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ASSESSMENT OF FARMERS' AWARENESS OF THE ECONOMIC IMPORTANCE OF PHYSIC NUT (JATROPHA CURCAS) IN NDOKWA EAST LOCAL GOVERNMENT AREA, DELTA STATE, NIGERIA

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ABSTRACT: *In recent time, Nigeria Government has shown great interest in Jatropha as a biofuel plants. The aim is to gradually reduce the nation's dependence on imported gasoline, reduce environmental pollution as well as create a commercially viable industry; which is not yet publicized in the rural areas where the crop is grown. This study, thus focused on the assessment of farmers' awareness of the economic importance of jatropha curcas in Ndokwa East Local Government Area, Delta State, Nigeria. Cross-sectional data collected for the study was achieved through the use of well structured questionnaire administered to seventy (70) farmers purposively selected from the study area. It specifically described the socio-economic characteristics of the respondents, examined farmers awareness of the economic use of the plant, identified farmers source of information on the economic importance of jatropha curcas in the study area. Descriptive statistics such as frequency distribution, percentage, mean and mode were used to analyze the socio-economic characteristics of the farmers while regression model was used to determine the relationship between the awareness of the economic importance of the crop and their socio-economic characteristics. The result showed that majority (31.43%) of the respondents were within the age range of 41-50years, , 52.86% were males, 61.43% were married, 44.30% were civil servants, 34.29% had farming experience of above 15years, 44.29% had household size of the range of 5-8 persons and 85.71% did not belong to any farmers' associations. The result also revealed that majority(85.70%) of the respondents' source of information was from friends and neighbours, majority (94.29%) of the respondents planted the crop for fencing their farmlands and gardens, 84.26% used it for boundary demarcation, 81.43% used it as hedges, 72.86% used it for medicinal purposes, and 70.00% used it for erosion control. The R^2 (0.3618) value which is very low shows that only 36.8% of the variation in the awareness of the economic importance of Jatropha curcas was explained by the combined effects of age, sex and educational level of the farmers. The study revealed that majority (82.86%) were not aware that biofuel can be distilled from Jatropha curcas while only 17.14% were aware of this economic importance of the crop. It was therefore recommended that more enlightenment campaign about the production and economic usse of the crop be embarked upon through extension and training programmes by the State Government.*

KEYWORDS: Jatropha Curcas, Farmers, Economic Importance, Regression Analysis, Delta State, Nigeria.

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INTRODUCTION

Background of the Study

Jatropha curcas is a species of flowering plant in spurge family, Euphorbiaceae, that is native to the American tropics, most likely Mexico and Central America. (Janick, Jules, Robert E. Paull: 2008). It is cultivated in tropical and subtropical regions around the world, becoming naturalized in some areas. The specific epithet, "curcas", was first used by Portuguese doctor, Garcia de Orta more than 400 years ago and is of uncertain origin. Common names include Barbados nut, purging nut, physic nut, or JCL abbreviation of *jatropha curcas* Linnaeus. *Jatropha curcas* (2009).

The seed contains 27-40% oil (average: 34.4%) that can be processed to produce a high- quality biodiesel fuel, usable in a standard diesel engine (Achten *et al.*, 2008).

Jatropha curcas tree can easily be propagated by cutting and is widely planted as hedges to protect field erosion. It is a drought resistant and can grow in gradually sandy saline soil. This plant can grow up to 8 metres; it has large green to pale green leaves and can produce seeds up to 35 years (Mohammed *et al*; 2012). The seed of *jatrophas* is oval in shape and black in colour. The oil produced from the seed of *jatropha* is golden yellow in colour. The genus *jatropha* contains approximately 175 known species. The genus named *jatropha* derived from the Greek words jatros (Doctor),*jatrophe* (food) which implies medicinal uses. *Jatropha curcas* thrives in poor, stony soil and under adverse climatic conditions.

It has numerous common names depending on the country where it is found, but is mostly referred to as physic nut or purging nut.(Openshaw, 2000).

Jatropha curcas is a plant that has many attributes, it uses are numerous; it is a multipurpose plant that have various numerous benefits.

It belongs to the euphorbiaceae or spurge family. It is an uncultivated, non-food, wild species. It is a plant with many attributes, multipurpose uses and considerable potential. (Openshaw, 2000, Sachdeva *et al.*,2012).

