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ASSESSMENT OF THE IMPORTANCE OF JATROPHA AMONG RURAL FARMERS IN SOME SELECTED LOCAL GOVERNMENT AREAS OF KADUNA STATE, NIGERIA

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Abstract

This paper analyzes the importance of planting jatropha in some selected Local Government Area of Kaduna State. The sample survey data were collected from 105 small scale farmers purposively selected. Data were collected using a well-structured questionnaire and were analysed with frequencies, percentages, mean and charts. The result of the study revealed that, majority of the respondents were male, 93.29% of the respondents were in their active ages 76.19% of the respondents were married, 59.04% had household size of between1-10persons,84.84% of the respondents had formal education and 51.43% had income of ₦101,000-₦500,000. The respondents' major source of information was from their relations which was 56.19% and the major reason why they plant jatropha is to protect their farm land from being destroyed by animas which made up 37.19%. The following recommendations were made Women in the study area who are also farmers should be encouraged to plant jatropha on their farm lands, more farmers should be involved in planting jatropha as a hedge row on their farm lands because of the importance and benefits it possess. extension agents should be greatly involved in information dissemination by organizing trainings and seminars for the farmers and government should make environmental policies including the use of jatropha for erosion control.

Key Words: *Rural, Farmers, Jatropha, Importance, Kaduna State*

Introduction

The genus name *Jatropha* is derived from the Greek words jatros (doctor), trophe (food) which implies medical uses. *Jatropha* refers to the species *Jatropha curcas*, although there are approximately 170 known species of the plant (Dehgan, 1984). *Jatropha curcas* belongs to the family *Euphorbiaceae*, which originated in Central America, but widespread in West and Central Africa countries (Abdul Khalil *et al.,* 2013; Habou *et al.*, 2011; Kumar and Tewari, 2015; Nabil *et al.,* 2012). It is a plant with many attributes,

multiple uses and considerable potential (Openshaw, 2000; Sachdeva *et al.,* 2012). *Jatropha curcas* tree can easily be propagated by cutting and is widely planted as hedges to protect field from erosion. It is a drought resistant large shrub or small tree, producing oil containing seeds (Jongschaap *et al.*, 2007). It also thrives in poor, stony soils and under adverse conditions. *Jatropha curcas* L. is the commonest specie found in Nigeria, but many species exist in different parts of the world.

It is a multipurpose, drought resistant tree and can be cultivated in areas of low rainfall (Pratt *et al.*, 2002). It can be planted with other crops, helps reduce soil acidity, increases fertility and can be grown in all types of soils. *Jatropha curcas* is suitable for quick and efficient domestication compared with other woody species (Achten *et al.*, 2010). Names used to describe the plant vary per region or country. Common names include Barbados nut, purging nut, physic nut, or JCL abbreviation of J*atropha curcas* Linnaeus. Common names for Jatropha among tribes in Nigeria it is known as '*Binidazugu*' (Hausa language) '*wuluidi*' (Igbo language) and '*lapalapa*' (Yoruba language) (Blench, 2003).

Jatropha is believed to have been spread by Portuguese seafarers from its centre of origin in Central America and Mexico via Cape Verde and Guinea Bissau to other countries in Africa and Asia. It is now widespread throughout the tropics and sub-tropics. Until recently, jatropha had economic importance in Cape Verde. Since the first half of the nineteenth century, with its ability to grow on poor soils with low rainfall, it could be exploited for oilseed production. Cape Verde exported about 35 000 tonnes of jatropha seeds per year to Lisbon. Along with Madagascar, Benin and Guinea, it also exported jatropha seeds to Marseille where oil was extracted for soap production. However, this trade declined in the 1950s with the development of cheaper synthetic detergents and, by the 1970s, the trade in jatropha oil had disappeared (Henning, 2004a; Wiesenhutter, 2003).

In the past, jatropha oil was used for lighting lamps (Gubitz *et al.*, 1999). Today, rural communities continue to use jatropha for its medicinal value and for local soap production (Hager, 2016). India and many countries in Africa use the jatropha plant as a living hedge to keep out grazing livestock. Jatropha is planted in Madagascar and Uganda to provide physical support for vanilla plants (Hager, 2016).

