

AGRO-BASED RAW MATERIALS AND THE CHEMICAL INDUSTRIES IN NIGERIA

A. U. Israel¹, E. A. Sunday², S. Mangsong³ and U. V. Ebong⁴

^{1,2,3,4} Chemistry Department, University of Uyo, Akwa Ibom State, Nigeria.

Correspondence: esthersunday403@gmail.com

Abstract

Nigeria is enriched with oil and other mineral sources and has solely depended on this resource as her principal source of income. Every part of the country is blessed with one resource or the other. This paper attempts to investigate the different agro-based raw materials in the country, their locations and industrial applications. A proper understanding of this information will encourage technological development and create employment for young intending entrepreneurs who will spark the creation of new small scale industries in Nigeria.

Keywords: Agro-based, chemicals, industries, Nigeria, raw materials, minerals

Citation: Israel, A. U., Sunday, E. A., Mansong, S. and Ubong, U. V. (2016). Agro-based Raw Materials and the Chemical Industries in Nigeria. *Journal of Industrial Technology*, 1(2): 1-15.

INTRODUCTION

Raw materials are unprocessed materials which can be processed into many useful products. It is one of the determinants of a product's quality and cost (Makio, Nobuhiro and Keizo, 2003). Raw materials are supplied in powder and liquid forms. Processing of raw materials such as grinding and mixing are very important. A lot of factors could affect the quality of raw materials such as impurities, moisture contents, particle shapes, particle size and size distribution, etc.

Agro-based raw materials are simply materials derived naturally from plants

and animals. Most chemicals used in industries are obtained from plants and animal by-products. Utilization of natural resources, green energy generation and proper waste management has become a global concern. Petroleum/mineral exploration and production in Nigeria and export of oil and gas resources by the petroleum sectors have substantially improved the nation's economy over the past decades (Aniefiok *et al.*, 2013). Other resources can also contribute to the economy of the nation if they are properly utilized. The utilization of agricultural wastes to fabricate products and energy is the current

trend of industrialization in the country and even in the world at large. Although, there are existing chemical industries in Nigeria but most industries are down because of the continuous importation of foreign products, thus, limiting the interest in local processing of raw materials. This paper seeks to encourage young graduates to take on the mantle of job creation in Nigeria.

In a bid to avoid over-independence of oil and imported goods and expand the economy, it is important to harness our mineral and agricultural resources (Adindu, 2014). Thus, the industrial applications of agro-based materials discussed in this paper are trace applications that can be completed by small scale entrepreneurs with or without special machines. This review will evaluate the agro-based raw materials in Nigeria, what they can be used for and where they can be found in abundance.

AGROBASED RAW RESOURCES IN NIGERIA

CASHEW/ CASHEW NUT

Cashew is economically grown for its apple, nut and wood. Products derived from the nuts include roasted kernel snacks, kernel oil, and cashew nut shell liquid. The apple product include: juice, jam and alcohol among others. Cashew wood is used for furniture and fishing boats (Adeigbe, 2015). It is commonly grown in the southern states of Nigeria especially: Enugu, Oyo, Anambra, Kogi, Osun, Abia, Ondo, Benue, Cross River,

Imo, Ekiti, Ebonyi, Kwara. The stem bark and leaves of cashew tree is used as herbal medicines, inks, glues, juice, fishing boats and ship rollers (Olife, 2013). The kernel is used for making snacks, butter, milk and the nut is pressed to get edible oil used as preservatives (Blomhoff, 2006). The waste generated during cashew nut shell is used to manufacture cashew shell resin for fuel in processing units (ACA (2012)).

