The Proceedings of the 15th National Research Conference and Network Meeting of CYIAP held in Adeyemi College of Education, Ondo state, Nigeria, from 9th to 12th March, 2020. CYAP-Network Publishing

Farmers Awareness on the Use of *Moringa oleifera* plant as Organic fertilizer in Kwara State, Nigeria

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Abstract
The study examined the level of farmers' awareness on the use of *Moringa oleifera* as organic fertilizer in Kwara State, Nigeria. Snowball sampling procedure was used to sample about 60 farmers who cultivate Moringa plant. Questionnaire was developed, validated and the reliability co-efficient calculated and found good enough for data collection. Data obtained were described with frequency counts, percentages and mean while Binary Logistics Regression model was used to identify the determinants of awareness of usage. Results showed that cultivation of *Moringa oleifera* was dominated by male and about 45.0% of the farmers had between secondary and tertiary education. A little above average (51.7%) showed that they know about the usefulness of the plant but not as an organic fertilizer. None of the socio-economic variables investigated influenced the awareness of usage. The study therefore, recommended that stakeholders must intensify effort in ensuring rigorous level of awareness on the important use of *Moringa oleifera as organic fertilizer* for increased crop production and sustainable farm income.
Keywords: Awareness, *Moringa oleifera*, organic fertilizer, sustainable income

Introduction
Tropical smallholder farming systems in Nigeria lack sustainability as a result of nutrient loses by soil erosion due to torrential rains, leaching, crop removal, lack of soil fertility restoring inputs and unbalanced soil nutrients (Adams *et al., 2015,* Loks *et al*., 2014, Yusuf 2014, Akinwole et al., 2012). To achieve high crop yield requires adequate and balanced supply of nutrients as declining soil fertility constrains good plant performance.

Smallholders depend mostly on inorganic fertilizers as source of soil fertility because of its ease of application and momentary increase in crop yield and consequently their gross margin (Akinwole *et al.,* 2012). However, the proper rates of plant nutrients are determined by the knowledge about the nutrient requirements of the crop and supplying power of the soil (Adams *et al.,* 2015*:* Loks *et al.,* 2014). Rural farmers often apply compound fertilizer (NPK) at blanket rate irrespective of the specific and crop nutrient requirements (Loks *et al*., 2014). The problem is that, as fertilizer rates are increased, the efficiency of fertilizer nutrient use decreases leaving behind in the soil an increasing proportion of the added nutrients which are likely to damage the soil and the environment (Loks *et al.*, 2014) Insufficient dose of fertilizer application will constraint good crop performance associated with low yield and income to farmers.

Aside from the use of inorganic fertilizer, the fertility of the soil can also be achieved through fallowing. This involves a process of allowing the soil after use to rest for some time for natural regeneration, or through the use of a well-planned system of crop rotation or regular application of manure. However, population pressure has already ruled out the issue of fallowing while planned system of crop rotation tends to be too technical for

rural farmers whose main focus is to provide farm produce which would satisfy the needs of their families from the meagre land area available to them. As for manures several researchers (Al-Kharusi *et al.*, 2009, Khawaja and Ikram 2010) advocated compost and farmyard manure which were generally viewed as the cheapest and easiest way of improving soil fertility because they improve soil physical properties and increase soil nutrients. These sources have been rendered unsustainable as a result of bush burning, crop residues removal for animal feeding and provision of bio-fuel for domestic uses.

The persistent high cost, over dependency on the use of inorganic fertilizers by farmers, land and soil degradation and environmental pollution have made the Federal Ministry of Agriculture and Rural Development to challenge agricultural researchers to search for alternative save natural sources of plant nutrients which would increase soil fertility, crop output and will be environment friendly This study is set to access the level of awareness among rural farmers on the use of moringa plant as organic fertilizer .

Moringa oleifera (family **Moringaceae)** is a highly valued plant with multiple effects (Emmanuel et al., 2011: Adebayo et al., 2011: Mishra et al., 2011)**.** The tree ranges in height from 5 to 10 meters and produces leaves and pods even when water supplies are scarce, allowing it to thrive in arid climates where few other plants can survive (Richter et al., 2003). It is considered as one of the world's most useful trees as almost every part of the tree has impressive food and industrial purposes. Moringa seeds can be eaten raw or cooked or it can be pressed into non desiccating oil of high quality (30 to 40% of seed weight), commercially known as "Ben oil" (Abdalla 2013). More so, the dry crushed seed or pressed seed cake contain certain poly peptides, natural coagulants that have antibacterial and antifungal characteristics which can be used for water purification (Abdalla, 2013)

Moringa oleifera is equally popular for its medicinal characteristic. It acts as cardiac and circulatory stimulants; possess antitumor, antipyretic, antiepileptic, anti-inflammatory, antihypertensive, antibacterial and antifungal activities and are being employed for the treatment of different ailments in the indigenous system of medicine particularly in South Asia. (Mishra et al., 2011: Abdalla, 2013)