Jatropha's potential as a petroleum fuel substitute has long been recognized. It was used during the Second World War as a diesel substitute in Madagascar, Benin and Cape Verde, while its glycerine by-product was valuable for the manufacture of nitro-glycerine (Hager, 2016).

Description

Jatropha, a succulent perennial shrub or small tree, can attain heights of more than 5 metres, depending on the growing conditions. Seedlings generally form a central taproot, four lateral roots and many secondary roots. The leaves, arranged alternately on the stem, are shallowly lobed and vary from 6 to 15 cm in length and width. The leaf size and shape can differ from one variety to another. As with other members of this family, the vascular tissues of the stems and branches contain white latex. The branches and stems are hollow and the soft wood is of little value.

Jatropha is monoecious, meaning it carries separate male and female flowers

on the same plant. There are fewer female than male flowers and these are carried on the apex of the inflorescence, with the more numerous males borne lower down. The ratio of male to female flowers averages 29:1 but this is highly variable and may range from 25-93 male flowers to 1-5 female flowers produced on each inflorescence (Raju and Ezradanum, 2002). It also has been reported that the male-to-female flower ratio declines as the plant ages (Achten *et al.*, 2008), suggesting that fruiting capacity may increase with age.

The unisexual flowering of jatropha makes it depend on insects, including bees, flies, ants and thrips for pollination. One inflorescence will normally produce 10 or more fruits. Fruit set generally results from cross pollination with other individual plants, because the male flowers shed pollen before the female flowers on the same plant are receptive. In the absence of pollen arriving from other trees, jatropha has the ability to self-pollinate, a mechanism that facilitates colonization of new habitats (Raju and Ezradanum, 2002).

The fruits are ellipsoidal, green and fleshy, turning yellow and then brown as they age. Fruits are mature and ready to harvest around 90 days after flowering. Flowering and, therefore, fruiting is continuous, meaning that mature and immature fruits are borne together. Each fruit contains two or three black seeds, around 2 cm x 1 cm in size. On average, the seeds contain 35 percent of non-edible oil (Jongschaap *et al.*, 2007)

Jatropha grows readily from seed which germinate in around 10 days, or from stem cuttings. growth is rapid. The plant may reach one metre and flower within five months under good conditions (Heller, 1996). The growth is sympodial, with terminal flower inflorescences and lateral branching, eventually reaching a height of 3 to 5 metres under good conditions. It generally takes four to five years to reach maturity (Henning, 2008a).

Vegetative growth occurs during the rainy season. During the dry season, there is little growth and the plant will drop its leaves. Flowering is triggered by rainfall and seed will be produced following the end of the rainy season. Seeds are produced in the first or second year of growth. Jatropha trees are believed to have a lifespan of 30 to 50 years or more.

Uses of Jatropha

The glycerine 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* plant has been used traditionally for medicinal purpose. The plant possesses anti-inflammatory, anti-parasitic, wound healing, insecticidal, disinfectant, anti-me static, antitumor, coagulant, pregnancy terminating activity and anti-diarrhoea effect, (Nabil *et al.,* 2012). The plant contains terpenes which have shown a wide range of biological activities including mollusc dial, insecticidal and fungicidal activities. Cytotoxicity assay results of *Jatropha curcas* indicated the potential of its metabolic 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 mollusc dial, insecticidal and fungicidal activities. Cytotoxicity assay results of *Jatropha*

curcas indicated the potential of its metabolic 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 "atropine" 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 (Gupta *et al.*, 2010). The latex has antimicrobial property (Egharevba and Kunle, 2013).

In addition to its use as a biofuel, *Jatropha* oil can also be used as bio pesticide (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. 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 and 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).

An Overview of Jatropha Production

Cultivation of *Jatropha curcas* plant can be cultivated in places where enough rainfall and warm climates exits. It grows on almost any soil, such as sandy-saline. It is resistant to long periods of drought and can withstand short spells of light frost. The trees may produce for over 35years. Thus, it is known that Jatropha can be established from seed, seeding and vegetative from cuttings. Plants from seeds develops typical and lateral roots and cutting do not develop a taproot (Heller, 1996). Use of branch clustering for propagation is easy and results in rapid growth, the plant can be expected to start bearing fruit within one year of planting (Jones and Miller, 1992).

