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An Overview Study of Jatropha Curcas as a Sustainable Green Energy and its Economic Impacts to Local Farmers in Kano State, Nigeria

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Abstract

The planet is dying due to so many human activities that are harmful to our environment, such as cutting down trees without growing new ones, carbon emissions through the use of combustion engines and burning firewood etc. As such, these anthropogenic activities pollute our environment and compromising human sustainability. These harmful activities were carried-out either deliberate or unknown to people in search of energy, survival and luxuries of life. Therefore, there is strong need to find sustainable source of energy that is renewable and environmentally friendly for continual existence of man on this planet. Biodiesel can be extracted from Jatropha Curcas L, which serve as a source of renewable energy. In this paper; the awareness, processing method, economic and medicinal benefits of Jatropha Curcas in Nigeria was discussed. The paper gives priority to three different studies, with addition of regression analysis. The research concluded that there is high rate of awareness of Jatropha Curcas plant, mainly used in live fencing, homestead fencing and farm boundaries mainly in Kano state, Nigeria; though, most of the farmers were not aware of its benefits such as biodiesel oil, medicinal uses, anti-desertification features, soap making among many others, but they are willing to produce the biodiesel from it. The research also recommends awareness campaign and government incentives in the cultivation, production and marketing the biodiesel in Nigeria.

Keywords: Biodiesel; Biofuel; Fuel; Fossil; Jatropha Curcas; Kano state; Nigeria; Renewable energy

1 Introduction

Jatropha Curcas seed is a green plant that can be cultivated, harvested and processed to produce energy which is renewable and safe for human existence, as such, it becomes sustainable and reliable biofuel in the world. Dehgan (1), (1984) and jatrophaworld (2), (2007) describes Jatropha Curcas as a drought-resistant plant that belongs to the family Euphobiaceae, in other words, Euphorbiales containing some 7500 species in 275 genera. Others provide waxes and oils as well as medicinal drugs. Jatropha Curcas can grow to heights of six meters or more thus, making the collection of seeds more convenient (3). Biofuel means the aspect of using organic matter to produce energy for our daily needs, even though, there are various organic biofuels we eat and use as our daily activities, but there are lot problems we might encounter if they will be used in production of fuel, for example our ancestors use groundnut oil for fuel in lamps, and as same time used the groundnut oil to cook meals, this is not sustainable being to the fact it will cause shortage and starvation of food around the world, if the food we eat is used in the production any form of energy production. Jatropha Curcas is not edible and it can be planted on degraded farms where other edible crops can hardly survive, the roots of Jatropha plant penetrate deep into the soil to reach unground water, and thus, assists in strengthening the soil quality and reduce erosion of the soil and fight desertification (4). Desertification is one of the severe threat to the soil nutrients and economic condition in Nigeria, especially the northern part of the country (5). The most amazing part of Jatropha Curcas is it does not emit any harmful greenhouse gasses when burning or during any stage in the process of using or processing it. The energy of Jatropha Curcas is gotten when the jelly in the dried seed was extracted and filtered, which is pale yellowish. With the world's fossil fuel depleting rapidly one cannot predict the time left before it finishes, this is found using the R/P ratios; that is the ratio of reserves to production rates at current stage. At the production rates currently, crude-oil will finish in 53 years, coal in 110 years, and natural gas in 54 years from June 8, 2018 (6). However, Devanesan (7), (2007) also established the fact that crude oil reserves might be exhausted before 50 years at the current state of use by various machineries. This research shows the demand for other alternative sources of energy sources to use in the future, nevertheless Jatropha Curcas can be a solution to future energy needs in the world. The only disadvantage about Jatropha Curcas is the poison in it when accidentally swallowed, but the damage can be treated if the victim receives medical attention, though, no mortality cases were reported yet (8).

Nigeria practices a mono-economic system on fossil fuel mainly, thereby abandoning agriculture and other essential sectors of the economy. Jatropha Curcas was introduced into Nigeria in the year 2007, and many policies were developed by past Nigerian governments about how to promote biofuel but nothing much beneficial has been brought out of those policies. Nigerian Federal Executive Council (FEC) in 2007 propose and approve the establishment of the Biofuel Research Institute and Biofuel Energy Commission (BRI & BEC), the diversification of Nigerian

