

Resource-use Efficiency in *Moringa oleifera* (Lam) Production in Semi-Arid Region of Nigeria

Zira, B.D.*

Department of Forestry and Wildlife, University of Maiduguri, Nigeria

*Corresponding author: zirabamidel@gmail.com

ABSTRACT

This study examined the resource – use efficiency in *Moringa oleifera* (Lam) production in Semi-Arid Region of Nigeria. It focused on the socio – economic characteristics of *Moringa oleifera* farmers, Resource–use efficiency and constraint affecting *Moringa oleifera* production in the study area. Data were collected from a random sample of 280 *M. oleifera* farmers using structured questionnaire. The data were analyzed using descriptive statistics to describe the socio – economic characteristics of the respondents while regression model was used to examine the input-output relationship of *Moringa oleifera* production. The result revealed that about 64% of the respondents were males, 82% were in the active age of 20-50 years, while 92% have more than 5 people in their families. The result also showed that 71% of the farmers were married, 55% had one form of formal education or the other while about 70% had more than 10 years of farming experience. While 68% had average farmland of 1.8 hectares, about 76% of them depended on their personal savings to finance their farming. The Cobb- Douglas production function gave the best equation fit with an R² of 0.64 which means that about 64% of the variability in output was explained by the variations in the variables included in the model. The analysis showed that age, family labour and hired labour were positively related to the output. The result also indicated that, family size, hired labour and farm size were significant at 1% while family labour was significant at 5%. Resource productivity analysis revealed that hired labour was over-utilized while family labour was under-utilized. The major problems facing the farmers include inadequate Planting and harvesting technology, pest and disease. Others include poor market, lack of awareness of marketing outlets and inadequate loan/credit facilities. The study therefore recommends that family labour should be increased and hired labour be reduced, this will boost *Moringa oleifera* production in the study area.

Key words: Efficiency, resource, production, *Moringa oleifera*, semi-arid, Nigeria

INTRODUCTION

Moringa oleifera is a multipurpose, fast growing tree species of the monogenic family *Moringaceae* of the order *Brassicales*. It is now naturalized across the tropics and is cultivated widely in Africa, Thailand, Burma, Singapore, West Indies, Sri Lanka, Mexico, Malaysia and the Philippines (Fahey, 2005). In Nigeria, it is commonly referred to as *Zogallagandi* in Hausa, *Ewelgbale* in Yoruba and *Okwe oyibo* in Igbo Language.

The tree has been shown by many researches to be very nutritious and highly medicinal. Usman *et al.*, (2013) reported that different parts of the plant contain important minerals and are good source of vitamins, proteins, amino acids and various phenols. It has also been shown that *Moringa* seeds apart from been a good source of oil can also be an effective ingredient for water treatment (Meitzner and Prince, 1996). The increased focused on biodiesel makes *Moringa* a very important prospect to the economy of the

rural dwellers as the biodiesel potential of the tree has been shown to be high (Buba and James, 2006).

The importance of *Moringa oleifera* in nutritional, health and other economic uses therefore, makes its study imperative. This study is therefore, aimed at determining the resource use efficiency of *Moringa oleifera* production in Semi-arid region of Nigeria. The specific objectives of the study are to describe the socio-economic characteristic of the farmers, examine the variables affecting *Moringa oleifera* production, determine the resource – use efficiency of *Moringa oleifera* farmers in the study area and to identify factors militating against its production in the study area.

METHODOLOGY

Study area

The study was carried out in semi-arid zone of Sokoto State, Nigeria. The area lies between latitude 13° 15' and 14 45'

North of the equator and longitude 5° 14' and 6° 24' East of the Greenwich Meridian. The region is bounded in the north by Niger Republic, Zamfara State to the east and Kebbi State to the south and west (Sokoto State Government, SOSG, 2009). It has a land mass of 28,232.37km with population of 3,696,999 (SOSG, 2009; National Population Commission, NPC, 2007). The mean annual rainfall ranges from 500mm to 700mm with distinct dry season, which begins in October and ends in April while wet season begins in May and ends in September or sometimes October. The region is also located within the Sudan Savannah belt of the Nigeria's vegetation zones (SOSG, 2009).

Sampling Techniques

The sample frame was established by obtaining a list of all Moringa producing Local Government Areas and respective Moringa producing villages from the ministry of Agriculture and SARD, Sokoto. Thereafter, the names of all Moringa producing farmers in the respective villages were obtained from the village heads and leaders of cooperative associations. This provided the bases for sampling. A three stage multi-stage sampling technique was used to select Moringa farmers. The first stage involved a purposive selection of three leading local government Areas noted for Moringa production in the State; these include Goronyo, Kware and Silame Local Government Areas. The second stage involved a random selection of the Moringa producing villages in each of the selected Local Government Areas. The third stage was a random selection of 50 Moringa farmers from each of the sample Villages. A total of three hundred Moringa farmers were sample and interviewed, only 280 copies were correctly completed and retrieved, which were then used for this study. Data were collected using questionnaire administered by trained enumerators.

