FACTORS AFFECTING THE PROFITABILITY OF M*ORINGA OLEIFERA* PRODUCTION IN OYO STATE, NIGERIA

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ABSTRACT

This study identified the socioeconomic characteristics of Moringa oleifera farmers in Oyo State, estimated the costs and returns to M. oleifera production and determined the factors affecting the profitability of its production. This was with a view to providing information on how the production of M. oleifera could enhance the income of farmers. A multistage sampling technique was employed for this study. The data obtained were analysed with descriptive statistics, budgetary analysis and multiple regression technique. Major findings from the study showed that about 90% of the respondents were men thus, making moringa production a male dominant enterprise. The mean age of the farmers was 46.45 year and the average farming experience was 5.1 years. Literate farmers were predominant in the study area with the least being secondary education. The mean farm size was 1.77ha putting farmers into the class of smallholders. The study revealed that the level of education; planting materials; labour and land rent were the factors that affected the profitability of moringa farming and were statistically significant at 5% level. The profitability ratio gave a benefit-cost ratio of 2.77, this showed that M. oleifera production was profitable. The study concluded that M. oleifera farming is profitable and economically efficient in the study area. The study recommended that provision of improved planting material, access to labour and reduction in land rent could further enhance the profitability of moringa production.

Key word: ***Moringa, Production and profitability***

INTRODUCTION

Nigeria is one of the countries in Sub-Saharan Africa (SSA) where self-sufficiency in food production remains a critical challenge even in the absence of wars and natural disasters (Alimi *et al*., 2006). Despite the abundance of production resources, sustainable agriculture is a mirage and the country's promising agricultural potential has not been fully realized. Sustainable agriculture is the one that, over a long term, enhances environmental quality and resource base on which agriculture depends; provides for basic human food and fibre needs; is economically viable, and enhances the quality of life of farmers and society as a whole (CGIAR, 1988).

One of the keys to sustainable agriculture is integrated biodiversity. Biodiversity is the variety of living organisms considered at the genetic, species and ecosystem or landscape level which includes not only plant and animal, but very importantly micro-organism (Okali, 2005).

The integrated biodiversity management approach to agriculture is largely dependent on effective land management. The Federal Government of Nigeria (FGN) recognized that the nation's food security can be improved mainly through increasing agricultural productivity, and has instituted various interventions aimed at encouraging widespread adaptation of intensive farming technologies (Banful *et al.*, 2009). There is no doubt to the fact that agriculture relies and depends largely on environmental services such as; water, forests, pastures and soil nutrients. Hence, intensive land use without appropriate soil management practices may lead to environmental degradation.

The fragility and high susceptibility of soils in Nigeria to degradation and loss of nutrients make augmentation through the use of fertilizers necessary to obtain reasonable crop yield (Alimi *et al*., 2006). Fertile soil provides essential nutrients for crop plant growth, supports a diverse and active biotic community, exhibits a typical soil structure, and allows for an undisturbed decomposition (Mäder *et al*., 2002). Organic fertilizers derived from *Moringa oleifera* (L) seeds increase the soil aeration and richness of invertebrates, beneficial arthropods, earthworms, symbionts and microbes (FAO, 2010). Introduction of *Moringa oleifera* into a farm which has a biodiverse environment can be beneficial to both the owner of the farm and the surrounding ecosystem (Foidle *et al*., 2001).

According to Verma *et al*. (1976), *Moringa oleifera* L. (horseradish tree) is a short, slender, deciduous, perennial tree. It is one of the most useful tropical trees. Its relative ease of propagation through sexual and asexual means, low demand for soil nutrients and water after being planted makes its production and management easy. *Moringa* news (2008) reported that the leaf is a power house of nutritional value. *Moringa oleifera* is considered as one of the World's most useful trees, as almost every part of the M. *oleifera* tree can be used for food, medication and industrial purposes (Khalafalla *et al*., 2010). Its leaves, flowers and fresh pods can be used as vegetables, while other parts are used as livestock feed (Anjorin *et al.*, 2010).