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energy sources from conventional to renewable energy as well as promoting the agricultural sector through the use of gas and oil industry, as well as job creation and sustainable development. The Nigerian National Petroleum Commission (NNPC) establishes Renewable Energy Division (RED) by former President Olusegun Obasanjo, which was inaugurated in 2005. NNPC through Renewable Energy Division (RED) initiated Automotive Biofuel Program for the production of biodiesel that is mixed with Premium Motor Spirit (PMS) also called Automotive Gas Oil (AGO) and Petrol, in not more than 10% volume proportions. Other benefits were the biofuel has the potential to generate revenue of N21,000,000,000.00, approximately $27,000,000.00 (twenty-seven million USD) annually for Nigeria and local Nigerian farmers (9). Nigerian population is 140,003,542 (NPC, 2006) and about 16.5% of the total population unemployed (CIA, 2017). Nigeria's population at growth rate of 2.6% is expected to be 195,458,568 people in 2019 and 433,134,619 in 2050, reaching the fourth (4th) most populous country in the world. Nigeria has high growth rate and is expected to continue growing in the future because of high birth rate and high population momentum (CIA, 2019). The GDP is 2.1% (2019) which is growing slowly (World Bank, 2019). While Kano, on the other hand, is located within the north-western part of Nigeria and it is the most populated part of Nigeria, with a population of 11,058,300 people (Census, 2006). All these Figures show the demand for Nigeria to find varieties of job employments for Nigerian citizens as well as other sources of government income apart from crude oil exportation. Jatropha Curcas can as well help provide continuous job creation with the abundance of agricultural land in Nigeria as well as fighting desert encroachment in the northern part of the country, thereby making a better future for our next generation.

The studies related to Jatropha Curcas with regards to awareness, economic impact and productions methods has gotten some attention from different literature across the globe. As such, the objective of the study was to evaluate the recent related studies as an adaptation of brief overview study. The current research also examines and compare the economics of Jatropha Curcas to local Nigerians; Kano as a case study with that of India. Thus, it will bring awareness to Nigerians and the world as a whole, about the benefits of Jatropha Curcas as sustainable green energy, to reduce the use of fossil fuels. However, this paper will promote the use of biodiesel to the Nigerian government to adopt Jatropha Curcas as a medium of poverty alleviation, sustainable biodiesel production and diversification of the Nigerian economy from the mono economic system.

2 Material and Methodology

2.1 Case Study

Kano state was chosen to be the case study area due to its desertification features encroaching from the northern part of the state; other reasons include high population, unemployment and abundant land for agriculture. The people surrounding villages in Kano state mostly practice subsistence agriculture. Kano State is the highest populated state in Nigeria and economically Kano is called Center of Commerce, and the vegetation of Kano state is Sudan Savannah with traces of Guinea Savannah towards the southern part of the state in the border with Kaduna and Bauchi states (10). The northern and eastern parts of the state are typically Sudan savannah. Kano is located in the northwestern part of Nigeria, created on May 27, 1967, by former Military Head of State Yakubu Gowon. Kano state shares boundaries Kaduna State to the south-west, Bauchi State to the south-east Jigawa State to the north-east and Katsina State to the north-west.

Table 1: Study Area

S/N	KANO	FIGURE
1	Population	11,058,300 (2016) = 5.5% of Nig. Pop.
2	Density	470 People/km2
3	Coordinates	11°30′00”N 08°30′00”E
4	Climate/Vegetation	Sudan Savannah
5	Duration of Rainfall	April-October
6	Maximum Temperature	35 to 40ºC
7	Total land coverage	20,131 km2 (7,773 mi2)

(2006 Census), (11), (World Bank, 2017) and (United nation, 2019).

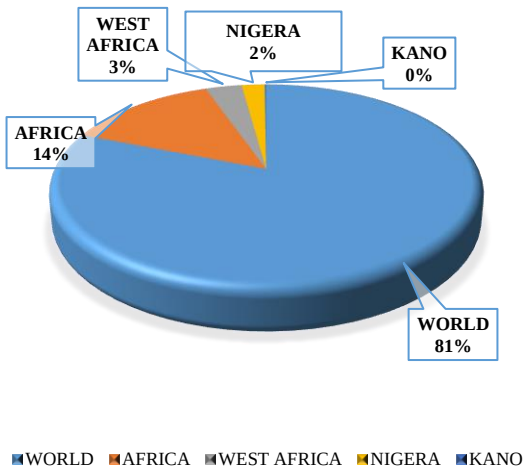


Figure 1: 2016 Summary of the Population Figures (Census, 2006)

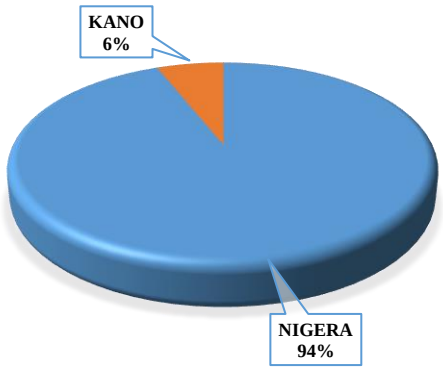


Figure 2: Projected Population Figures of Kano in comparison with Nigerian population in 2019