Although, Jatropha grows naturally in Nigeria, its cultivation on an economic scale is a recent venture of which little reliable scientific data exists either for environmental assessment/management or as bioenergy crops for biofuel production; therefore, the Jatropha industry is in its early stage. Though large-scale cultivation and, production of Jatropha has been embarked upon by Nigeria government in some northern States-Adamawa, Kastina, Kano, Gombe, Borno, Bauchi, Yobe, Jigawa, Zamfara, Sokoto and Kebbi.

More than 85 percent of Jatropha planting are in Asia, chiefly Myanmar, India, China and Indonesia. Africa accounts for around 12 percent, mostly in Madagascar and Zambia (FAO, 2010). Also, estimation of planted Jatropha is

Tanzania is 17,000 ha which is 1.9% of the global cultivation and 14.4% of the total cultivation in Africa (Mkoma and Mabiki, 2012). Tanzania is considered very important for Jatropha cultivation with area under Jatropha cropping estimated to have increased from 69, 870 ha in 2010 to 620,110 ha in 2015. Globally, the area planted to Jatropha is expected to grow from 4.72 million ha by 2010 and 12.8 million ha by 2015. Indonesia is expected to be the largest producer in Asia with 5.2 million hectares, Ghana and Madagascar together have the largest in Africa with 1.1 million ha, and Brazil is projected to be the largest producer in Latin America with 1.3 million hectares (GEXsi, 2008); With Jatropha cultivation and production systems information is lacking. The study therefore will address the following objectives describe the socio-economic characteristics of the respondents, identify their source of information and identify the different uses of jatropha by the respondents and knowledge of importance of jatropha among the respondents in the study area.

Methodology

Study Area

Kaduna State is located in the northern part of Nigeria, between latitudes 10° 30′N and longitudes 7°45′E of the prime meridian. It shares borders with Federal capital territory to the south, Nassarawa and Plateau to the East, Kastina, Kano and Zamfara States to the North and Niger to the West. There are 23 Local Government Areas in the State. The State has a land mass of about 46,053km^2. It is made up of four agricultural zones namely, Maigana, Lere, Samaru kataf and Birnin Gwari. In 2006 census Kaduna State had a population of 6,113,443 people and a projected population of 8,789,003 people in 2019, based on an annual growth rate of 3.2% (National Population Commission, NPC,2006). Kaduna State is located in the sub-humid agro-ecological zone of Nigeria. The zone has a mean annual rainfall greater than 1,016mm. The growing season is the raining months of April to October and has been estimated to vary from 120 days in the drier northern parts to 150 days in the wetter southern part. The mean annual temperature for the zone is in the range of 25-27°C. The grains grown in the zone are millet, maize, sorghum and rice, the legumes include groundnut, soybeans, melon and pigeon pea. The vegetables are tomato, okra and ginger. The root and tubers include yam, Irish potato and sweet potatoes. The livestock kept are cattle, sheep and goats.