Analytical Tools

The analytical tools used for this study were; descriptive statistics and multiple regression analysis. Descriptive statistics, which involved the use of percentage, frequencies and means, was used to analyze the socio – economic characteristic of *M. oleifera* farmers such as their age, gender, marital status, household size, level of education, years of experience and farm size. Multiple regression analysis was used to examine the influence of various variables on the output of *M. oleifera* in the area as well as the marginal analysis of the efficiency of input used by farmers. The implicit function is presented as follows (1):

$$Y = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, U_i) \dots\dots\dots (1)$$

Where;

- Y = Output of *Moringa oleifera* (Naira)
- X₁ = Age of the respondent (Number)
- X₂ = Household size (Number)
- X₃ = Years of experience (Number of year)

- X₄ = Farm size (ha)
- X₅ = Quantity of seed (kg)
- X₆ = Family labour (Man day)
- X₇ = Hired labour (Man day)
- U_i = Error term

Four different functional forms (2 – 5) were employed for the analysis, the best was selected based on *a priori* , statistical and econometric criteria, thus the equations below;

(i) Linear function

$$Y = b_0 + b_1X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7X_7 + U_i \dots\dots\dots (2)$$

(ii) Semi log function

$$Y = \ln b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + U_i \dots\dots\dots (3)$$

(iii) Exponential function

$$\ln Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + U_i \dots\dots\dots (4)$$

(iv) Double Log function

$$\log Y = b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + U_i \dots (5)$$

The independent variables were regressed on the dependent variable (Y) to determine resources that have significant effect on the farmers' output. The coefficients (β₁, β₂.... β₇) of the best fit function were used to compute the Marginal value product (MVP (6)) for some inputs, the marginal factor cost (MFC (7)) for each input was also computed. It is noted that

$$MVP = MPP * P_y \dots\dots\dots (6)$$

$$MFC = P_{X_i} \dots\dots\dots (7)$$

Where;

- P_{X_i} = Price of the ith variable input
- MPP = Marginal physical production that is dy/dx
- U_i = Error term

The ratios of the MVP to MFC were used to determine the efficiency of resources used in *Moringa oleifera* production. The ratio used thus;

- r_i = MVP/MFC Where r_i is the efficiency determinant
- r_i = 1 (MVP = MFC), resource being efficiently utilized
- r_i < 1 (MVP < MFC), resource being over used
- r_i > 1 (MVP > MFC), resource being under utilized

A firm maximizes profit when the ratio of the MVP to MFC is unity (Kay, 1981).

RESULTS AND DISCUSSION

Socio – Economic Characteristics of *Moringa oleifera* farmers

The socio –economic characteristic of *Moringa oleifera* farmers is shown in Table 1. The finding reveals that majority (81 %) of *Moringa oleifera* farmers are within the productive age range of 21 – 50 years. It suggests that the

average *Moringa oleifera* farmer in the study area is active and still in his/her productive age. This finding agrees with the report of Pageil (2007) who found that majority of the agroforestry farmers in Adamawa State were within the age of 21 - 50 years.

Table 1: Socio-Economic Characteristics of Respondents (n=280)

Variable	Frequency	Percentage
Age		
< 20	4	1.43
21 – 30	48	17.14
31 – 40	96	34.29
41 – 50	84	30
> 50	48	17.14
Gender		
Male	180	64.29
Female	100	35.71
Marital Status		
Single	32	14.43
Married	198	70.71
Divorced	36	12.86
Widow(er)	10	3.57
No response	4	1.4
Household Size		
< 5	22	7.86
5 – 10	152	54.29
11 – 15	74	26.43
> 15	32	11.42
Educational Level		
No Formal Education	126	45
Primary Education	40	14.28
Secondary Education	66	23.58
Tertiary Education	48	17.14
Farming Experience		
< 5	22	7.86
6 – 10	62	22.14
11 – 15	76	27.14
16 – 20	74	26.43
> 20	46	16.43
Farm Size (ha)		
< 0.5	102	36.43
0.6 – 1	74	26.43
1.1 – 1.5	16	5.71
> 1.6	88	31.43

Source: Field Survey, 2016

The significance of this active age range is that, able-bodied manpower would be available for production. This will lead to increased level of output and invariably to higher income. The result of gender analysis reveals that 64% of the respondents were male while 36% of them were female. This agrees with the findings of Bayo and James (2006) who states that the majority of *Moringa oleifera* farmers are

male (90%). In agreement with the result of this study, Buba *et al.* (2015) reported that 87% of *Parkia biglobosa* farmers in Borno State, Nigeria, were male. However, this result is not in consonant with the traditional believe that the production of Moringa plant is female dominated. The analysis further revealed that 70% of the farmers were married, Buba (2012) opined that 94% of the Moringa farmers surveyed in Yobe State, Nigeria were married. Buba (2012) concluded that this could mean that Moringa plant can yield income that can alleviate family problems.