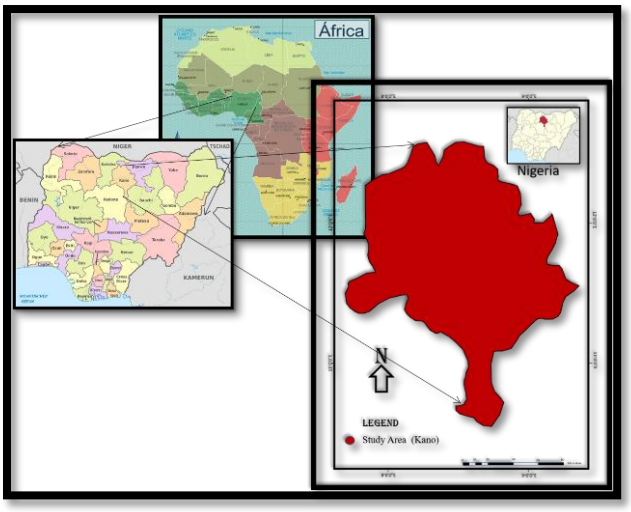


Figure 3: Showing map of Kano state from map of Nigeria

3 Processing Method and Economic Benefits

3.1 Processing Method

There are two methods of processing Jatropha Curcas to produce biodiesel; thus are local and industrial methods. Local method is the simplest way of producing it; the process is itemized as follows: (a) harvesting the matured seed out of the plant from the farm; (b) allowing the outer part of the seed to dry; (c) removing the dried impurities; (d) extracting the fluid out of the seed by grinding and squeezing (physical pressing) process; and (e) extra purification to filter impurities.

Fig.4 Jatropha Plant (Source: Aung, 2012)

With the fuel gotten from these steps were enough to be used locally. While, on the other hand, the industrial method also has all the above stages involved in it. Though, here, further chemicals were added to the extracted liquid of Jatropha seed to add more standards to it (through esterification and transesterification method). Though the processing stages involved (harvesting, drying, degumming, extraction and de-acidification) will add the cost of production and negatively affect the biodiesel production cost. Other studies revealed that Sulphuric acid as an acidic catalyst can be used in reactive extraction of Jatropha oil in the production biodiesel can reduce the high cost of production (12). In transestirification and esterification reaction 1mol of a triglyceride of Jatropha Curcas oil reaction with 3mol of alcohol to give 3mols of alcoesters (biodiesel) with 1mol of glycerol. However, 3:1 ratio of moles alcohol to moles Esther oil can satisfy the reaction to be complete; but to drive the reaction to the product side 6:1 molar ratio is required. At the end of the reaction the excess alcohol was not used, which serves as a catalyst.

Figure 5: Dried Jatropha seed and the processed oil (Source: TKI Resources)

The traditional methods of Jatropha oil extraction requires about twelve hours to produce 1L of oil, which makes highly labour intensive. Another process of Jatropha Curcas oil extraction requires heating the seed kernels to fry it, crushing them to squeeze the water paste out, water is then added, then boiling it, and later separating the oil by the process of skimming and filtering procedure (FAO/IFA, 2010). Many studies have been reported on the production of Jatropha Curcas, but only study reported on the use of enzyme as the catalyst (Hoong et al., 2010). Another research by (Somorin et al., 2017) recently conducted reviews shows that 25.7% of Nigerian families owns generators, and 70.7% businesses use a generator for electric supply and this amounts to 60% of private electricity consumption in Nigeria. This happens due to lack of (unstable) public electric supply in Nigeria.

3.2 Economic Uses of Jatropha Curcas Oil

Jatropha Curcas oil can be used in many ways such as fuel for cooking, lantern (see Fig. 6 to 9 below), can also be used in vehicles such AGO and PMS as mentioned earlier, it can also serve electricity in electric generators mostly in regions where electricity is scarce. With the electricity problem and scarcity in Nigeria, there can be a great achievement if the citizens and the government can produce green electric energy for domestic needs using Jatropha Curcas fuel energy. In India, the cost of Jatropha seedling is ₹3 Indian Rupee (equivalent to 15.2NGN), and a number of seedlings per hectare vary from 1,500 to 2,500, amounting to ₹4500/ha (22,732 NGN) to ₹7500/ha (37,890 NGN) seedling per hectare (Goswami et al., 2011). Thus, happens due to government incentive given to Indian farmers engaged in Jatropha Curcas production. This shows that Nigerian farmers can generate lots of income if the Nigerian policy on green energy is working efficiently. Jatropha Curcas can be used in producing soap, by amazingly adding sodium hydroxide (caustic soda) to the oil. The amazing soap gotten from Jatropha Curcas can be used in treating so many skin diseases. However, Jatropha soap production can be highly profitable, thirteen liters of Jatropha oil can used to produce 4.7 kg of soap within 5 hours (Brittaine et al., 2010). Though, (17) stated that soap made locally from Jatropha Curcas oil has less quality compared to standard factory soap, thus, gives it less commercial potential (FAO/IFA, 2010). Even though, in my opinion, further research can improve the quality standards of the Jatropha soap.

Figure 6: Jatropha Cooking Stove

Figure 7: Oil Lantern, Source: (16)

Burning Jatropha Curcas when cooking or lighting produces less greenhouse gasses, thus, makes it sustainable compared to fossil oil which produces carbon monoxide and nitrogen oxide. This oil reduces toxic smoke inhalation and gives lots of environmental benefits, such as afforestation (i.e. planting Jatropha) instead deforestation by avoiding cutting down trees to make fuel.