It has been reported that M. *oleifera* leaves contain two times the protein of yoghurt, seven times the vitamin C of oranges, three times the potassium of bananas, four times the vitamin A of carrots and a lot more calcium than is available in milk (Fahey, 2005). It has also claimed to boost immune systems (Jayavardhanan *et al.*, 1994; Fuglie, 1999; Olugbemi *et al.*, 2010)). The leaves and green fresh pods are used as vegetables by man and are rich in carotene and ascorbic acid (vitamin C) with a good profile of amino acids (Makkar and Becker, 1996). They are also used in livestock feed and the twigs are reported to be very palatable to ruminants (Sutherland *et al.*, 1990; Sarwatt *et al.*, 2002; Kimoro, 2002; Kakengi *et al.*, 2007). The edible leaves are very nutritious and are consumed as vegetables in Nigeria.

Moringa does well on a temperature range of between 25 and 40^0C but is known to tolerate high temperatures of up to 48^0C. *Moringa oleifera* does well under shade and its establishment as an agroforestry tree

should have a companion shading plant like cassava among other useful cultivated crops or fruit trees. These companion shading crops also help to protect it from strong winds, drought and heavy rains during its young stages of growth. It can be established through direct seed planting or use of cuttings at a spacing of 3m by 3m on east-west direction of planting rows. Alley cropping with sunflower and beans is recommended but maize and egg plants should be avoided as they compete for nutrients with the plant. In case of alley cropping when the plant is matured and established, a spacing of 10m between rows is recommended to avoid the shading of intercropped plants. M. *oleifera* is gaining some prominence in Southwestern Nigeria, but there is a dearth of knowledge on costs and returns of its production. Profitability is the key factor which decides the long term survival of commercial enterprises, M. *oleifera* production inclusive. There are many factors which affect the profitability of M. *oleifera* production such as agronomic practices, demographic factors, costs of production to mention a few. Relative impact of these factors on profitability is important as a decision tool to be used by the M. *oleifera* farmers and any other institutions involved in M. *oleifera* enterprise directly or indirectly. But then, it is imperative to note that while a number of studies have been carried out on the origin, morphology and chemistry of M. *oleifera* (Fuglie, 2001 and Olsom, 2001), little effort has been made on the economic performance of the crop in Oyo State, Nigeria. Hence, this study determined the level and factors affecting profitability of M. *oleifera* production in the study area. The broad objective of the study was to evaluate the economic performance of M. *oleifera* cropping in Oyo, Nigeria. The specific objectives were to identify socioeconomic characteristics of M. *oleifera* farmers in the study area; evaluate costs and returns to M. *oleifera* production and; determine factors affecting the profitability of M. *oleifera* production in the study area.

Methodology

This study was conducted in Oyo State of Nigeria. Oyo is one of the 36 States in Nigeria and it lies in the Southwest part of the country. The State with two ecological zones (rainforest to the South and derived savannah to the North) is well suited for food crop production. Oyo State Agricultural Development Programme (OYSADEP) has grouped the State into four zones namely Ibadan/ Ibarapa, Ogbomoso, Saki and Oyo zones. The zones have agriculture as their major traditional occupation. Mixed cropping is the major farming practice in the area with a combination of various food crops in the mixture. Small scale livestock keeping is also predominantly practiced by the farmers especially the female members of the household. Majority of the farmers in the area are small-scale farmers with average farm size of about 1.5ha. Also, both family and hired labour are common, though with most children going to school, the importance of family labour is fast declining.