It is very abundant in Nigeria. It is commonly known as purging or physic nut. In Nigeria it is known as "binidazugu / cinidazugu" and lapalapa in Hausa and Yoruba languages respectively (Blench 2007 and Blench 2003). It is also known by other various local names as Nmkpoko in Ndokwa East, Idiokpa in Isoko North of Delta State.

Jatropha curcas seeds are rich in oil used as biofuel which makes this plant an important subject for research into renewable energy (Habou *et al.*, 2011). The *jatropha curcas* plant (JCP) is currently receiving a great deal of attention. It has been recognized as a source of medium viscosity pure plant oil that is easily converted to biodiesel with good product properties and has been tested successfully in stationary diesel engines. (Openshaw *et al*., 2000 and Manrung *et al.*, 2009).

In developed nation like Europe and United States, as well as several developing countries, there are intensive efforts towards cultivation of energy crops specifically for the production of biomass as fuel. The potential for energy production from biomass throughout the world is enormous. Biomass (biodiesel, biogas, bioethanol) from biomass source are currently being recognized globally as a renewable energy for cooking, heating, lighting, vehicle and engine

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operation fuel. Non-edible oil from *jatropha* and seed cakes can be used to provide the needed energy although other crops such as palm kernel oil, soya beans, peanut and variety of less common oil also have great potentials and are good sources of raw materials for bio-fuel production (Baroutian *et al;* 2008 Chhetri *et al.*, 2008).

Jatropha curcas has received much attention because of it's immerse role in biodiesel production, an eco-friendly fuel, biodegradable, renewable and non-toxic in nature compared to pertrol-diesel (Pandey *et al.,* 2012). The oil from *jatropha curcas* plants is considered as the best source of biofuel (diesel fuel) production among the various plant based fuel resources the world over (Belewu *et al.,* 2010).

Jatropha plant has been used traditionally for medicinal purpose. The plant possesses anti-inflammatory, anti-parasitic, wound healing, insecticidal, disinfectant, anti-mestatic, anti-tumor, co-agulant, pregnancy terminating activity and anti-diarrhea effect, (Nabil *et al.*,2012). The plant contains terpenes which have shown a wide range of biological activities including molluscidial, insecticidal and fungicidal activities. Cytotoxicity assay results of *jatropha curcas* indicated the potential of its methanolic extract as a source of anti-cancer therapeutic agents against breast cancer cells. (Abdullahi *et al.*, 2011). According to Manjunath *et al*., (2013), *Jatropha* plant has been used traditionally for medicinal purposes. It has been reported that the plant contains terpenes which have shown a wide range of biological activities including molluscidial, insecticidal and fungicidal activities. Cytotoxicity assay results of *jatropha-curcas* indicated the potential of its methanolic extract as a source of anti-cancer therapeutic agents against breast cancer cell (Abdullahi *et al* .,2011). The latex of *jatropha* contains an alkaloid known as "jatrophine" which is believed to be anti – carcinogenic. It is also used as external application for skin diseases and rheumatism and for sores on domestic livestock (Haque *et al*; 2010). The latex has antimicrobial property (Egharevba & Kunle, 2013). In addition to its use as a biofuel, *Jatropha* oil can also be used as biopesticide (Habou *et al*; 2011). Several authors have attested to the use of oil emulsion against insects that attack stored maize grains due to environmental concern and expensive/synthetic insecticides in granaries of small scale farmers which led to a number of problems, such as killing of non-target species, user hazards, formed residues, evolution of resistance to the chemicals, high cost of the chemicals and destruction of the balance of the ecosystem (Musa *et al.,* 2011).

Jatropha curcas is also used in the preparation of arrow poison and fish poison. The seeds are often a source of accidental poisoning both in animals and humans; but in areas where seeds are not toxic, the seeds are boiled or roasted and eaten as a snack and young leaves eaten as vegetables leaf, sap yields a black dye or link which is indelible. Ash from the rocks and bunches are used as curing salt and as lye in dyeing (Vossen *et al*; 2007). *Jatropha* is widely cultivated in the tropics as living fence, for erosion control, demarcation of boundaries and for protection of homesteads, garden and fields against browsing animals (Tigere *et al*; 2006).