Another important use of Jatropha Curcas is the pesticide effects present in it. Molluscicides (insecticide) which is present in the oil kills vector snails (Schistosoma) that causes bilharzia chronic disease (snail fever) widespread in some Africa and South American regions, it is caused by direct contact with blood stream or when bitten by the insect. The miraculous oil gotten from Jatropha Curcas can also be used as a purgative in traditional medicine. Producing Jatropha oil does not require large scale machinery and the large quantity of the seed; therefore, farmers with little income can start the business of Jatropha Curcas oil production.

Figure 8: Jatropha Curcas seed (section view)

Figure 9: Medicinal Jatropha Curcas (special variety), Source: (Qinghua et al, 2019)

The juice of the oil cake can be used to treat pile infection and to clean teeth. The remnant of this miraculous plant after extracting the oil can be used to produce biogas and is safe for domestic use (cooking, lighting, electric generation, etc.). However, in December 2008, Jatropha oil was mixed with jet engine fuel in New-Zealand and successfully reduced the cost of flying by 1/3 (one-third). Talking about income, Jatropha Curcas oil will give lots of financial benefits to the farmer and investors, with 1600gallon/acre annually. Lastly, the oil cake gotten from the plant can be used fertilizer in the farm is to the fact that it is rich in Nitrogen (5.73%), Potassium (1%) and (1.5%) Phosphorus, therefore it is a good source of manure in the farm. The defatted cake cannot be used without detoxification due to the presence of a substance called Curcin in the defatted cake, which is a toxic substance. Nevertheless, it can be used in bio-methanisation to produce biogas when detoxified (Ali et al., 2010). More than 25% of Nigerians acquired electric generators in their homes, >70% in their offices and business places; amounting to 60% of electric energy consumption by the businesses in Nigeria. Akinbami (19), (2001) reported that the most prominent energy used in Nigeria during the years before 2001 were mainly firewood as shown in Fig.10 above, while renewable energy sources (hydroelectric, biofuel etc.) have less patronage. Fig.11 here shows the major energy used in Nigeria was fossil fuel with about 80% in 2015, these fossil fuel were mentioned in Fig.10 above (natural gas, gasoline, diesel, kerosene and coal) with a total of about 98%; hydroelectric and other renewable energies only has 2%, which clearly shows that renewable energy usage was very low in past. However, hydroelectric power have improved from the past years

when comparing hydroelectric percentage energy use in Fig.11 with data gotten from Fig.10 in 2001. This shows that the use of renewable energy source very minimal in Nigeria.

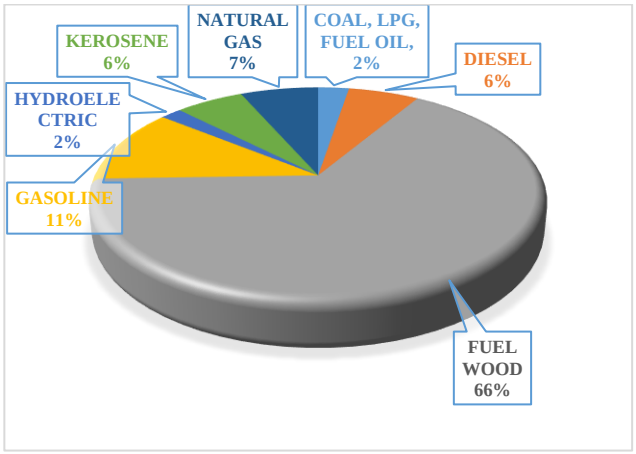


Figure 10: Nigerian Energy Usage Percentage in 2001. Source: (19)

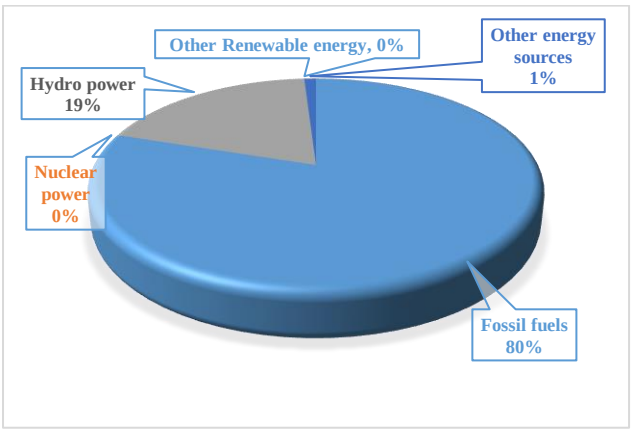


Figure 11: Total percentage of energy used from various sources in Nigeria (kWh), Source: (20)

4 Scenario Based Analysis

In this section, three different previous studies and their respective outcomes will be given priority with the addition of regression analysis. As mentioned earlier, the adaptation of the recently published works would employ in this study in order to have a comprehensive overview of Jatropha Curcas. Besides that, other recent studies related to Jatropha would be briefly summarised in Table 2.