CASSAVA

Cassava is planted by farmers all over the country but the main producing states are Imo, Ondo, Anambra, Kogi, Taraba, Cross River, Enugu, Ogun, Benue, Delta and Edo. Cassava is eaten in variety of ways: as locally processed garri, fufu, cassava flakes (editaiwa in Efik), etc. The flour manufactured from the cassava (starch) is used directly, made into a group of baked or gelatinized products or manufactured into glucose, dextrin and other products (Okogbenin, 2012). According to Grace (1997), Starch and starchy products are used in many food and non-food industries and as chemical raw materials for foods (custard, biscuits), pharmaceutical products (pills, facial creams), binding and stabilizing agents in pills, fermentation of alcohol, etc. In the non-food industries, cassava starch is used to formulate natural adhesive and coat cloths in the textile industry. Cassava peelings is a waste generated during cassava processing. It is often dried,

pulverized and used as livestock feed (Adebayo, 2008).

COTTON

Cotton is a major cash crop is of social and economic importance to Nigeria. Cotton is grown in Borno, Bauchi, Gombe, Sokoto, Zamfara, Katsina, Ondo, Oyo, Ogun, Kaduna, Kano and Jigawa (Sani, 2012). Apart from the major industrial use of cotton in production of textile products, cotton balls, paper and candle wicks; cotton seed is crushed to make oil. This cotton-seed oil is used in products like cooking oil, soap, cosmetics, plastics, margarine, emulsifiers and pharmaceuticals. Cottonseed hulls are the outer coverings of cotton seeds, and the by-products of the dehulling necessary for cottonseed oil extraction. After removing the lint, the hulls are separated from the kernel by screening. Cottonseed hulls are a fibrous product, primarily used to feed ruminants (Hall and Akinyode, 2000). Cottonseed hulls are fed as a bulk feed, or pelleted. They are sometimes mixed with cottonseed meal to create a higher density product that is easier to transport and handle (Blasi and Drouillard, 2002)). Cottonseed hulls are one of the best roughages used to add bulk to diets rich in protein and energy, in order to reduce digestive upsets in ruminants (Lane, 2006). Cottonseed hulls are a valuable substrate for mushroom cultivation and the spent substrate can be fed to livestock (Bae, Kim, Jung, Oh and Kwak, 2006). Cottonseed hulls also have numerous industrial uses such as plastic manufacture, oil drilling (mud additive) and furfural production (a solvent used in plastic and synthetic

rubber production and in petroleum refining) (NCPA, 2011). Studies by Jolaoso and Onwualu (2013) revealed that cottonseed hulls can reduce greenhouse gas (CH₄) production. A liquid made from the hulls called furfural is a solvent used in agricultural applications and to manufacture other chemicals such as furoic acid, etc. The remaining mash is used for livestock feed.

KOLA NUT

Kola is a cash crop that has industrial usage in production of soft drinks, wines, confectionaries and pharmaceutical products. It is grown in all states in Nigeria. The kola nut pod husk gotten from processing the nut is used as organic fertilizer and for animal feeding (Asogwa, 2012).

LIVESTOCK RESOURCES

Livestock include cattle, goats, sheep, donkeys, horses, pigs, rats, guinea pigs, birds and rabbits. They are cultivated mainly for meat and egg production. Livestock blood and offal gotten from livestock farming can serve as a renewable source of energy (biogas/biodiesel production). Bones are utilized in the production of pharmaceutical products (because they contain calcium and other essential minerals), adhesives, washing powders, cosmetic products, etc. The hides, skin and horns, feathers of animals are used in the textile industry for decorative purposes. Eggshell has

found applications in pharmaceutical fillers for processing.
 industry for wound healing and as



			
cashew	cotton	yam	Seafood
			
cassava	Sesame	groundnut	onions

Table 1: map of Nigeria, showing selected agro-based raw materials and where they can be found in abundance

SESAME SEED (BENISEED)

Sesame seed is a plant that has many uses in pharmaceuticals,

cosmetics and other industries. The largest producing states are Bauchi, Benue, Jigawa, Nassarawa, Niger

and Taraba (Idongesit, 2016). Sesame oil is used in the production of soap, margarine, biscuit, buns, bread etc. Sesame husk is used as filler for processing and as organic fertilizers.