The plants and fruits hulls could be used for firewood and seed cake resulting in very high quality charcoal that has the potential to be used in high value markets (Misra&Misra, 2010).

It was discovered that 23 percent of carbon dioxide (CO_2) in the air where *(Jatropha curcas*) is planted is absolved by the plant per annum (Belewu *et al.*,2010).

Jatropha oil cannot be used for edible purpose without detoxification, making it attractive for biodiesel production, the non consumptive utilization of the plant will facilitate durable

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greening of the country, help to conserve the soil water and provide permanent renewable source of energy (Hipal *et al.,* 2009).

The shedding of leaves on *(Jatropha)* plantations begins to rebuild the humus layers. The primary conservation benefits to be derived from production of *Jatropha* relates to improved soil restoration and management.

Jatropha oil projects have been able to provide income and organic fertilizer to increase crop yields as well as being an eco-friendly source of alternative energy to rural farmers.

The findings of Kumar and Sharma; (2008) have shown that the heavy metal contaminated soil can be restored by using combination of industrial wastes and suitable bionoculants strains (*Azotobater*). *Jatropha* in addition to protecting crops from livestocks, it reduces wind erosion and pressure on timber resources and increase soil moisture retention.

According toMakkar *et al*,(2012),the seed kernel of *Jatropha curcas* plant contains up to 60% oil which can be transesterified to biodiesel; JCL plant is a robust energy plant, which in addition to seed oil, also produces wood, fruits, shells, seed, husks and press cake.

Jatropha curcas has received much attention because of its biodegradable, renewable and non-toxic nature compared to petro-diesel (Pandey *et al.,* 2012). The oil from (*Jatropha curcas*) plant is considered as the best source of biodiesel (diesel fuel production among the various plants based fuel resource in the world over (Belewu *et al*; 2010).

The oil is also incorporated in cosmetic and soap products and the seed kernel meal remaining after extraction is rich in nutrients and used as organic fertilizer (Makkar *et al*; 2012). The oil extracted from *Jatropha* can be used as a substitute for kerosene without any further processing (Ofori, Boateng and Lee, 2011).

Jatropha curcas offers significant possibilities for reducing green house gas emission and the potentials to mitigate against climatic change.

The glycerin that is a by-product of biodiesel can be used to make soap and soap can be produced from *Jatropha* oil itself. In either case, the process produces a soft durable soap and is a simple one well adapted to household or small scale industrial activity.

Jatropha curcas seed can provide employment for unemployed youths in Nigeria. For instance, Nigeria still imports fossil fuel despite the facts that Nigeria is one of the largest oil producers in the world. The cost of these fossil fuel can add up to billions of dollars and every dollar spent on energy import is a dollar that the local economy has lost. Renewable energy source using *Jatropha curcas* oil and cake however can be developed. *Jatropha* contributes to the rural poor by creating additional source of income and alleviation of countries balance of payment (Endalew *et al*; 2011).

Renewable energy provides job opportunity; job evolves directly from the manufacture, design installation, servicing, and marketing of renewable energy products.

Jobs even arise indirectly from business that supply renewable energy companies with raw materials, transportation, equipment and professional service such as accounting and clerical services. In turn the wages and salaries generated from these jobs provide additional companies also contribute more tax revenue locally than conventional energy sources.

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Jatropha curcas will increase the price of food in that it may displace food crops on agricultural land. The impact will depend on the intensity of cultivation. It is argued that if *Jatropha curcas* is cultivated exclusively on set aside land or marginal land, with little competition with food crops, the impacts of food crops can be theoretically minimal but in reality *Jatropha curcas* may still compete with other resources like water or labour and thus adverse impact on food production,(Rejogopal and Zitberman, 2007). Allocating land to *Jatropha curcas* means taking land away from other uses like food, pastures, forest or for environmental preservation. The worry in the world is that once *Jatropha curcas* is adopted, in a large scale, many farmers would not be willing to grow food crops such as maize and countries would become importers of food.

Bio-fuels are more labour intensive than other energy technologies per unit of energy delivered basis. Therefore, bio-fuels should result in a net creation of new jobs related to energy production with the bulk of the increase occurring in the agricultural and processing phase, (Rajagopal and Zilberman 2007). It is argued that even if land is available for *Jatropha curcas* production which is not for crop production or grazing, the availability of adequate labour will become an issue since such land is likely to be located far away from settlement areas.