Table 2: Past Publications on Jatropha Curcas L

Author	Country	Year	Publisher
Umar et al	Nigeria	2013	Advanced Journal of Agricultural Research
Abdulsalam	Nigeria	2016	Taylor and Francis
Steven et al.	Malaysia	2010	Science Direct, Biofuel Technology
Fatemeh	Austria	2013	Biotechnology Journal
Anuj et al.	India	2016	Egyptian Journal of Forensic Sciences
Bojan et al.	India	2012	Journal of Sustainable Energy and Environment
Goswami et al.	India	2011	Agricultural Economics Research Review
Mmopelwa et al.	South Africa	2017	Journal of Fundamentals of Renewable Energy and Application
Akinbami et al.	Nigeria	2001	Renewable and sustainable Energy reviews
Shuit et al.	Malaysia	2009	Fuel
Tosin	Nigeria	2017	Renewable Energy

4.1 Scenario 1

In this scenario, biodiesel incentive created by the government of Jigawa state was discussed by Mas'ud, (2016), who reported that the pilot study about Jatropha Curcas was carried out in Kazaure Jigawa state, in comparison with the continuous adaptation of Jatropha Curcas plantation with other countries (specifically Choudhuri and Goswami in India). Data was collected by direct interview with farmers in Kazaure, Jigawa state. Questions related to 7 influential factors were asked to determine whether the proposed determinants are likely to influence the respondent's decision to continue with the existing Jatropha Curcas seed production. The result of the pilot study indicated that that three out of the five (3/5) farmers interviewed in Jigawa state indicated that their personal factors could influence their decision to continue with the project (see Table 3). Results in Table 3 also shows that all the remaining factors in the table can influence the farmer's decision in Jatropha Curcas production.

4.2 Scenario 2

Lim et al., 2010 reported biodiesel production technology using supercritical reactive extraction from Jatropha Curcas L oil seeds, as a cost-effective processing technology in comparison with the local production method and the extraction of oil and followed by esterification/transesterification process to fatty acid methyl esters (FAME) at the same time in a relatively short period of 45-80 min. 0.5-2.0 mm of Jatropha seed and 200-300°C/240MPa of temperature/pressure was being investigated in the research.

Table 3: Pilot Interview on the Relevance of Each Proposed Determinant

Farmers	Personal Factors (age, age squared, education and primary occupation	Physical Factors (distance to market and farm, rain)	Economic Factors (e.g. Access to credit, technical support and extension services)	Institutional Factors (access to credit, technical support and services)	Risk and uncertainty (risk behaviour, low yield, ants and pests	Social factors (influence of community, family and friends)
Farmers 1	X	✓	✓	✓	✓	✓
Farmers 2	✓	✓	✓	X	X	✓
Farmers 3	X	✓	✓	✓	✓	✓
Farmers 4	✓	✓	✓	✓	✓	✓
Farmers 5	✓	✓	✓	✓	✓	X

Source: (9)

10.0 ml/g methanol to solid ratio and 2.5mlig of n-hexane was also used, which at the end produce oil extraction efficiency yield of about 1053%viv and 1035%wfw respectively, which exceeded theoretical yield calculated based on n-hexane Soxhlet extraction of Jatropha oil seeds. The results obtained indicated that the extraction process at lower temperature (200-240oC) yield mother than 65% v/v, while, at temperatures above 240oC yield higher increment rate compared with the previous outcome, since supercritical fluid extraction began to take effect, thus, bring the reaction to 100% oil extraction. When the particle size is <1.0 produce the best supercritical fluid extraction reaction. Conclusively, the experiment yield result above novel supercritical reactive extraction technology of Jatropha Curcas L seed, which proven its economic potential for commercial activities to both government and private investors.

4.3 Scenario 3

Umar, et al., (2013) explain the rate of awareness, marketability and acceptability of the usefulness of Jatropha Curcas plantation in Kano state. The simple random technique was used for the study, and Kano state was divided based on agricultural activities of the state. 1280 respondents were selected randomly amounting to 30% of the respondents tested for an oral interview.