YAM

Yam is planted everywhere in Nigeria but the major yam producing states in Nigeria are: Adamawa, Benue, Cross River, Delta, Edo, Ekiti, Imo, Kaduna, Kwara, Ogun, Ondo, Osun, Oyo, and Plateau. Benue state is however the largest producer. Yam is eaten as food, processed into flour, and used in the production of many pharmaceutical products. Yam peel is used as livestock feed, broiler chicken meal, Researchers are presently seeking methods of utilizing yam peels in small scale biogas and ethanol production.

GROUNDNUT

Groundnut is an important oil seed crop in Nigeria, the leading producing states include: Niger, Kano, Jigawa, Zamfara, Kebbi, Sokoto, Katsina, Kaduna, Adamawa, Yobe, Borno, Taraba, Plateau, Nasarawa, Bauchi, and Gombe States. Groundnut oil when extracted is used in cooking, it can also be processed into flour, snack (peanut), beverages, groundnut cake. Groundnut has several industrial uses in the production of pharmaceutical products,

varnishers, soap, paints, furniture polish, and chemicals (e.g, nitroglycerin is made from groundnut oil). Groundnut shell is used as livestock feed. It is processed into pellets for fuel. Residual oil is extracted from groundnut shell for soap production.

OIL PALM PRODUCTION, NIGERIA

The main oil palm producing states in Nigeria are: Cross River, Akwa Ibom, Ekiti, Delta, Bayelsa, Ogun, Rivers, Anambra, Ondo, Enugu, Imo, Oyo, Abia, Edo, Ogun. Palm oil (extracted from the fruit pulp) is used in cooking, soap and candle making. Palm kernel oil (extracted from the seed kernels of the fruit) is used in making margarine, soaps, cream and other cosmetics. The sludge (by-product of the fruit pulp) is used in traditional soaps and fertilizer, palm kernel cake serves as feed to livestock. Empty fruit bunches are sundried and used for fuel. Palm fibre is used as fuel and the ash generated is used to make cleaning powders. Palm kernel shell is used for industrial processing of cement (Poku, 2002).

COCOA PRODUCTION

Cocoa is mostly grown in fourteen states in Nigeria, with most production areas located in: Ekiti, Ogun, Ondo, Osun, Edo, Cross River and Oyo. The cocoa pulp juice

is used in alcohol and soft drink production. Cocoa butter is used in the production of chocolate and cosmetic products. Cocoa powder and liquor can be used as an ingredient in chocolate flavoured drinks, ice cream, cakes and biscuits. Pelletized cocoa pod husk is used as livestock feed. Potash from cocoa pod husk is used for soap production; it may also be used as fertilizer (Adomako, 1995).

WHEAT PRODUCTION

Nigeria's northern states like Bornu, Yobe, Jigawa, Kano, Zamfara, Katsina, Adamawa, Sokoto and Kebbi, are major wheat growing areas (Uche, 2014). Wheat is used in the manufacture of flour for bread and pastries, beer, whiskey, and industrial alcohol. Low grades of wheat, and wheat bran are used as feed for livestock, wheat starch is employed as a sizing for textile fabrics.

CORN PRODUCTION

Corn is cultivated in all parts of Nigeria. The major growing states in Nigeria are: Niger, Kaduna, Taraba, Plateau and Adamawa (Uche, 2014). Corn is used in industries to prepare carbohydrates like dextrose ($C_6H_{12}O_6$)_n and dextrin ($C_6H_{10}O_5$)_n, which is used in making of antibiotics, beverages, bakery products (biscuits, bread, etc.), wines and adhesives. Corn starch is used in the production of baking powders, baby foods and pharmaceutical products. Refined

corn oil is employed as cooking oil, margarine and medicinal products in capsule forms. The bran (seed coat), germ (centre of the grain) is used to synthesize corn gluten meal.

