeria. *International Journal of Sustainable Agricultural Research*, 2017, 4(2): 28 – 44.

Ashagidigbi W. M., Yusuf T. M. and Agboola U. O. (2019). Productivity of arable crop farmers: Panacea to youth unemployment. *Biomedical Journal of Scientific & Technical Research*, 22(4): 16871 – 16877. DOI.10.26717IBTSTR.2019.22.003792

Ayoola, P. B., Adeyeye, A. and Onawumi, O. O. (2012). Chemical evaluation of food values of groundnut (*Arachi hypogaea*) seeds. *American Journal of Food Nutrition*, 2(3): 55 – 57.

Bayu, T. (2020). Review on the contribution of integrated soil fertility management for climate change mitigation and agricultural sustainability. *Cogent Environmental Science*, 6:1 1823631 https://doi.org/10.1080/23311843.2020.1823631

Engel, R., Liang, D. L., Wallander, R., & Bembenek, A. (2010). Influence of urea fertilizer placement on nitrous oxide production from a silt loam soil. *Journal of Environment Quality*, 39(1): 93 – 115.

Lawal, J. O., Omonona, B. T. and Oyinyele, O. D. (2011). Effects of livelihood assets on poverty status of farming households in Southwestern Nigeria. *Paper prepared for presentation at EAAE 2011 Conference*. Change and Uncertainty: Challenges for Agriculture, Food and Natural Resources. ETH Zurich, Switzerland.

Lin, H. S. (2006), Temporal stability of soil moisture spatial pattern and subsurface preferential flow pathways in the Shale Hills Catchment. *Vadose Zone Journal*, 5: 317– 340.

Lunze, L., Abang, M. M., Buruchara, R., Ugen, M. A., Nabahungu, N. L., Rachier, G. O., Ngongo, M. & Rao, I. (2012). Integrated soil fertility management in bean-based cropping systems of Eastern, Central and

Southern Africa. In J. K. Whalen (Ed.). *Soil fertility improvement and integrated nutrient management – A global perspective*. London, UK:IntechOpen. https://doi.org/10.5772/29151

Mgbenka, R. N. and Mbah, E. N. (2016). A review of smallholder farming in Nigeria: Need for transformation. *International Journal of Agricultural Extension and Rural Development Studies* 3 (2) pp.43-54.

Nakhumwa, T. O. (2004). Dynamic costs of soil degradation and determinants of adoption of soil conservation technologies by smallholder farmers in Malawi. *PhD Thesis submitted to the University of Pretoria*, Faculty of Natural and Agricultural Sciences, p 179.http://repository.up.ac.za/bitstream/handle/2263/25032/Complete.pdf?sequence=5.

Nhamo, N., Kyalo, G. and Dinheiro, V. (2014). Exploring Options for Lowland Rice Intensification under Rainfed and Irrigated Ecologies in East and Southern Africa: The Potential Application of Integrated Soil Fertility Management Principles. *Advances in Agriculture*, 128: 181–219.

Nkonya, E., Pender, J., Kayuki, C. K., Kato, E., Mugarura, S., Ssali, H. and Muwonge, J. (2008). *Linkages between Land Management, Land Degradation, and Poverty in Sub-Saharan Africa: The Case of Uganda*. International Food Policy Research Institute, Washington D. C. Res. Rep., p. 159.

Okunlola, J. O. (2010). Factors influencing adoption of rubber-based techniques among smallholder rubber farmers in Delta State, Nigeria. *Journal of Food, Agriculture and Environment*, 8(2): 91-94.

Ollenburger, M. H. (2012). *Modeling integrated soil fertility management options in Malawi profitability, sustainability and efficiency of nutrients through site-specific fertilizer recommendations in West Africa Agro-Ecosystems*. New York: Springer International Publishing.

Sanginga, N., Woomer, P. L. (2009). *Integrated soil fertility management in Africa: principles, practices and developmental process*. Tropical Soil Biology and Fertility Institute of the International Centre for Tropical Agriculture, Nairobi.

Séhouéto, L. (2006). Localised agricultural knowledge and food production in sub-Saharan Africa. *International Social Science Journal*, 58(187), 121-128.

Senjobi, B. A., S. J. Akinsete, O. T. Ande, C. T. Senjobi, M. Aluku, & Ogunkunle, O. A. (2013). An assessment of spatial variation of some soil properties under different land uses in Southwestern Nigeria. *American Journal of Experimental Agriculture* 3(4).

Shisanya, C. A., Mucheru, M. W., Mugendi, D. N. and Kung'u, J. B. (2009). Effects of organic and inorganic nutrient sources on soil mineral nitrogen and maize yields in central highlands of Kenya. *Soil and Tillage Research*, 103, pp. 239-246.

Vanlauwe B., Bationo, A., Chianu, J., Giller, K. E., Merckx, R., Mokwunye, U., Ohiokpehai, O., Pypers, P., Tabo, R., Shepherd, K., Smaling, E. M. A. and Woomer, P. L. (2010). Integrated soil fertility management: operational definition and consequences for implementation and

dissemination. *Outlook on Agriculture*, 39, pp. 17-24.

Vanlauwe, B. and Zingore, S. (2011). Integrated Soil Fertility Management: An operational definition and consequences for implementation and dissemination. *Better Crops*, 95, 4–7.

Vanlauwe1, B., Descheemaeker, K., Giller K. E., Huising, J., Merckx, R., Nziguheba, G., Wendt J. and Zingore, S. (2015). Integrated soil fertility management in sub-Saharan Africa: unravelling local adaptation. *SOIL*, 1: 491–508.