Descriptive statistical analysis was devised using logic regression to test the obtained variables that may affect awareness of Jatropha Curcas cultivation in Kano state. Respondents who were aware of Jatropha Curcas in Kano state were regressed on the following variables: Knowledge of Jatropha Curcas seed cake, willingness to use Jatropha Curcas oil, willingness to use Jatropha Curcas seed cake and willingness to use Jatropha Curcas biodiesel

$$p1 = b_o + b_1 b_1 + b_2 b_2 + \ldots. \; b_n b_n \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

p1 = Dependent variable (awareness of Jatropha Curcas)

a = Regression constant

b1, b2…bn = Regression coefficient

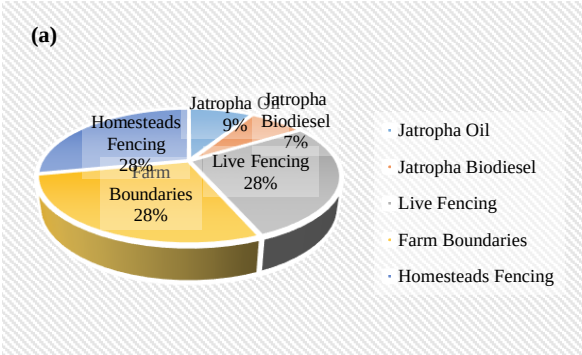
x1, x2…xn = Independent variables

(Knowledge of Jatropha Curcas seed cake, willingness to use Jatropha Curcas oil, seed cake and biodiesel).

5 Result and Discussion

Results obtained were presented in the charts below. The chart above (Fig.12 a. and b.) reported that live fencing, homestead fencing and farm boundaries were more acceptable, having the highest percentage of about 22%, while Jatropha oil and biodiesel have less percentage acceptability by the farmers. Fig. 13. a. and b. acceptability and non-acceptability of Jatropha Curcas, respectively. The highest frequencies here were homestead fencing and farm boundary with 22% each, followed by Jatropha oil (21%), Jatropha biodiesel (20%) and least acceptable frequency was Jatropha oil with 15%. This data shows that the people of Kano state accepts the use of Jatropha Curcas in homestead fencing and farm boundary more than any other use. These figures indicated that the respondents do not accept the use of Jatropha seed to produce Jatropha oil.

The usefulness and acceptability of each product by the respondents was assessed here in fig.14. Live fencing was the most acceptable option with (99.24%). Also, 68.18% accepted Jatropha oil and 90.91% accepted biodiesel as opposed to 9.09% of the respondents that were not sure if it is possible to acquire biodiesel from Jatropha Curcas. A great percentage of the respondents uses Jatropha Curcas in their household and farm boundaries fencing materials. However, the Logit Regression Analysis (fig.14) is carried out to examine the awareness depth of the respondents' the usefulness of Jatropha Curcas and the bye products and also the respondents' willingness to utilize the product extracted from it.



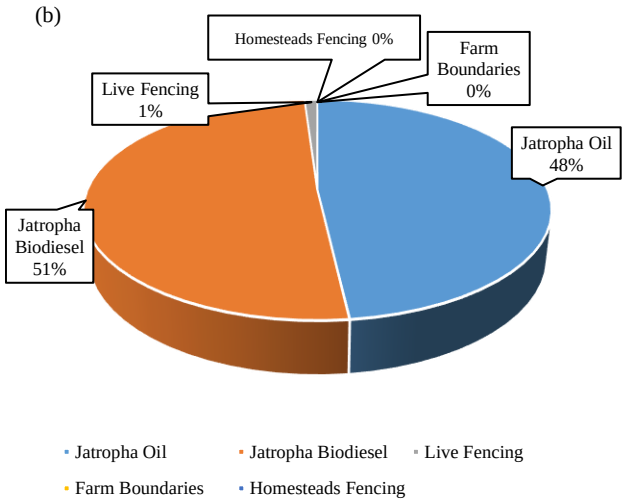


Figure 12: Farmer's awareness (a) and unawareness (b) of Jatropha Curcas products and usefulness. Source: (3)

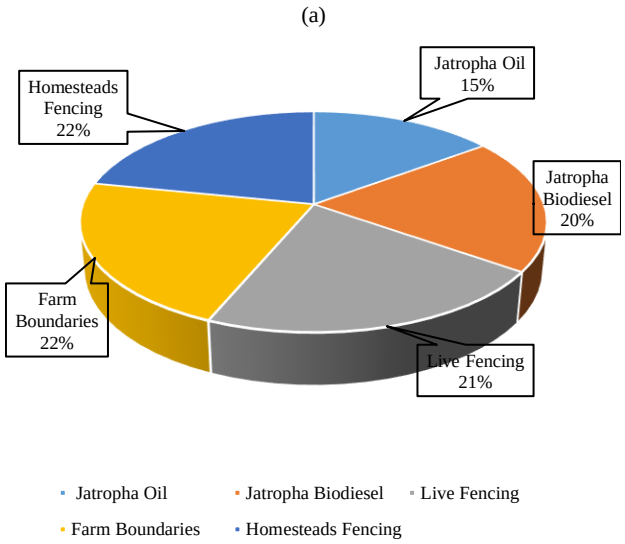
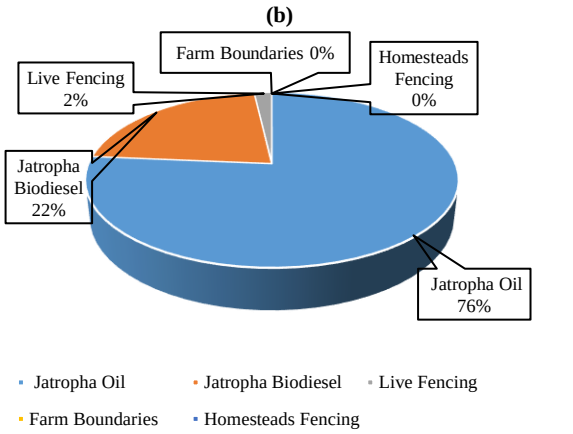