Labour migration and its attendant challenges, might therefore become an issue (Tomomatsu and Swallow, 2007).

Jatropha curcas can be an invasive species which can undoubtly influence public acceptance (Ngethe, 2007).

The harvest of *Jatropha* is labour intensive so farmers will have to be flexible and optimize their work schedule to accommodate *Jatropha* in their farm organization.

The production of biodiesel also requires specific technical skills, in particular for the storage and drying of seed which are crucial steps to obtain a vegetable oil of sufficient grade for esterification.

Another critical characteristics of *Jatropha* is that its oil is not edible and the long term side effects of skin contact with the pharbol esters contained in the granus have not been fully investigated yet (Ullenberg, 2007).

In line with August 2005 Government directive on biofuel, the country released the Nigeria biofuel policy and incentives in 2007 which mandated the Nigeria National Petroleum Corporation (NNPC) to receive and blend 20% of biodiesel into petro-diesel fuel sold in Nigeria with the aim of linking the agricultural sector with the petroleum sector in order to boost the agricultural and rural sectors. Incentives included in the policy for emerging biofuel companies included waivers (VAT, withholding and import duty). Loans and insurance coverage (Galadine *et al*; 2011).

Presently, Nigeria Government has shown great interest in *Jatropha* as a biofuel plants. The aim is to gradually reduce the nation's dependence on imported gasoline, reduce environmental pollution as well as create commercially viable industry; large scale cultivation and production of *Jatropha* has been embarked upon by Nigeria Government in some Northern States such as Adamawa, Gombe, Borno, Bauchi, Yobe, Kastina, Kano, Jigawa, Zamfara, Sokoto and Kebbi (Gupta *et al*; 2009).

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Similarly, promising results was reported by Vijay *et al* (2008) on the production of methane through anaerobic digestion of *Jatropha* and pongamia oil seed cakes.

Research has shown that Africa has worked with farmers in Shimba Hills. Several companies have also been involved in *Jatropha curcas* planting (ESDA 2008).

Experiment on the use of biogas slurry as a fertilizer are still on the early stages. Recently experimentation on solid state fermentation of *Jatropha* seed cake showed that it could be a good source of low cost production of industrial enzymes (Mahanta *et al*; 2008).

Training, Extension and Awareness Creation are all forms of change-oriented communication in which a sender or source conveys messages to one or more receivers with the explicit purpose of establishing a change in the knowledge, attitudes and, ultimately, the behaviour or practices of those receivers.

Awareness creation should therefore build on this common knowledge and focus on

- need for change
- willingness of government to participate
- prospects that positive impacts can be enhanced and negative be mitigated
- procedure that will be followed,
- assessment by team of local specialists, selection of cases
- identification of options with stakeholders,
- integration of options into existing procedures for policy making, program planning, implementation, monitoring and evaluation.

According to Taiwo Williams, Fenley, and Ebun Williams (1984), awareness is the first stage that an individual moves through in terms of adopting improved practices. At this stage the individuals know little about the new idea beyond the fact that it exists. They lack details about the new idea. They do not know the intrinsic qualities. They only know that the idea exists. The acceptance of a new idea is a complex process; it apparently involves a sequence of thoughts and actions with limited knowledge. Fortunately many new facts and ideas have been provided by research workers about the knowledge required to increase the efficiency of agricultural production, distribution marketing and family uses of farm products in Nigeria.

Environmental degradation remains one of the major problems facing the arid and semi arid land in Nigeria and land degradation in particular can be related to high poverty levels in rural agro ecosystem. Addressing this problem calls for a wide range of interventions that includes the use of *jatropha curcas as* a valuable multipurpose crop with high potential as a source of income. The plant can reduce land degradation, decrease deforestation, provide biofuel and can make communities to be energy self- sufficient while reducing fossil fuel consumption and greenhouse gas emissions, among other uses, (Ngethe, 2007).

Despite the reports on the benefits of *jatropha curcas* in other parts of the world, similar information in Nigeria in general and in Ndokwa East in particular, is limited. Potential growers do not have adequate information base about the potential and economics of the plant in order to make decisions relating to its commercialization for wealth creation and poverty alleviation. Thus the specific objectives of the study were to:

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i) describe the socio-economic characteristics of physic nut farmers in the study area.

ii) identify the prevalent uses of physic nut (*Jatropha curcas)* in the study area.

iii) assess farmers source of information on the use of *Jatropha curcas.*

iv) determine the level of relationship between farmers' awareness of the economic importance of the plant and their socio-economic characteristics.