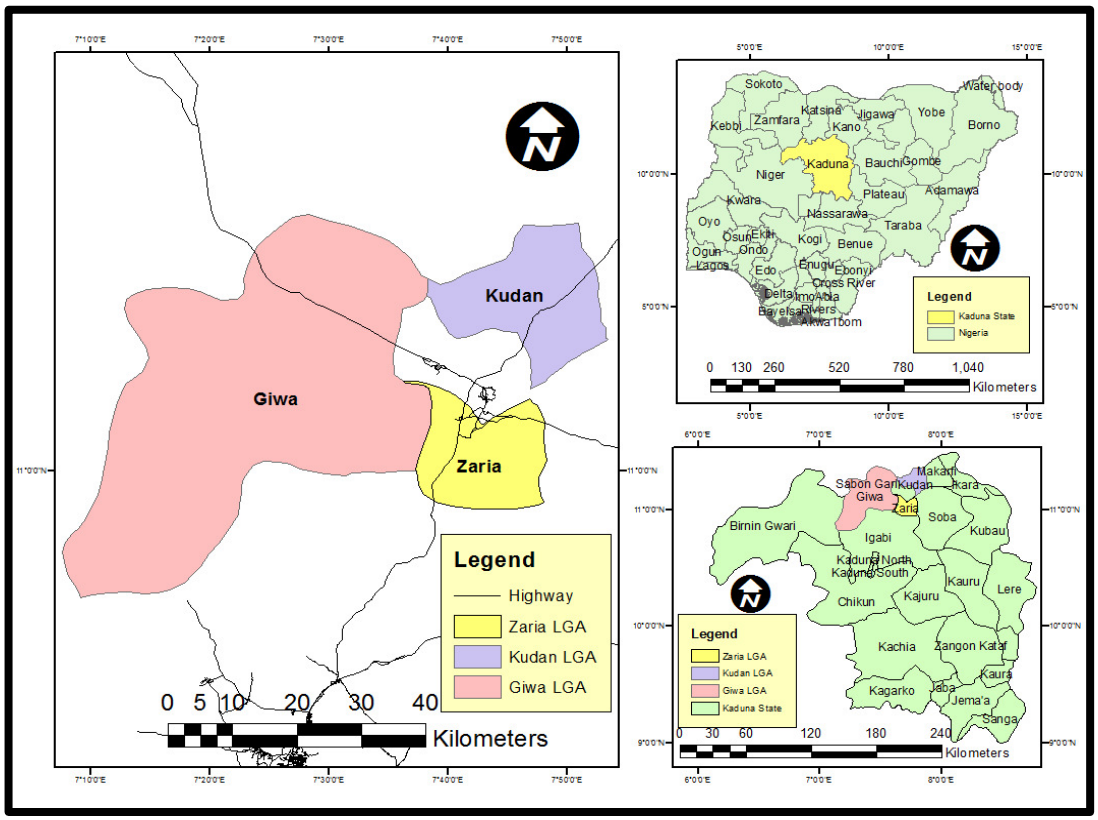

Fig 1: Map of Nigeria showing Kaduna State and Giwa, Kudan and Zaria Local Government Areas

Sampling Procedure

Multistage sampling technique was used to select the respondents. The first stage, was done by purposively selecting three Local Government Areas such as Kudan, Giwa, and Zaria Local Government Areas because they are inhabited by farmers with reference to planting jatropha as hedge row. In the second stage, two (2) villages each was selected from the Local Government Areas to make a total of six (6) villages. In the third stage a 10% population was taken from the total sample from each village. A total number of one hundred and five (105) respondents were selected and used for the study.

Data Collection

Primary data was used for the study. Information was collected with the aid of a structured questionnaire and interviews. Information was collected on the socio-economic characteristics of the farmers such as their age, household size, educational level, extension contact, income etc, source of information and uses of jatropha.

Analytical Techniques

The following analytical tool was used to analyse the data that was collected from the respondents in the study area. These includes descriptive and inferential statistics.

Descriptive statistics

This involves the use of percentages, means, frequency distributions.

Results and Discussion

Socio-economic Characteristics of the Respondents

Table 1 presents the socio-demographic characteristics of the respondents in terms of age, marital status, farm size, education, household size as well as their income. The mean age of the respondents was 36 years; however, 94.21% of the respondents were below 60 years of age. This implies that majority of the respondents were still in their active age and therefore expected to be productive given available resources. In terms of sex, 98.10% of the respondents were male while 1.90% were female. This shows active involvement of men in the planting of jatropha as a hedge row in the study area.

Furthermore, majority (76.19%) of the respondents in the study area were married and the mean household size was 10 persons. The implication of this is that in the traditional rural setting; a family is a good source of labour in food crop production. Table 1 further revealed that 84.76% of the sampled respondents in the study area had formal education whilst 15.24% had no formal education. The respondents in the study area had one form of education or the other. Also, 51.43% of the respondents in the study area earned an annual income of between ₦101,000 to ₦500,000. In terms of farming experience, the mean farming experience of the respondents was about 25 years. Majority (78.05%) of the respondents in the study area had a farm size of 0.1 to 2 hectares with a 2.1ha mean farm size. A high proportion (88.57%) of their farm size falling below 3 hectares shows clearly the subsistence nature of farming in the study area.