A multistage sampling technique was employed. In the first stage, two agricultural zones: Ogbomoso and Ibadan/Ibarapa were

purposively selected based on the predominance production of M. *oleifera* in the study area. In the second stage, five local government areas (LGAs) from Ogbomoso and two from Ibadan/Ibarapa were selected from the zones using a proportionate random sampling technique. More LGAs were selected from Ogbomosho for higher prominence of M. *oleifera* farmers. Twenty M. *oleifera* farmers were selected from each LGAs with the aid of a simple random sampling technique. A total of one hundred and forty farmers were interviewed but 114 copies of the questionnaire were used for the analysis because information provided in 26 was incomplete. Descriptive statistics such as frequency distribution was used to describe the socio-economic characteristics of the respondents, while budgetary analysis was used to determine the profitability of the enterprise and multiple regression analysis was used to determine factors affecting the profitability of the enterprise.

Budgetary analysis

Budgetary analysis was used to determine the profitability of M. *oleifera* production in the study area. Revenue was computed as the monetary value of total farm output. Costs and returns were calculated on per hectare basis. Variable costs included costs of seed, fertilizer, herbicides, and labour, and fixed costs included land charge or rent and costs of hand tools. Straight line method of depreciation was used to determine the costs accrued to the fixed inputs.

Gross margin

(GM)/ha =GR – TVC .....(1)

where:

GR = Gross Revenue, TVC = Total Variable Cost

Net farm income

(NFI)/ha = GM – TFC.....(2)

TFC = Total Fixed Cost

Where TC = TVC + TFC and TC = Total Cost

The performance and economic worth of the enterprise was determined by the use of the following Benefit Cost Ratio

(BCR)/ha = NFI/TC .....(3)

Regression analysis

The use of regression analysis to examine the economic productivity of M. *oleifera* was used to measure the form of association between the identified variables.

The model specification for this analysis is given below:

$Y=f(X_1,X_2,X_3,X_4,X_5,X_6,X_7)$.....(4)

Where:

Y = net profit/ha of *Moringa oleifera* farmer(₦/ha)

X_1 = age (number of years of M. *oleifera* farmers) (years)

X_2 = education of respondent (number of years of formal education) (years)

X_3 = farming experience in years

X_4 = cost of labour (₦/ha)

X_5 = quantity of planting materials of M. *oleifera* (kg/ha)

X_6 = land rent on M. *oleifera* production (₦/ha)

X_7 = household size (number of person)

The relationship between the dependent variable and the independent variables was examined using three basic functional forms: linear, semi-log and Cobb-Douglas forms.

(a) Linear form:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + e \text{……..(5)}$$

(b) Semi-log form:

$$Y = b_0 + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + b_6\log X_6 + b_7\log X_7 + e \text{ ..... (6)}$$

(c) Double-log form:

$$\text{Log}Y = b_0 + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + b_6\log X_6 + b_7\log X_7 + e \text{ ……..(7)}$$

Where,

b_0 = constant,

b_1-b_7 = estimated coefficients,

X_1-X_7 variables. Economic and statistical criteria were employed to choose the lead equation using coefficient of determination (R^2), significant levels of the parameters, size and signs of the estimated coefficients that conform to the a priori expectations.

Results and Discussion

Socioeconomic characteristics of the farmers

The socioeconomic characteristics of the farmers described include age, gender, marital status, years of literacy, experience in M. *oleifera* farming, family size, farm size, sources of farm financing and contacts with the extension agents.

The major findings from the study showed (Table 1) that about 90% of the respondents were men making M. *oleifera* enterprise male dominant. Adoption or rejection of an innovation has always been influenced, although at varying degree, by the complementarities of males' and females' perceptions and roles within the farm families (Ekong, 2003).