BEANS/COWPEA/SOYBEAN/PULSE PRODUCTION

The major growing/production areas in Nigeria are: Benue, Borno, Gombe, Kaduna, Kano, Kebbi, Kwara, Nassarawa, Oyo, Plateau, Sokoto, Taraba and Zamfara. Beans is eaten as food. The oil extracted from beans is used in margarine, solvent and paint production. Biodiesel fuel for diesel engines can be produced from beans oil by an industrial process called trans-esterification. This involves the reaction of vegetable or animal fat (e.g beans oil) with short-chain alcohols (typically methanol or ethanol). This process removes the glycerine from the oil, leaving only the soy biodiesel. Beans biodiesel is non-toxic, renewable, environmentally friendly and its use reduces particulate emissions.

SORGHUM PRODUCTION, NIGERIA

Main producing states are: Zamfara, Niger, Plateau, Katsina, Kaduna, Benue, Kano, Bauchi, Borno (Uche, 2014). Sorghum is eaten as food. It is processed into cooking oil, margarine, starch and applied in synthesis of beer and

bakery products. Sorghum bran and sorghum spent grain is used fresh or dried for processing of african beer (INTSORMIL,2008). Sorghum distilled dried grains and solubles are used alone or mixed with other grains for ethanol production (Tokach, 2010). Another by-product of sorghum starch extraction is sorghum gluten feed and meal which serves as livestock feed.

TOMATO PRODUCTION

Tomatoes are cultivated in most states in :Jigawa, Katsina, Zamfara, Sokoto, Kaduna, Bauchi, Gombe, Taraba and Kano. Tomato is crushed into paste and used for cooking (e.g tin tomato). It is blended with other flavours to make juice concentrate. Tomato peels (treated with NaOH) is used for industrial processing of fibers (Knoblich, 2005).

PEPPER PRODUCTION, NIGERIA

The major part of pepper production in Nigeria is Kaduna, Kano, Jigawa, Katsina, Sokoto, Plateau and Bauchi states. Pepper serves as spicing in food. It is used in confectionery and industrial products such as pepper spray, insect repellents.

ONIONS

Onion husbandry is common in Borno, Sokoto, Kastina, Kebbi, Adamawa and Kano state. Onions is used as vegetable in food. Onions is

also used in non-food industries to synthesis dyes.

SUGARCANE

Sugar cane production is high in Kano, Jigawa, Kaduna, Kastina, Kebbi, Sokoto, Taraba and Adamawa. Sugarcane is predominantly used in sugar, beverage and alcohol production. Cane tops and bagasse (the pulp or dry refuse left after the juice has been extracted from sugar cane) is used for the generation of steam and power necessary to operate the sugar factory. It is also a starting material in the production of paper, board, furfural (C₅H₄O₂).

BANANA AND PLANTAIN PRODUCTION, NIGERIA

Plantain/banana cultivation is common in all states in Nigeria. They are eaten locally as fried slices and plantain/banana chips. In the food industries, plantain is used in making flour for bread,biscuits, pancake, baby foods, wine, beer, dried flakes and cookies. Fibres from the pseudostem can be employed in the fabrication of household decorative convenience items such as lawyer's wig, hand fans, hats, belts and fibre board suitable for use as ceiling board (Akpabio, 2016). The peels, leaves, pseudostem and stalk is used in the synthesis of thickening agent, colouring and flavour, alternative source for macro and

micronutrients, livestock feed, natural fibres, bio-fuel and bio-fertilizers (Birdie, 2010).

SEAFOOD PRODUCTION

Seafood includes mainly fish shrimps, periwinkles, clams, oysters, and Crayfish. Seafood production can be found majorly in areas such as Lagos, Ogun, Ondo, Edo, Bayelsa, Rivers Akwa Ibom and Cross River, which are located in the coastal zone. Fish is eaten as food. Oil extracted from fish is used for pharmaceutical products. Fish bones and offals is used in the synthesis of adhesives, ferterlizer emulsion, fish meal for livestock feed and calcium carbonate (CaCO_3) for industrial applications.