However, besides the medicinal value of moringa, it has been discovered to be an exceptionally great organic fertilizer (Jahn 1988). It is a renewable, biodegradable, sustainable and environmentally friendly organic fertilizer. *M. oleifera* does not require much processing as such its minerals remain bound up in their natural forms in the soil. These are slowly released roughly, at an equal rate as nutrient uptake by the plants. This tends to promote plant growth at a natural and healthy pace resulting into stronger and more stable plants with improved taste and nutrient value. This characteristic of organic *M. oleifera* creates healthy ecosystem that is sustainable and conducive to long term use. It increases the plant matter in the soil which improves soil structure and creates more spaces for air and water retention which in turn supports the growth of soil microorganism and earthworms, reduces erosion. More so, the fact that nutrients are released slowly makes it difficult for toxic build-up of chemicals and salts that can be deadly to plant as in the case of inorganic or chemical fertilizer.

M. oleifera has empirically been applied as liquid or solid organic fertilizer with favourable and significant results. Berger (1984) and Andrew (2011) proved that the

liquid spray of M. *oleifera* increased the crop production by 20-35%. Also, an elemental analysis of the soil carried out by Emmanuel *et al. (2011)* before and after application of *Moringa oleifera* seed cake as fertilizer on a Maize plot showed that the *Moringa oleifera* seed cakes increased the mineral content of the soil and this in turn increased the yield of the maize crop as compared to the control.

According to Pearson (2012), the use of *Moringa* leaves and seed cake as fertilizer has already been adopted in many parts of Southeast Asia, and, in Latin America. Farmers often plant *Moringa* as edge or fence around their farm land, and use the extracted juice from pruned leaves as liquid fertilizer. Sometime they leave their *Moringa* trees to flower and produce seeds during the off season. They then extract seed oil and use the seed cake as organic fertilizer for the following season. These practices enrich the depleted soil; save farmers funds that could have been used to buy inorganic fertilizer and increase quality and yield of food crops that will demand higher market price and subsequent increase in income.

In view of the high potential *M. oleifera* has for long- term impact on soil fertility, crops production and income of the rural dwellers in Nigeria and the fact that the federal government of Nigeria is emphasizing green source of fertilizer, this study sets out to access the awareness of the use of Moringa oleifera as organic fertilizer by rural farmers in Nigeria.

Objective of the study

The main objective is to access the level of awareness of the use of M. oleifera as organic fertilizer among rural farmers in Kwara State. Specifically, the study examined the socio-economic characteristics of Moringa Farmers; analyzed awareness level on alternative uses of M.olifera as organic fertilizer; and identified determinants of awareness of usage of M. oleifera as organic fertilizer

Methodology

The study was conducted in Kwara State, Nigeria. The State lies on Latitude 8^0 30^{l}N and Longitude 5^0 $0^{!}$ 0 E. Many of the inhabitants of the state are farmers and they cultivate crops like yam, wheat, millet, guinea corn and a host of other arable crops. Some of them grow *M.oleifera* (moringa) at commercial level

A snowball sampling procedure was used to select 60 farmers who cultivate *M. oleifera* in the study area consisting of Asa and Moro Local Government Areas of Kwara State. Well-structured questionnaires were used to elicit information from the respondents. The questionnaires were validated and reliability co-efficient calculated using Combach Alpha formula and was found to be 0.87; indicating a good degree of reliability co-efficient. Data collected were analyzed using descriptive statistics and Binary Logistic Model to determine factors influencing awareness of the usage of *M. oleifera* plant among farmers. In measuring the variables, awareness on usage of *M. oleifera* was measured on a 'yes' scored '1' and a 'no' scored '0' while the data regarding the socio-economic variables were measured using appropriate codes and scores.

Results and discussion

Results in Table 1 show that all 60 (100.0%) of the *M. oleifera* farmers in the study area were males. This indicates that cultivation of this plant is male dominated. This may be due to that fact that Moringa plant is a form of plantation that requires ownership of farmland either through outright purchase or inheritance. Thus, men accessibility to land for permanent crops has been severally documented to be higher than that of their female counterparts in Nigeria.

Similarly, majority (96.7%) was married and about 76.0% of the farmers were within 20

and 54 years of age. This implies that they were still in their active and productive ages for the cultivation of Moringa plant. They had an average family size of 7 persons per household. This means that farmers in the study area had a moderate household size. On the educational status of farmers, it was observed that about 38.3% of the farmers had primary education, 21.7% had secondary education while 23.3% had tertiary education and only 13.3% and 3.3% were with qur'anic and adult education, respectively. This study shows that farmers in the study area had a good level of education considering the fact that about 23.3% had tertiary education. The implication of this finding is that adoption of new cultivation practices in moringa cultivation may be easy for the farmers. as education had been adjudged as a significant factor to the use of innovation (Ashfaq et al., 2012). Mean farm size was about 8 acres while the average farming experience was 11 years.