This study would add to the body of knowledge that would enable researchers, farmers and policy makers obtain the needed information on the economic importance of *jatropha curcas.* Appropriate recommendations were made based on findings, if implemented as expected would bring about increase productivity to meet and increase farmers' incomes.

METHODOLOGY

Area of Study

The study was carried out in Delta State, Nigeria. The State covers a land mass of about 18,050km^2 of which more than 60% is land. The State is located in the southern part of Nigeria within latitude 6^06^1 and 6^0 N; and longitude 6^013^1 and 6^025^1 E, with annual mean rainfall and temperature of 2000-23000mm and 28-30^{0}C respectively, (Nwajei, 1993). The State shares boundary with Edo State to the North, Bayelsa State and the Atlantic Ocean to the South, Anambra State to the East and Ondo State to the West. The State lies in the forest vegetation belt. Trees and arable crops are predominantly grown by farmers who form about 70% of the population and are mostly small scale farmers.

Ndowka East Local Government Area is one of the eight Local Government Areas that make up Delta North Senatorial District of Delta State. The area covers a landmass of 1,796 square kilometers comprising mainland and riverine communities. The Local Government Area is bounded to the North by Aniocha South and Oshimili South Local Government Areas, to the south by Bomadi and Isoko North, Eastward by Anambra, Imo and River States and to the West by Ndowka West and Isoko North Local Government Areas. (Delta Beckons, 2011)

When carved out on 27th September, 1991, from the former Ndokwa Local Government Area, Aboh was made its administrative headquarter with a projected 1991 population figure of 1, 325,922, (National Population Commission, 2006)

The main occupation of the people is fishing and farming.

Sampling Procedures

Seven major towns were purposively selected from Ndokwa East Local Government Area; these were Ashaka, Iselegu, Ossissa, Ibrede, Aboh, Afor and Obikwele. Ten (10) farmers were purposively selected from each of the seven selected communities to make a total sample size of 70 respondents for the study.

Method of Data Collection

The primary data used for the study were elicited sourced through the use of well-structured questionnaire, administered to the respondents. Cross-sectional data were collected during the 2015 harvesting period.

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Method of Data Analysis

Data collected were analyzed using descriptive statistics such as mean, mode, frequency distribution, percentages and regression model. The linear exponential, semi-log and double-log functions were fitted into the model, but the linear function gave the best fit and was used for further analysis in the study.

The implicit form of the equation is given as;

$Y=b_0+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+ e$

Where Y=Awareness of the economic importance of *jatropha curcas*

X_1=Age
X_2=Sex
X_3=Marital status
X_4=Educational level
X_5=Household size
e=Error term

RESULTS AND DISCUSSION

Socio- economic Characteristics of the Respondents.

The socio-economic characteristics of the respondents which include the age, sex, marital status, educational level, major occupation, farming experience, household size, and membership of farmers association are represented on Table 1.

The result shows that majority (31.43%) of the respondents were between the age group of 41-50 years old, with a mean age of 42.9 year. This reveals that most of the respondents are people in their economic active age. Majority (52.86%) were males while 47.14% were females, majority (61.43%) of them were married, and 35.71% of the respondents had National College of Education (NCE)/National Diploma (ND) Certificates. This shows that majority of the respondents in the study area were educated and education plays a vital role in agriculture. This corroborates Bomire *et al*:, (2007) who stated that education and experience improves the managerial competence of farmers in production and thus increase productivity. the major occupation of the respondents in the study area shows that majority (44.30%) of the population studied were civil servants, while 37.14% focused mainly on farming and other kinds of business which indicates that agriculture plays a significant role in the live of people in the study area.

The farming experience of respondents in the study area shows that 34.29% had farming experience of above 15years with a mean of 8.94years, The study revealed that majority (34. 29%) of the farmers had farming experience of above 15years with a mean of 8.94 years, while 5.71% had farming experience of below 1year. The high number of farmers with above 15years experience could be attributed to high number of elderly people engaged in agriculture.