Table 1: Socioeconomic characteristics of the respondents in the study area

Variable	Frequency(N=105)	Percentage
Sex		
Male	103	98.10
Female	2	1.90
Age		
Less than 21	11	10.48
21-40	66	62.86
41-60	22	20.95
61-80	5	4.76
Above 80	1	0.95
Marital Status		
Single	23	21.90
Married	80	76.19
Widow	1	0.95
Divorced	1	0.95
Household size		
1-10	62	59.04
11-20	35	33.33
21-30	5	4.76
31-40	3	2.86
Education		
Non formal	16	15.24
Primary Education	22	20.95

Secondary Education	45	42.86
Tertiary Education	22	20.95
Farm Size		
0.1-1	58	55.24
1.1-2	25	23.81
2.1-3	10	9.52
3.1-4	5	4.76
4.1-5	4	3.81
Income(₦)		
10,000-100,000	25	23.81
101,000-500,000	54	51.43
501,000-1,000,000	14	13.33
More than 1,000,000	12	11.43

The respondents tend to know about the importance of jatropha through various means. Their major source of information was from their relations which made up 56.19%, followed by 26.67% from friends, then 10.48% from radio, 3.81% from extension and lastly 2.86% got their information from ADPs.

Table 2: Distribution of the respondents according to their source of information

Source of information	Frequency (N=105)	Percentage	Rank
Relations	59	56.19	1st
Friends	28	26.67	2nd
Radio	11	10.48	3rd
Extension agents	4	3.81	4th
ADP	3	2.86	5th

There are different uses jatropha possess. In the study area jatropha was majorly planted to protect their crops from being damage by animals such as cattle which made up 37.91%. According to Tigere *et al.* (2006) one of the uses of jatropha is to protect farms from animal damage. This is so because the animals cannot browse on it because it is poisonous. Jatropha is known to protect lands from land degradation such as soil erosion and from the respondents it made up 28.57%. It cures many diseases such as ringworm, sexually transmitted diseases etc (Heller,1996). From the respondents in the study area this made up 18.13%, for fencing and soil fertility 2.74% respectively and beautifying the farm 0.94%. The results just shows that the farmers in the study area use jatropha for different purposes.

Table 3: Distribution of the respondents according to the use of Jatropha

Uses of jatropha	Frequency	Percentage
Animal encroachment	69	37.91
Soil erosion	52	28.57
Medicine	33	18.13
Demarcation	17	9.34
Fencing	5	2.74
Soil fertility	5	2.74
Beautify the farm	1	0.94
Total	182*	100

*Multiple responses

Respondents' Knowledge on the Importance of Jatropha

Results in Table 4 revealed the mean scores of farmers' knowledge on the importance of jatropha. For erosion control with a mean of 4.67, fertility enhancement with a mean of 4.33, increase water infilteration with a mean of 4.11, increase crop yield with a mean of 4.03 and for medicine with a mean of 4. The implication of the results is that majority of the respondents have knowledge on the importance of jatropha.

Table 4**:** Respondents responses to the importance of Jatropha (N = 105)

Statements	SA	A	UD	D	SD		
	F	F	F	F	F	Total	Mean
Erosion control	78 (74.29)	19 (18.0)	6 (5.71)	1 (0.95)	1 (0.95)	487	4.67
Fertility enhancement	60 (57.14)	25 (23.81)	16 (15.24)	3 (2.86)	1 (0.95)	455	4.33
Increase water infilteration	45 (42.86)	30 (28.57)	27 (25.71)	3 (2.86)	0 (0)	432	4.11
Increase crop yield	47 (44.76)	32 (30.48)	12 (11.43)	10 (9.52)	4 (3.81)	423	4.03
Medicine	77 (73.33)	11 (10.48)	17 (16.19)	0 (0)	0 (0)	480	4.57

*SA=Strongly agree, A=Agree, UD= Undecided, D=Disagree, SD=Strongly disagree, F=Frequency
Values in brackets are percentages

Conclusion

Jatropha is a shrub which can survive for a long time and its potentials cannot be ignored. It was concluded that jatropha has various use of which was used by the respondents. It has a lot of importance and most especially to farm land and to the environment.

Recommendations

1. Women in the study area who are also farmers should be encouraged to plant jatropha on their farm lands.
2. More farmers should be involved in planting jatropha as a hedge row on their farm lands because of the importance and benefits it possess.