Age distribution pattern of farmers in the study was between 30 and 70 and the modal class falling between 30 and 50. The mean age of the farmers was 46.45 years. The result agrees with the findings of Ezedinma and Oti (2001) that the mean age of farmers in Nigeria is between 45-48 years and also conforms to the findings of Okunade *et al*., (2005) that in Surelere Local Government Area of Oyo State, farmers are mostly between 36 and 56 years of age. This implies that most of the farmers in the study area are in their middle forties and probably in their productive age. The average farming experience was 5.10 years with the minimum being one year and maximum ten. The low level of farming experience among M. *oleifera* farmers in the study area is an indication that most of them are new in the enterprise. Table 1 shows the educational level of respondents. It shows that all the farmers had formal education; 23.7% had

secondary school education while 76.3% had tertiary educational training. This indicates that they possessed the ability to adopt modern farming techniques that could enhance productivity and efficient management of risks in agriculture (Fabiyi *et al.*, 1991). The mean farm size was 1.77 hectares putting the farmers into the class of smallholders. Contacts with extension agents showed that, on the average, about 70% of the farmers did consult extension workers on farming related issues.

Table 1: Socioeconomic characteristics of *Moringa oleifera* farmers

Characteristics	Frequency	Percentage (%)	Mean
Gender			
Female	12	10.5	
Male	102	89.5	
Age (Years)			
Less than 40	35	30.7	
41 – 45	25	21.9	
46 – 50	28	24.6	46.45
Above 50	26	22.8	
Marital status			
Married	112	98.2	
Widowed	2	1.8	
Household size			
Less than 3	34	29.8	
4 – 5	53	46.5	4.57
6 –7	22	19.3	
Above 7	5	4.4	
Educational level			
Secondary	27	23.7	
Tertiary	87	76.3	
Years of experience			
Less than 3	16	14.0	
4 – 5	53	46.5	5.15
6 – 7	39	34.2	
Above 7	6	5.3	
Farm size			
Less than 1	17	14.9	
1.01- 2.00	65	57.0	1.77
2.01- 3.00	31	27.2	
Above 3.01	1	0.9	
Sources of fund			
Family and friends	8	7	
Personal savings	67	58.8	
Personal savings and friends/family	39	34.2	
Contacts with extension agents			
Yes	79	69.3	
No	35	30.7	

Source: Field survey, 2014

It can be seen from Table 2 below that on moringa enterprise every farmer on the average realized a gross margin of ₦150,509.10/ha and total revenue of ₦79,767.01 per ha while the total cost of production was ₦70742.09/ha of land cultivated made up of ₦45,232.46 total variable cost and ₦25,509.63 as total fixed cost. The Benefit cost ratio was 2.77, meaning for every one naira invested in M. *oleifera* farming, ₦2.77 will be realized. A project with benefit cost ratio greater, equal or less than unity, indicates profit, break-even or loss, respectively. Since the ratio is greater than unity for this production system, it indicates that M. *oleifera* production is profitable.

Table 2. Budgetary Analysis of M. oleifera Farm/ha in Oyo State

S/N	Item	Mean Amount(₦)	Percentage of Cost(%)
A	**Total revenue/ha (TR)**	**195,741.50**	
	VARIABLE COSTS		
I	Planting materials/ha (9.0kg) at ₦504.39	2564.70	
II	Cost of inputs	18854.23	
III	Cost of labour	17385.77	38.43
IV	Cost of transportation	6427.88	14.21
B	**Total variable cost/ha (TVC)**	**45232.46**	
C	**Gross Margin/ha (TR - TVC)**	**150509.10**	
D.	**Total fixed cost/ha (TFC)**	**25509.63**	
E	Total cost/ha(TC) = (TFC + TVC)	**70742.09**	
F	**Net income (NI) = (GM - TFC)**	**79767.01**	
J	Benefit cost ratio	2.77	

Source: Field survey, 2013

Factors affecting profitability of M. *oleifera* production

Out of the three functional forms of linear, semi-log and Cobb-Douglas forms tried, Cobb- Douglas production function was chosen as the lead equation because it was best fitted and satisfied the economic and statistical conditions such as high coefficient of determination (R^2), significant levels of the parameters, numbers and signs of the estimated coefficients that conform to the *a priori* expectations.