RICE PRODUCTION, NIGERIA

The main areas of rice cultivation in the country include Benue, Borno, Kaduna, Kano, Niger and Taraba, Enugu, Cross River and Ebonyi. Rice is eaten as food. Rice is also used in the industry to formulate wine, beverages, rice flakes, and rice flour. The fibrous bran of brown rice is rich in oil; protein; the B vitamins thiamine, riboflavin ($\text{C}_{17}\text{H}_{20}\text{N}_4\text{O}_6$), and niacin ($\text{C}_6\text{H}_5\text{NO}_2$); and the minerals iron, phosphorus, and potassium. The bran is used in medicine, livestock feed and as cooking oil. Rice hull is used as fuel, fertilizer, and insulation. Straw from the leaves and stems is used as bedding for animals and for weaving roofs, hats, baskets, and sandals.

GARLIC

Garlic is grown in the northern part of the country like Bauchi, Kaduna, Kano, Kebbi, Kastina, Jigawa, Sokoto and Garlic bulbs are used as food spices. It pungent smell, which is always horrible when fresh, adds a delightful taste to meals. It is used as locally to treat hypertension, diabetes, bacterial and fungal diseases, cancer, rheumatism, ulcer, whooping cough to mention but a few.

CHARCOAL PRODUCTION

Charcoal production is the emerging source of income to entrepreneurs. It is available all over Nigeria as many local communities have fashioned the technology of charcoal production. Some known charcoal expatriate are found in the western part of the country such as Oyo, Minna, Jos, Kaduna and so on. Charcoal is gotten from burning of wood residues. Fine charcoal can be produced from sawdust and tree bark on a large scale (Klar, 1937). Apart from its major use as a source of fuel, charcoal is compounded with fillers and binders to make charcoal briquettes; used in the chemical industry to synthesis chemicals such as carbondisulphide (CS_2), sodium cyanide (NaCN) and carbides; in the metallurgy industry for smelting and sintering of iron ores and production of silicon; in

the cement industry as a source of fuel (Waisberg, 1982); in water purification, dechlorination, gas purification, solvent recovery, waste water treatment, cigarette filters, cleaning of bottles and tanks in wine industries, carbonation of soft drinks, poultry mixtures, animal feed (for disease control), pharmaceutical products (to control infections of the digestive tract), the list is endless.

SNAIL

Snail is cultivated everywhere in Nigeria. Snail farm can be raised anywhere and is fast becoming a source of huge income to entrepreneurs. Snail is eaten as meat; it is used to treat waste water from food industry. Snail is also used in the cosmetic industry to formulate creams for acne, scars, antiaging, spot and wrinkles, etc. Snail slime is used in wound healing and other skin disorders. The shell is used as a source of calcium carbonate (CaCO_3), baking powder (NaHCO_3); it is also used to formulate feed for layer hens.

RECOMMENDATION

There are many other raw materials that are not mentioned in this work. This means that there are several areas in which wealth can be created from. The position of

industrial technology is a veritable tool in the development of any nation. In order to attain a stable space economy and sustainable development, there is need to focus attention on sustainable exploitation of the available resources in Nigeria. This will not only promote our export rates but will also increase the use of industrial products like fertilizers, feedstuffs and food which will in turn expand and or create industries, improve economy and create jobs. Poor road networks, poorly maintained drainage, and numerous road security check points also contribute to increasing cost of production by as much as twenty percent thereby, yielding low productivity (Uche, 2014). For instance, in the last three years, over one hundred and thirty firms have closed down due to challenges of unauthorised levies and charges from local government, weak transportation network, communication and domestic demand, as such, many Nigerians are forced to move all or part of their operations to other countries or simply fold up (Ikpong,2013). The president of the Nigerian Association of Chambers of Commerce, Industry, Mines and Agriculture (NACCIMA) complained that; over eight hundred (800) companies in Nigeria are closed due to harsh business operating environment (Herbert, 2012). Industrialization in Nigeria is also