3. Extension agents should be greatly involved in information dissemination by organizing trainings and seminars for the farmers.
4. Government should make environmental policies including the use of jatropha for erosion control.

References

Abdullahi, I., Ismail, A., Musa, A.O. and Galadina, A. (2011). Effect of Kinetic Parameters on Biogas Production from Local Substrates using a Batch Feeding Digester. *European Journal of Scientific Research*, 57(4): 626-634.

Abdul Khalil, H.P.S, SriAprilia, Aamir, H.B and Mohammed, J. (2013). A Jatropha biomass of renewable materials for biocomposities and supplications 2013. *Renewable and Sustainable Energy Reviews,* 22: 667-685.

Achten, W.M.J., Nielsen, L.R., Aerts, R., Lengkeek, A.G, Kjaer, E.D., Trabucco, A., Hansen, J.K., Maes, W.H., Graudal, L.A., Kinnifesi, F.K. and Muys, B. (2010). Towards domestication of *Jatropha curcas Biofuels,* 1(1): 91-107.

Belewu, M.A., Adikola, F.A., Adebayo, G.B., Ameen, O.M., Muhammed, N.O., Olaniyan, A.M., Adekola, O.F. and Musa, A.K. (2010). Physio-Chemical Characteristics of Oil and Biodiesel from Nigeria and Indian, *Jatropha curcas* seeds. *International Boil-chemsci*., 4(2): 524-529.

Blench, R. (2003). Hausa names for plants and trees. Available at http://www.org/odi/staff/r. Printout August 5, 2003.

Dehgan, A. (1984). Phytogenetic significance of interspecific hybridization in *Jatropha* (Euphorbiaceace). *Systematic Botany*, 9(4): 48-59.

Egharevba, H.O. and Kunle, O.F. (2013). Broad Spectrum Antimicrobial Activity of Extracts of *Jatropha curcas. Journal of Applied Pharmaceutical Science,* 3(4): 88-87.

Food and Agricultural Organization (FAO), (2010). Jatropha: A small holder Bioenergy Crop, The potential for pro-poor Development. Integrated Crop Management Vol.8-2010

GEXSI (2008). Global Market Study on Jatropha. Final Report; prepared for the World-Wide Fund for Nature (WWF). London/Berlin. Accessed at http://www.jatropha.platform.org/downloads.htm.

Habou, J.A., Haougui, A., Mergeai, G., Haubruge, E., Toudoe, A. and Verheggen, F.J. (2011). Insecticidal Effect of *Jatropha curcas* Oil on the *Aphid aphis fabael* Hemiptera; Aphididae) and on the Main Insect Pests Associated with Cowpea (*Vigna unguiculata*) in Nigeria *Tropicultura*, 29(4): 225-229.

Gubitz, G.M., Mittelbach, M. and Trabi, M. (1999). Exploitation of the tropical oil seed plant *Jatropha curcas* L. *Bioresources Technology*, 67: 73-82.

Gupta, D.D., Isam, N.M.D., Haque, E., Isam, N. Md; Rahman, S., Hassan, A.K.M. and Shibib, B.A. (2011). Alkanoid and Steroid from the Stem/bark of *Jatropha curcas* (Ephobiaceae). Dhaka. *Universal Journal of Pharmaceutical Science,* 10(1): 9-11.

Hager, S.A.A. (2016). Anatomical, phytochemical and antimicrobial

studies in *Jatropha carcus* plant. A dissertation submitted in partial fulfilment for the degree of Bachelor of Science in Botany. Faculty of Science, University of Khartoum.

Heller, J. (1996). Physic Nut. *Jatropha curcas* L. Promoting the Conservation and Use of Underutilized and Neglected crops. 1. Institute of Plant Genetics and Crop Plant Research, Gatersleben/International Plant Genetic Resources Institute, Rome. ISBN 92-9043-278-0.

Henning, R.K. (2004). The jatropha system Integrated Rural Development by Utilization of *Jatropha curcas* L. (JCL) as Raw material and as Renewable Energy.