Fig. 14 shows the awareness of Jatropha Curcas by the Kano state farmers which indicated that it is probably going to be influenced by the awareness on the benefits of Jatropha Curcas seed cake. The awareness will also likely to influence the willingness of the farmers in using seed cake along with Jatropha Curcas oil and biodiesel. There was a great high level

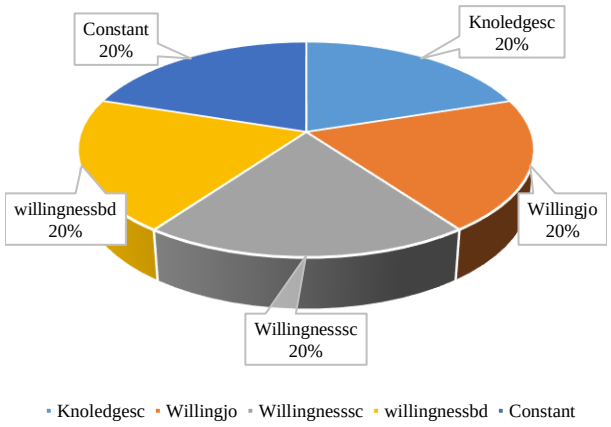
of acceptance of Jatropha Curcas from the respondents and it can be attached to prolong historical use in strengthening homestead fencing and delineating farm boundaries.



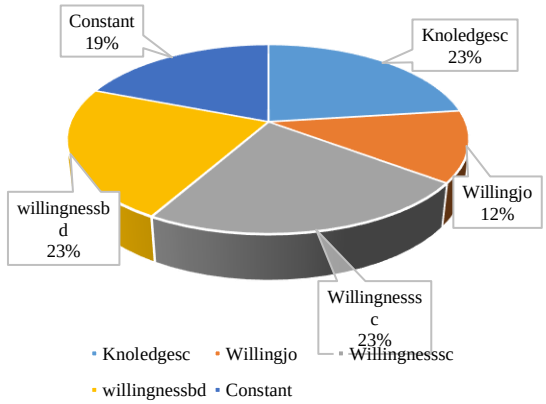
Source: (3)

Figure 13: a. (Not Acceptable Frequency) and b. (Not Acceptable Frequency) Assessment of acceptability of identified Jatropha products and usefulness

(a)



(b)

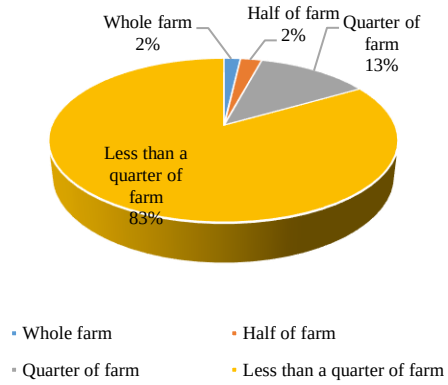


Source: (3)

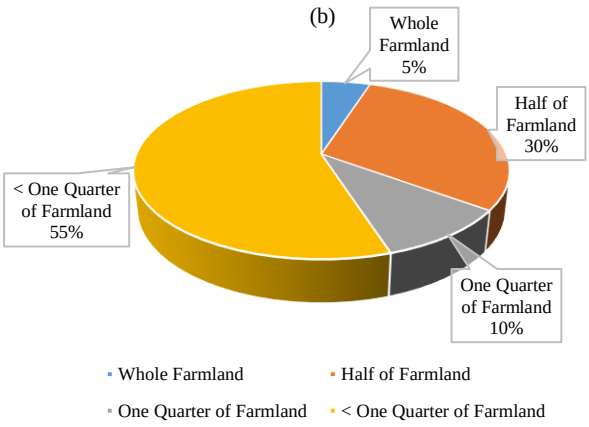
Fig.14: a. (Significant Value) and b. (Standard Error Values) Logic Regression on the Awareness of Jatropha Curcas Products by the Respondents in Kano state

The respondents' willingness to admit Jatropha Curcas biodiesel Indicates the hardship in getting diesel fuel around the rural or less developed regions and the expectation of earning high income (21). he farmers accepted the notion of the likelihood of becoming biodiesel producers because of the level of experience they have. This statement reinstates the discoveries of Singhal and Rogers (22), ((2001) which states that "the readiness and ability of farmers accepting new findings and innovations is proportional directly to their media and communication access like television and radio or when they travelled widely across the globe. Singhal and Rogers (2001) also realized that fresh inventions were accepted very fast especially if it can be conducted on a small business scale, like demonstration plots. Even though, there were no demonstration plots found in the field survey. No Effort made by either, Non-Governmental Organizations (NGOs) or Community Based Organizations (CBOs) nor the government in the demonstration.