affected by lack of manpower, moribund, inadequate funding and poor research patronage, epileptic power supply and non-existence of statutory regulatory support (Ikpong, 2013). This affirmation is in agreement with the ideas of Chike (2012) who positioned that: *“The prime sector of our economy, which is agriculture, exploitation of abundant mineral resources and local manufacturing is not been assisted by government and the preference of foreign products to that made in Nigeria by the Nigerian masses is not helping matters either. Instead of government to support, she is rather frustrating the effort of the manufacturers and researchers with multiple taxation policy. Cost of production is too high coupled with the outrageous bank interest on loans. Power supply is massively construed in the hands of the politicians”*.(sic).

For Nigeria to broaden the scope of her economic sources and improve her economic-technological growth there is urgent need to maximally exploit the abundant minerals and other raw materials in the country. The utilization and consumption process will yield the needed outcome through:

- organization and funding of technology and engineering apparatus in our tertiary institutions.

- establishment of more effective industries and resuscitation of moribund ones.
- improved power supply.
- good road network for easy transportation from the rural areas.
- adequate funding of research and development (R&D), and manpower training in technology and engineering, and solid mineral exploitation and processing.
- statutory policy to support local ceramic products.
- Imposition of high tariff on foreign products over domestic products.

CONCLUSION

Studies carried out by Ajibade (2016) reveals that Average total cost of producing cassava tubers and processing cassava tubers by women in Oyo state, Nigeria ranges from N57,697.50k per hectare and N599,929.70k per month respectively. The net returns for women cassava producers and those women that combined cassava production and processing ranges from N221,052.00k and N7,289,950.00k per annum respectively. This is a proof that the initiative is highly profitable. The abundant natural resources in Nigeria will result to increase domestic food production, economic empowerment, job creation and technological advancement when well utilized. Transforming the

challenges to opportunities will strengthen the nation and bring her close to the economically and technologically developed nations of the world.

REFERENCES

- Adebayo, A. O. (2008). Using cassava waste to raise Goats. Project 2008-4345. World Bank Development Market place.
- Adomako, D. (1995). Non-traditional uses of Cocoa in Ghana. *Eighth meeting of the Advisory Group on the World Cocoa Economy, Yaounde, Cameroon*, pp.79-85.
- ACA (2012). Overview of the West African Cashew Scenario. *Cashew week. Special issue for ACA Conference*. 13(38):16-18.
- Adeigbe, O. O., Olasupo, F. O., Adewale, B. D. and Muyiwa A. A. (2015). A review on Cashew Research and Production in Nigeria in the last four decades. *Science Research and Essay*. www.academicjournals.com. Vol. 10(5); 196-209.
- Adindu, C. I., Moses, J., Thaddeus, C. A. and Tse D. T. (2014). Exploring Ceramic Raw Materials in Nigeria and their contributions to Nation's Development. *American Journal of Engineering Research (AJER)*. 3(9): 127-134.
- Ajibade, Y. E. and Adetunji, M. O. (2016). Profitability Analysis of Women in Cassava Enterprises in Ogbomoso Agricultural Zone of Oyo State, Nigeria. *Journal of basic and applied Research* 2(3): 306-312.
- Akpabio, D. U., Rosemary, W. A., Udofia, E. A. and Udiong, S. D. (2016). From Waste to Wealth with Musa Species (Plantain and Banana) Pseudostem: Production of pulp, paper and decorative/Utility objects. *Centre for Energy and Environmental Sustainability Research (CEESR), University of Uyo, Uyo, Nigeria*. (2); 2-7.
- Akangbe, J. A., Oloruntoba, O. O., Ayanda, I. F. and Komolafe, S. E. (2012). An Analysis of Yam Storage Strategy to Promote Food Security in Asa Local Government Area of Kwara State, Nigeria. *Ethiopian Journal of Environmental Studies and Management EJESM*: 5 (4): 1-7.
- Aniefiok, E. I., Udo, J. I., Margaret, U. I. and Sunday, W. P. (2013). Petroleum Exploration and Production: Past and Present Environmental Issues in the Nigeria's Niger Delta. *American Journal of Environmental Protection*, 1 (4); 78-90.
- Asogwa, E. A., Otuonye, K., Oluyole, T. N. and E., Uwagboe (2012). Kolanut Production, Processing and Marketing in the South Eastern States of Nigeria. *American – Eurasian Journal Agric. & Environ. Sci.*, 12 (4): 436-468.
- Bae, J. S., Kim, Y. I., Jung, S. H., Oh, Y. G. and Kwak, W. S. (2006). Evaluation on feed-