The study also reveals that most of the farmers (92%) have more than five people in the households which shows that most of them may depend on family labour instead of hired labour, which may likely reduce cost of hired labour. The distribution of respondents according to level of educational attainment reveals that 55% (14.28 – 23.58%) have one form of formal education or the other. A very high percentage (45%) of the respondent had no formal education, which could imply that they may lack the capacity to adopt modern technological innovations in Moringa farming.

The distribution of the farmers based on their experience in farming business indicated that most (70%) of the farmers have over 10 years of farming experience; which could be an indication that the farmers have enough experience and thus would be expected to understand farming management practices. Amaza (2000) pointed out that experience enhances efficiency in resource use. Majority (70%) of the respondents inherited their farmlands, 7% rented their lands, 14% were gifts from family and friends while 9% of the farmers purchased their farmlands. With respect to farm size, Table 1 showed that 69% of the respondents have farmland of < 0.5 to 1.5 (ha) which indicates that the farmers are small-scale farmers.

Contributions of input variables to output of Moringa Production

The importance of production function analysis is to measure the contribution of each input to production when the input interacts with one another to produce output (Adepoju *et al.*, 2008). The results of regression analysis (Table 2) indicated that the R² of Constant was 0.64 which means that 64% of the output was accounted for by the independent variables included in the regression equation. The estimated coefficients indicated that age, family size, family labour and hired labour are positively related to output (i.e. the yield of *Moringa oleifera*). On the Contrary, years of experience, farm size and quantity of seed are negatively related to the yield of *Moringa oleifera*. Out of the seven independent variables, three (household size, farm size and hired labour) were significant at 1% while family labour was significant at 5%.

Table 2: Regression Coefficient of Estimated Parameter

Regression Coefficient	T. Value	R ²
Constant	1.7437**	0.64
Age	0.4325 ^{NS}	1.23
Household Size	0.1353***	0.93
Years of experience	-0.2302 ^{NS}	-1.32
Farm size	-0.02335***	-0.23
Quantity of seed	-0.1253 ^{NS}	-0.74
Family labour	0.2141**	0.91
Hired labour	0.2411***	0.93

Field survey, 2016, *** (p<0.01), ** (p<0.05), ^{NS} Not Significant

Resource Use Efficiency

The result of the efficiency of resource used is presented in Table 3, which shows that family labour (r =1.56) was under –utilized while hired labour (r = 0.30) was over–utilized. This indicates that the *Moringa oleifera* farmers in the study area did not utilized the productive resource optimally. Hence, the farmers were inefficient in the use of input resource. In a similar study, Buba *et al* (2015), who worked on the efficiency of resource use among *Parkia biglobosa* farmers in Borno state, Nigeria, reported that labour was over-utilized by the farmers.

Table 3: Efficiency of Resource Use in *Moringa oleifera* Production

Resource	MPP	MVP	MFC	r=MVP/MFC
Family labour	3.32	341.96	219.5	1.56
Hired labour	0.14	14.5	48.21	0.3

Source: Field Survey, 2016

Problems associated with *Moringa oleifera* production

Moringa oleifera, like any other plant, is faced with a number of problems. The problems faced by farmers in the production of *Moringa* in the study area are presented in Table 4.

Table 4: Problems faced by farmers in the Production of *Moringa Oleifera*

Nature of the problem	Frequencies	Percent age	Rank
Pest and Disease infestation	104	21.41	2
Poor Market	60	14.08	4
Lack of Awareness	22	5.16	5
Lack of Planting technology	160	37.56	1
Lack of access to loan	80	18.78	3
Total	426*	100	

Source: Field Survey, 2016 * Multiple response

The major constraint faced by the farmers is lack of planting and harvesting technology, which agrees with the findings Bayo and James (2006) who observed that in *Moringa oleifera* production, there is little or no adoption of modern technology in the production of *Moringa*, from land clearing to harvesting. Other problems faced by farmers in the production of *Moringa* in the study area include: pest and diseases infestation, lack of access to loan, poor market outlet and lack of awareness of the importance of *Moringa oleifera*. These problems are the major constraints affecting *Moringa oleifera* production in the study area. If these problems are alleviated, the output of *Moringa oleifera* will be higher.

CONCLUSION

The study revealed the existence of inefficiency in *Moringa oleifera* production in Semi-arid region of Sokoto, Nigeria. Most of the famers were male, with an average household size of 7 persons. Most of famers were literate and had one form of formal education or the other. The *Moringa oleifera* farmers in the study area did not utilized the productive resource optimally. Hence, the farmers were inefficient in the use of input resource. The result shows that the major constraint faced by the farmers is lack of planting and harvesting technology of *Moringa oleifera* in the study area. Other problems faced by farmers in the production of *Moringa* in the study area include: pest and diseases infestation, lack of access to loan, poor market outlet and lack of awareness of the importance of *Moringa oleifera*. The study therefore recommends that family labour should be increased and hired labour be reduced, this will boost *Moringa oleifera* production in the study area.

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