The regression result on Table 3 shows that the coefficient of the cost of planting materials was positive (0.213) and significant. This implies a direct relationship between the quantity of planting materials and the profit made by the farmer as in line with the *a priori* expectation. The farmers can increase profit by increasing that quantity of planting materials. It therefore follows that if the farmers increase the quantity of planting materials by 1%, the profit will increase by 0.213% all things being equal. Labour constitutes the most important factor of production in developing countries. It actually plays a central role in the growth of the economy, directly as the most important input of production, and indirectly as the dominant influence in the human environment. From Table 3, the coefficient of the quantity of labour is positive (0.365). This implies a direct relationship between the quantity of labour used and the profit realised. This was in line with the *a priori* expectation. This follows that if the farmers increase the quantity of labour by 1%, the profit will increase by 0.365% all things being equal. As shown in the regression table, the coefficient of the land rent is negative (-0.143) which agrees with the *a priori* expectation and shows that as the land rent decreases, the profit made increases. Reduction in the land rent increases the purchasing power and the farmers' ability in acquiring more land for production of M. *oleifera* which can bring about an increased profit to the farmers. The Level of education coefficient is also observed to be negative (-0.160) as against the *a priori* expectation stated earlier. This follows that there is an inverse relationship between the level of education of the farmers and the profit they realized. Education and household size have been proved to have positive relationship with output, income and profit (Nwaru, 2005; Chukwuji, 2006; Giroh and Adebayo, 2007). All the M. *oleifera* farmers were educated to at least secondary education. The movement from secondary to tertiary education reduces the level of profit. This may be due to the fact that they do not have internal satisfaction or total concentration on the production of M. *oleifera*.

Table 3: Results of Functional Forms of Regression Analysis

Variables	Linear	Semi log	Double log
Constant	79374.735	11.436	9.390
	(2.483)	(46.251)	(11.339)
Age (X_1)	-.103	-.102	-.045
	(-1.180)	(-1.140)	(-.497)
Education (X_2)	-.170*	-.172*	-.160*
	(-1.936)	(-1.901)	(-1.828)
Farm.exp (X_3)	.263	.256	.189
	(1.785)	(1.691)	(1.175)
Planting materials (X_4)	-.015	-.013	.213*
	(-.145)	(-.123)	(2.112)
Labour_cost (X_5)	.531*	.498*	.365*
	(5.199)	(4.750)	(3.604)
Landrent (X_6)	-.150	-.158*	-.143*
	(-1.828)	(-1.875)	(-1.755)
Household_size (X_7)	-.195	-.191	-.150
	(-1.403)	(-1.336)	(-0.972)
R^2	.334	.329	0.341

Source : Field survey
Extracted from computer analysis results; *: Significant at 5% level of significance.
Note: figures in parentheses are t-value

The coefficient of determination (R^2) was 0.341; this implies that 34.1% of the variation in the profit of M. *oleifera* production in the study area was explained by the explanatory variables in the model. Labour was found to be the most important determinant of M. *oleifera* output in the study area because it accounted for about 40% of total cost. This conforms to the study of Oniah *et al*. (2008).

Conclusion and Recommendation

The study concluded that the production of M. *oleifera* is a profitable venture and a good employer of labour. These can be observed from the high rate of returns on investment recorded among the farmers and that the profitability of M. *oleifera* was affected by some factors such as level of education, planting materials, labour and land rent.

To improve M. *oleifera* production in the study area, government in conjunction with the private sectors should make available industries and research institutes that can covert or incorporate the output of M. *oleifera* into human foodstuffs or livestock feeds other than the medicinal usage of the crop. Farmers should increase their scales of operation so as to enjoy the economies of scale. This can be achieved by increasing the area of land invested in the cultivation of M. *oleifera*. This will reduce unit cost and increase profitability. Lastly, government should encourage agricultural loans as processing of M. *oleifera* to other products is capital intensive.

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