Also the low number of farmers with less than 1 year experience could be attributed to the slow increase in number of young people engaged in agricultural activities. Young people engaged in farming means they lack experience in farming therefore they need more training to be able

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to get more information on modern agriculture. Majority (44.29%) had household size of the range of 5-8 persons with a mean of 5 persons while majority (85.71%) of the population studied did not belong to any farmers' associations.

Table 1: Summary of Socio- economic Characteristics of the Respondents.(N=70)

Age	**Frequency**	**Percentage**	**Mean /Mode**
Below 20	1	1.43	
21-30	18	25.71	
31-40	6	8.60	
41-50	22	31.43	42.9
51-60	16	22.86	
61 and above	7	10.00	
Sex			
Male	37	52.86	
Female	33	47.14	Male
Marital status			
Single	13	18.57	
Married	43	61.43	Married
Widow	6	8.57	
Divorce	3	4.29	
Widower	5	7.14	
Educational level			
No formal education	5	7.14	
Primary education	6	8.60	
Secondary education	9	12.85	
NCE/ND	25	35.71	NCE/ND
HND/BSC	23	32.85	
Others	2	2.85	
Occupation			
Farming	26	37.14	
Trading	11	15.71	
Civil servant	31	44.30	Civil servant
Others	2	2.85	
Farming experience			
Below 1	4	5.71	
1-4	22	31.43	
5-10	14	20.00	8.94
11-15	6	8.57	
Above 15	24	34.29	
House- hold size			
1-4	28	40.00	
5-8	31	44.29	5.29
Above 9	11	15.71	

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Membership of Farmers' association			
Members	10	14.29	
Non-members	60	85.71	Non-members

Source: Field Survey Data, 2015

Distribution of Respondents by Prevalent Uses of *jatropha curcas*

Table 2.0 indicates that majority (94.29%) of the respondents planted the crop for fencing their farmlands and gardens, 84.26% used it for boundary demarcation, 81.43% used it as hedges, 72.86% used it for medicinal purposes, 70.00% used it for erosion control, 21.43% used it as ornamental plant. This corroborates Tigere *et al*, (2006) who stated that *jatropha* is widely cultivated in the tropics as a living fence, for erosion control, demarcation of boundaries and for protection of homestead, gardens and field against browsing animals. This also agrees with (Mohammed *et al*; 2012) who stated that *Jatropha curcas* tree can easily be propagated by cutting and is widely planted as a hedge to prevent field erosion.

Table 2.0: Distribution of Respondents by Prevalent Uses of *jatropha curcas*

Uses	**Frequency**	**Percentages (%)**
Fences	66	94.29
Boundary demarcation	59	84.26
Hedges	57	81.43
Medicinal purpose	51	72.86
Erosion control	49	70
Ornamental plant	15	21.43

Source: Field Survey Data, 2015

Distribution of Respondents by Awareness of the Economic Importance of *Jatropha –curcas*

Table 3.0 shows the awareness of the economic importance of *Jatropha –curcas* in the study. The study revealed that majority (82.86%) were not aware that biofuel can be distilled from *Jatropha curcas* while only 17.14% were aware of this economic importance of the crop. This is in agreement with MOE (2008) that uptake and adoption of new technology on *Jatropha curcas* is a challenge which is highly dependent on the level of understanding and awareness of the product. For optional use of *jatropha curcas*, farmers require relevant knowledge for their successful use.

Table 3.0: Distribution of Respondents by Awareness of the Economic Importance of *Jatropha –curcas*

Variable	**Frequency**	**Percentage (%)**
Awareness	12	17.14
Non-awareness	58	82.86

Source: Field Survey Data, 2015.

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Distribution of Respondents by Source of Information Table 4.0 shows that majority(85.70%) of the respondents got their information from family members and neighbours, while 77.14% obtained their information from fellow farmers, 68.57% heard from radio, 58.57% got from Agricultural Officers, 52.86% obtained from social groups, 45.71% got from Extension Agents, 38.57% received from television, 30.00% read from newspapers and 21.43% learnt from seminars/conferences. This finding is in consonant with Hefferman and Misturelli (2001) who stated that a key parameter important to uptake of technologies is their access to relevant knowledge and access to knowledge relates to good delivery systems.