(a)



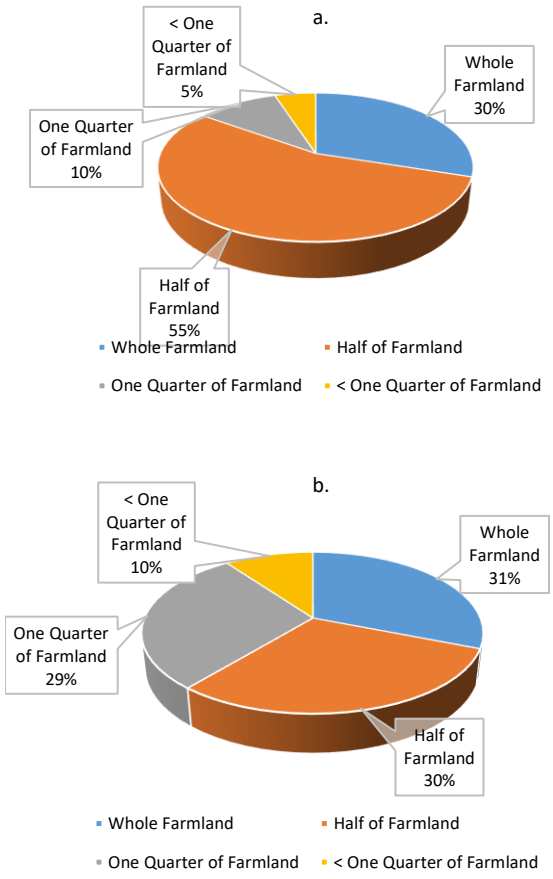
(b)



Source: (3)

Fig.15: a. (Proportion of Jatropha plantings owned by farmers) and b. (Distribution of respondents' percentage of farmland that can be committed to Jatropha Biodiesel Production)

In Fig.15 a. the proportion of individual farms used in Jatropha crop production by farmers is less than quarter of their farms with 83% frequency, which shows that the farmers mainly agreed to use less Jatropha Curcas production in their farms. While the percentage of farmland for biodiesel production by the respondents in Fig. 15 b. was less than a quarter of the farm with 55% and half of the farm with 30%, one-quarter of the farm 10%, and whole farm 5%. This indicates that most of the farmers are willing to cultivate Jatropha Curcas plant in less than a quarter of their farmland.



Source: (3)

Fig.16: a. (Farmland for Jatropha Production with Market vailability) and b. (Farmland with Government Incentive)

The distribution of farmland allocated to Jatropha Curcas cultivation with ready market to the farmers was shown in Fig.16 a., 55% of the respondents use half of their farms, 30% use whole of their farm, 10% use one quarter of their farm, and only 5% use less than a quarter of the farm. This shows that most of the respondent uses half of their farmland in the cultivation of Jatropha Curcas production due to the fact that they have a ready market. While farmland with government incentives was shown in Fig.16 b. where the respondents are willing to use the whole of their farm with 31%, followed half of their farm with 30%, one quarter with 29% and finally less than quarter if the farm with 10%. This literally shows if the government intervene into Jatropha Curcas cultivation, most of the farmers will be willing to use whole their farmland in Jatropha Curcas production.

Conclusively (3) reported that income and employment generation of Jatropha Curcas production is very less. People were not aware of the biodiesel present in Jatropha Curcas seed, as most of them use it in their farm boundaries. All the benefits of Jatropha Curcas were found to be highly acceptable by the respondents.

6 Conclusion and Recommendation

6.1 Conclusion

The data presented above shows that there is a very high rate of awareness and acceptability of Jatropha Curcas plant by the farmers in Kano state and Nigeria as a whole. Though, there was low awareness of its opportunities and economic benefits by the local farmers, such as income, health, medicinal, environmental benefits and employment opportunities. The research also shows a high rate of the farmer's willingness to use Jatropha Curcas as Jatropha biodiesel/oil, and treated seed cake for animal feed (3). Also, the government support is very less or abandoned, despite the Biofuel Energy Commission and Biofuel Research Institute's approval by the Federal Executive Council (FEC) of Nigeria in 2007.

6.2 Recommendation

The need to revive the production and cultivation of Jatropha Curcas is very high. Therefore it should be given the attention required, so as to benefit from the nature surrounding us, and also to save our dying planet from the use of fossil fuels. These can be achieved through an awareness campaign, policy amendments, and access to funding from both government and private sectors in the country. Both small-scale and large scale production should be encouraged to enable the farmers to engage in Jatropha farming and also capture people's interests into this money-making business of Jatropha Curcas oil production in Nigeria. It will be a great achievement if Nigeria can be exporting Jatropha Curcas oil/biodiesel instead of the conventional crude oil exportation.

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