- nutritional value of spent mushroom (*Pleurotus ostreatus*, *Pleurotus eryngii*, *Flammulina velutipes*) substrates as a roughage source for ruminants. *J. Anim. Sci. Technol.*, 48 (2): 237-246.
<http://dx.doi.org/10.5187/JAST.2006.48.2.237>
- Birdie, S. P., Hoe, S. T., Fook, Y. C. and Mohd, I. A. (2012). Banana by-products: An under-utilized Renewable Food Biomass with great Potential. *Journal of Food Science and Technology*. 51(12):11-18
- Blasi, D. A. and Drouillard, J. (2002). Composition and feeding value of cottonseed feeds products for beef cattle. Kansas State University, May 2002. Accessed online on 4th August 2016 at <http://www.ksre.ksu.edu/bookstore/Item.aspx?catId=562&pubId=1054>
- Blomhoff, R., Carlsen, M. H., Andersen, L. F. and Jacobs, D. R. (2006). "Health Benefits of Nuts: Potential role of Antioxidants". *British Journal of Nutrition*. 96 (S2):S52-S60.
- Bo, Y. K., Yang, H. J., Wang, W. X., Liu, H., Wang G. Q. and Yu, X. (2012). Metabolisable Energy, *in situ* Rumen Degradation and *in vitro* Fermentation characteristics of Linted Cottonseed Hulls, delinted cottonseed hulls and cottonseed linter residue. *Asian-Aust. J. Anim. Sci.*, 25 (2): 240-247
- Chike, O. (2012). A philanthropic Industrialist. *The Kings Magazine*. Issue 5. Nigeria. Pp. 38 - 39.
- Elisha, S. (2006). Nigeria. Available online at <http://www.thebeehive.org>. Accessed on 13th June, 2016.
- Fagbenro, O. A. and Adebayo, O. T. (2014). A review of the Animal and Aquafeed Industries in Nigeria. *Federal University of Technology*, Ondo State, Nigeria. Available online at: www.fao.org/docrep/008/a0042e/a0042e05.htm. Accessed on 29th May, 2016.
- Grace, M. R. (1997). Cassava Processing. FAO Plant Production and Protection Series (3). Available online at: www.fao.org/docrep/x5032e/x5032E6.HTM
- Hall, M. B. and Akinyode, A. (2000). Cottonseed hulls: working with a novel fiber source. In: Proc. 11th Ann. Florida Rumin. Gainesville, FL: Nutr. Symp.: 179-186. <http://dairy.ifas.ufl.edu/rns/2000/Hall.pdf>
- Herbert, A. (2012). 800 Companies Fold in Two Years- In: Economic Diversification. *The Revenue Mobilisation Allocation and Fiscal Commission (RMAFC)*.
- Ibrahim, A. (2014). The Effect of Inorganic Fertilizer on Onion Production. *International Journal*

Israel, A. U., Sunday, E. A., Mansong, S. and Ubong, U. V. (2016).

of Biological Science. 1 (5) 21-29.