Table 4.0: Distribution of Respondents by Source of Information

Source of information	Frequency	Percentage (%)
Family members and neighbours	60	85.70
Fellow farmers	54	77.14
Radio	48	68.57
Agricultural officers	41	58.57
Social groups	37	52.86
Extension Agents	32	45.71
Television	27	38.57
Newspaper	21	30.00
Seminars/ conferences	15	21.43

Source: Field Survey Data, 2015

Awareness/Socio-economic Characteristics Relationship of Jatropha curcas Production. The result of the linear regression analysis of the relationship between farmers socio – economic characteristics and farmers awareness of the economic use of *Jatropha curcas* is presented in Table 5 below. The OLS result shows that coefficient of the independent variable (age X_1=0.0701), (sex X_2=-0.1428), and educational level (X_4=0.0616) were positive and significant and have positive relationship with farmers awareness of *jatropha curcas,* while the coefficients of marital status (X_3=-0.0731) and house hold size (X_5=-0.0959) were negative and not significant and have a negative relationship with farmers awareness of the economic importance of *jatropha curcas.*

The R^2 (0.3618) value which is very low shows that only 36.8% of the variation in the awareness of the economic importance of *jatropha curcas* was explained by the combined effects of age, sex and educational level of the farmers.

This implies that with increasing age of farmers and educational level would increase the level of awareness of economic importance of the crop. On the other hand, the level of awareness of *jatropha curcas* economic importance would most likely reduce with increase in house hold size. The implication is that the variables of sex, age and educational level were not important in determining the level of awareness of the economic importance of the crop in the study area.

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Table 5. Estimated Linear Production Function of Awareness/Socio-economic Characteristics of Jatropha curcas Production.

Variables	Parameters	Coefficients	Standard error	T-value
Constant terms	b_0	0.2086	0.4702	0.4436
Age (X_1)	b_1	0.0701**	0.0902	0.7761
Sex ($X_{2)}$	b_2	0.1428**	0.2366	0.6033
Marital status ($X_{3)}$	b_3	-0.0731	0.1281	-0.5706
Educational level ($X_{4)}$	b_4	0.0616**	0.0936	0.6579
Household size ($X_{5)}$	b_5	-0.0959	0.1676	-0.5722
R^2		0.36183		
F- ratio		0.458003		
SE		0.877344		

Source: Computed from Field Survey Data, 2015

**Significant at 5% level

Regression equation

$Y = 0.2086 + 0.0701X_1 + 0.1428X_2 – 0.0731X_3 + 0.0616X_4 - 0.0959X_5$

CONCLUSION

From the research findings conducted in Ndokwa East Local Government Area, it can be concluded that farmers in the study area are not aware of the economic importance of *jatropha curcas*. It was also observed that the prevalent uses of the crop in the study area were mainly for fences, for boundary demarcation, as hedges, and for medicinal purpose.

RECOMMENDATIONS

1. It is therefore recommended that more enlightenment campaign about the production and uses of the product should be carried out especially for the young ones in active age to sensitive them into the business and in general on the advantage of the use of the fuel to human health and the environment. This will minimize the destruction of green-house gases (GHG) which is the current major concern of agricultural production.

2. Credit should be made available to those interested in biodiesel production and marketing business.

3. Government of the Federal Republic of Nigeria should do more to support research on *jatropha curcas* as a bioenergy crop and provide farmers with incentives that would boost productivity. In this way, development of biofuel from *jatropha curcas* would not only serve to reduce dependence on fossil fuel, but also in generation of employment opportunities and accelerated rural development.

4. Adequate information base is required on a number of scientific and processing hurdles in order to sustain the use of *jatropha curcas* as a biobased resources especially in the area of oil processing, oil pretreatment and isolation.

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5. Effort should be geared towards attracting investment from government and private sectors into *jatropha* plant breeding. This would increase the likelihood of developing *jatropha* varieties with improved and stable oil yields. The country with her arable expansive land mass can be one of the world's leading exporters of biodiesel; if the governments put a premium on energy security like many countries are now doing. A well defined road map should be put under implementation by the government of Nigeria, extension agents visit in their service to rural dwellers, more information should be passed to the rural dwellers on commercial benefits of the plants (*Jatropha Curcas)* so that commercial use of biodiesel will be implemented in the rural areas and mega cities and subsequently spread over the country.

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