Henning R.K (2008a) The Jatropha booklet. A Guide to the Jatropha System and its Dissemination in Zambia. GTZ-ASIP Support Project Southern Province. Bagani GbR

Jongschaap R.E.E., Corre, W.J., Bindraban, P.S. and Brandenburg, W.A. (2007). Claims and Facts on *Jatropha curcas* L: Global *Jatropha curcas* Evaluation, Breeding and Propagation Programme. Plant Research International, B.V. Wageningen, The Netherlands. p1-

Kumar, A. and Tewari, S.K. (2015). Origin, Distribution, Ethnobotany and Pharmacology of *Jatropha curcas*. *Research Journal of Medicinal Plants*, 9(2): 48-59. ISSN 1819-3455/DO1: 10.3923/rjmp 2015. 48.59.

Manjunath, S.M., Sumit, N.I., Surendra, S., Mruthunjaya, K. and Sachin, B. Z. (2013). *Jatropha curcas:* A Systemic review on Pharmacological, Phytochemical, Toxicological Profiles and Commercial Applications. *Research Journal of Pharmaceutical, Biological and Chemical Sciences,* 4(1): 989-1008.

Misra, M. and Misra, A.N. (2010). *Jatropha* the Biodiesel Plant Biology Tissue Culture and Genetic Transformation. A Review. *International Journal of Pure and Applied Science Technology,* 1: 11 – 24.

Mkoma, S.I. and Mabiki, F.P. (2012). Jatropha as energy potential biofuel in Tanzania, *International Journal of Environmental Science,* 2(3): 1553-1564S.

Musa, A.K., Belewu, M.A., Muhammed-Lawal, A., Adekola, F.O., Olarewaju, B.O. and Ibraheem, S.O. (2011). Cost Analysis and toxicity of *Jatropha curcas* L. on maize weevil, *Sitophilus zeamais* Motsch, African *Journal of Plant Science*, 5(4): 233-236. http://www.academicjournals.org/ajps.ISSN 1996-0824 2011.Academic Journals.

Nabil, A.E., Yasser, A.M. and Whalifa, (2012). *Jatropha curcas* Oil as Insecticide and Germination Promoter. *Journal of Applied Science Research* 8(2): 668-675.

NPC, (2006). National Population Commission, Population Figure. Federal Republic of Nigeria, Abuja. Retrieved from http://www.npc.gov

Openshaw, K. (2000). A Review of *jatropha curcas,* an Oil Plant of Unfulfilled Promise. *Biomass and Bioenergy*, 19:1-5.

Pratt, I.H., Henry, E.M.T., Mbeza, H.F., Mkaka, E. and and Satali, L.B. (2002) Knowledge, Adoption against some economic characteristics. Malawi

Agroforestry Extension. Project, Marketing and Enterprise Program main report. Malawi *Agroforestry Publications*, 47: 44-46.

Raju, A.J.S. and Ezradanam, V. (2002). Pollination Ecology and Fruiting behaviour in a monoecious species, *Jatropha curcas* L. (Euphorbiaceae). *Current Science*, 83: 1395-1398.

Sachdeva, K., Garg, P., Singhal, M. and Srivastara, B. (2001). Pharmocological evaluation of *Jatropha curcas* L. stem bark for wound healing potentials. Pharmacology on line, 3:251-264, http//doi.org 10.5530/pj.2014 10.009.V

Tigere, T.A., Gatsi, T.C., Mudita I.I., Chikuvire, T.J., Thamagani, S., Mavunganidze, Z. (2006). Potential of *Jatropha curcas* in Improving Small Holder Farmer's Livelihood in Zimbabwe: An Exploratory Study of Makosa Ward, Mutoko District.

Vossen, H.A.M., Mkamile, G.S. (Eds) Lemonens, R.H.M.J. and Oyen, L.P.R. (General Editors) (2007). Plant Resources of Tropical Africa 14. Vegetable Oils. PROTA Foundation Buckuys Publishes OTA, Wageningen, Netherlands.

Wiesenhutter, J. (2003). Use of the Physic nut (*Jatropha curcas* L.) to combact desertification and reduce poverty. Possibilities and limitations of technical solution in a particular socio-economic environment, the case of Cape Verde. Deutsche Gesellschaft fur Technische Zusammenarbelt (GTZ)-Convention Project to Combat Desertification (CCD Project) Bonn, Germany, 13pp.