3.1 Farmers' awareness of usage

Findings from this study revealed that majority (51.7%) of the farmers indicated that they were aware of the use of Moringa oleifera plant for various uses (Table 2). On the uses of the parts, it was revealed that the use of leave was the highest among the farmers as about 33.3% shows that they were aware of the use of Moringa leaves but only 3.3% indicated their awareness of the use of Moringa flowers and roots for various uses, respectively. The findings showed that farmers use more of Moringa leaves more than the other parts of the plant. More so, among the uses of Moringa leave, about 55.3% indicated that it was used for all purpose, 16.7% showed that it was used for local herb while 19.3% showed that feeding and blood tonic was the main use of the plant and only 8.7% use moringa leave for soup This study conforms with the findings of World Health Organization (WHO), (2014) on the medicinal uses of *Moringa oleifera* plant that the plant contains many nutrients and components that makes it useful for the treatment of all sort of ailments and as supplement in human diet. Similarly, Ashfaq et al. (2012) regarded it as Moringa plant as a miracle plant. Thus, it is all purpose plant used for treatment of all manner of sickness. The fact that Moringa cures numerous diseases means that farmers will be willing to use every part for medicinal purposes. However, the use of M. oleifera as organic fertilizer as reported by many scholars across the globe seem to record low awareness among farmers in Kwara State. Thus, there is need for the extension agency to intensify efforts to ensure that farmers are adequately informed about the usefulness of other components of the plant.

3.1.1 Factors influencing awareness of use

Results in Table 3 show that none of the variables tested were significant factors that determine the awareness of the use of *M. oleifera* among farmers. This study contradicts the findings of Ajayi and Adeyemi, (2016) that submitted that factors such as level of education, membership of social organizations, access to extension service and availability of moringa plant were the determinants of the adoption in Southwest, Nigeria. Also, Abdalla (2013) researched that variables like marital status and family size influenced the adoption of *M. oleifera* plant usage among farmers in Kaduna State. The implication of this finding is that factors that determine the adoption of *Moringa oleifera* in other places may be different from those that influence its adoption and uses in Kwara State.

Conclusion

Moringa oleifera is considered as one of the world's most useful trees, as almost every part of the tree has an impressive feature of food, medication and industrial purposes.

Based on the findings of this study, it was observed that most male farmers engaged in the cultivation of Moringa plant and many of them had reasonable level of education with an average farm size and farming experience. The awareness of the usage of the plant was averagely high as about half of the farmers indicated that they had awareness of the use. However, none of them realised the importance of M. oleifera as important soil fertility plant. The fact that all the respondents are educated implies they will be willing to accept the idea of using M. oleifera products as alternative to inorganic fertilizer which will reduce cost of production and provide sustainable source of income for rural farmers.

It is recommended that agricultural stakeholders working on improving crop production must ensure rigorous enlightenment and awareness on the use of *Moringa oleifera as favoured organic fertilizer among the rural farmers*

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Table 1: Description of Moringa farmers' socio-economic characteristics n=60

Variable	Freq.	%	Mean
Gender			
Male	60	100.0	
Female			
Marital status			
Married	58	96.7	
Single	2	3.3	
Age (years)			
<25	9	15.0	
25-30	19	31.7	
35-44	15	25.0	
45-54	12	20.0	
55 and above	5	8.3	
Family size			**6.8**
Educational level			
Primary	23	38.3	
Secondary	13	21.7	
Tertiary	14	23.3	
Quaranic	8	13.3	
Adult	2	3.3	
Main occupation			
Farming	54	90.0	
Civil Service	6	10.0	
Farm size (Acres)			
<2	12	20.0	
2-5	27	45.0	**7.9**

6-10	15	25.0	
10 and above	6	10.0	
Years of experience			
6-10	29	48.0	
11-15	12	20.0	
16-20	10	16.7	**10.7**
21 and above	9	15.0	

Source: Field survey, 2017.

Table 2. Farmers' Awareness on the usage of M. oleifera in Kwara state Nigeria n=60

Uses	**Freq**	**%**
All purpose	33.3	55.3
Local Herb	9.8	16.7
Feeding and blood tonic	16.8	28.0
Organic manure	0.00	0.0

Source: Field survey, 2017

Table 3: Results of Binary Logistic Regression showing factors influencing awareness of the use of *M. oleifera* among farmers. N=60

Variable	**Coefficient**	**Prob.**
EDU	0.002	0.992
FAMLY_SIZE	0.060	0.448
FARM_SIZE	0.081	0.488
MEBBER_OF_ASSN	-0.214	0.797
AGE	-0.082	0.830
YRS_OF_FARM	-0.134	0.569

Source: Field survey, 2017.