Idongesit, S. (2016). Sesame Seed. Available online at: www.agronigeria.com.ng. Accessed on 27th May, 2016.

Igbara, N., Tordee, B., Nwadike, G. and Abuba, S. (2016). Budget and budgeting in the third tier of Government: Problems and prospects. *Equatorial Journal of Finance and Management Sciences*. 1(1):1-9.

Ikpong, U. (2013). Manufacturers Association of Nigeria (MAN) Cries Out-130 Firms Close Shops. *The Vanguard Newspaper*. December 15, p4.

INTSORMIL, (2008). Sorghum Lager and Stout Beer: A Boost to the African Economy. INTSORMIL Report No. 17, January 15, 2008.

Jolaoso, C. M. and Onwualu, A. (2013). Cashew Processing for Economic Development in Nigeria. *Agricultural Journals*. 8(1):45-50.

Klar, M. (1937). Wood Distillation. *Holz- und Werkstoff*. German: 1 (8) 139- 145.

Knoblich, M., Anderson, B. and Latshaw, D. (2005). Analyses of Tomato Peel and Seed By-products and their use as a Source of Carotenoids. *Journal of Science and Food Agriculture*. 85 (7): 1166-1170.

Lane, C. D. (2006). Feeding cottonseed and cotton byproducts to beef cattle. Univ. Tennessee. The University of Tennessee Extension. AS - B 352. Accessed online at www.animalscience.ag.utk.edu/beef/pdf/Drought/ASB352FeedingCottonseedandCottonByproductsToBeefCattle.pdf

Makio, N., Nobuhiro, S. and Keizo, U. (2003). Raw Materials. In: Handbook of Advance Ceramics. Elsevier Inc.

NCPA (2011). Petition for renewable fuel pathway for biodiesel using cottonseed oil - Renewable Fuel Standard 40 C.F.R. §80.1416. National Cottonseed Products Association, Tennessee, USA. Accessed online on 22nd September, 2016, at: <http://www.Cottonseed.com/Whatsnew/Cottonseed%20-%20RFS2%20-%20Petition%20-%202012-12-11.pdf>

Okogbenin, E., Fregene, M., Ceballos, H., Egesi, C., Fulton, T. and Alves, A. (2012). "Cassava Research in Nigeria - September (ppt). National Root Crops Research Centre. Retrieved 25 May, 2016.

Olife, I. C., Jolaoso, M. and Onwualu, A. (2013). Cashew Processing for Economic Development in Nigeria. *Agriculture Journal*. 8(1):45-50.

Poku, Kwasi (2002). Small-Scale Palm Oil Processing in Africa. *Fao Agricultural Services*

Israel, A. U., Sunday, E. A., Mansong, S. and Ubong, U. V. (2016).

Bulletin.vol. 148. Available online at: <http://www.fao.org/docrep/005/y4355e/y4355e00.htm#Contents>.

Sani, A. (2012). Reviving Cotton Production in Nigeria. *The Tide Newspaper*, September 5th, P.3.

Sunday, E. A., Israel, A. U. and Odey, M. T. (2016). Proximate Analysis and Mineral Element Composition of False Yam (*Icacina Trichantha*) Tuber and Oyster Mushroom (*pleurotus ostreatus*). *Equatorial Journal of Chemical Sciences*, 1(1): 125-135.

Tokach, M. D., Goodband, B. and DeRouchey, J. (2010). Sorghum

in swine production: Feeding guide (Sorghum). Checkoff, Kansas State University, Manhattan, Kansas.

Uche, M. Nzeka (2014), Agricultural Marketing Specialist. Grain and Feed Annual Report. *Global Agricultural Information Network*. Available online: <http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Forms/AllItems.aspx>.

Waisberg, B. (1982). Utilizacao do Carvao Vegetal na Industria de Cimento. SOEICOM, Vespasiano, Minas Gerais, Brazil. (In Portuguese).

APPENDIX



