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Nigeria, Factor 1: Plant Science

Cocoa Compost and Crop Rotation

Nigeria is a country of diverse people, languages, and cultures. Ranked seventh in population, it is as much of a melting pot as America. The land varies drastically from north to south and east to west. However, many there go hungry. In many places, the soil is infertile and cannot be used for farming. The climate is changing drastically, which makes it difficult to keep up with new means of assistance. Some cannot own a farm because of the expenses involved or cannot sell enough to break even with the cost of planting in their fields. Many, even though they can afford to farm, lack access to markets due to poor road conditions, a way to get to the market, decent market infrastructures, or safe roads. Olajide Adeloja writes in the *African Journal of Food, Agriculture, Nutrition and Development*, “The existence of markets is critical to the survival of the farm-household-family system.” However, despite these challenges, many people are willing to put their heads together and think of ways to help them in any way they can. Nigeria uses many agricultural techniques similar to those in America, so why not look at how America solved those to try and solve the problems that Nigeria faces? Hunger is a serious issue that affects 11.3 million people in Nigeria alone (Action). Those who live in poverty come to an astonishing statistic of 61% (“Nigerians”). Nigeria has been experiencing a food crisis since 1978, which heavily affects the daily life of every Nigeria (Agbelmoge).

In Nigeria, the seventh most populated country in the world, the average urban family includes four or five children, while a rural family could include ten or twelve. A polygamous family could even include up to twenty children (“Nigeria”). Characteristic to developing countries, much of the population does not have access to healthcare, and many hospitals are heavily understaffed with fewer than one physician per 1000 patients. According to Rachel Goedken, who lived in Nigeria for several years, “In the morning, people would come to the hospital and line up to see my mother [a nurse]. Some would wait all day and not get seen.” Maternal and infant mortality rates are incredibly high in rural areas with 14% of all children dying before the age of five (“Nigeria”). When it comes to education, 65% of boys and 55% of girls are enrolled in school, but many do not choose to continue on into secondary school. This is due to the high costs of supplying their own uniforms, supplies, and textbooks (“Nigeria”).

The diet of the average Nigerian includes tubers such as yams, potatoes, cocoyams, and cassava; animals such as goats, sheep, cattle, pigs, horses, chickens, turkey, duck, pigeons, and fish; and other crops such as sorghum, millet, rice, and soybeans. The typical Nigerian farm is small and used for subsistence only. A single farm is less than one hectare and tends to be fragmented. The farm owner could have a single farm, but it would be scattered in several places. Only about 33% of Nigeria’s incredibly diverse land is used for cultivation (“Nigeria- Agriculture”). Climate diversity makes it possible to grow many different types of food, depending on the region. Farming is simple, too. Tools are not very advanced, and America has outgrown them ages ago. Fertilizers are too expensive for the average farmer to use realistically, so many have to go without any help during the growing season. Many agricultural practices are used, including crop rotation, shifting cultivation, and bush fallow. These each have many practical and impractical uses that help the soil. Crop rotation reduces pathogens in the soil and can also reduce pest problems that occur when a single crop is planted several years in a row. Shifting cultivation allows for a farmer to use a plot of land until the soil is exhausted, then abandon it so that natural vegetation can take over until the soil is improved in time. Bush fallow, common for subsistence-only farming practiced typically by western Nigerian families, allows for the rotation of farms instead of crops. Many crops are often planted in the same field for between one and three years before leaving it in a long period of

fallow, usually between ten and fifteen years. Some farmers engage in aquaculture and raise fish, others poultry or larger animals (Etuk).

There are many barriers to improving agricultural productivity. Fear and distrust of genetically modified plants (GMOs) keeps many farmers from using new varieties of crops. Nigeria's climate varies tremendously from north to south and east to west, and climate change is affecting them greatly. They rely mainly on rain-fed cropping systems instead of irrigation. The soil is not terribly fertile, their land-tenure systems are weak, and there is an incredible lack of access to finance. The average farmer lives on only \$1.50 a day (African). Most cannot earn a living wage with subsistence-only farming, so there is not a lot of supply and demand. Many lack transport to market, and many roads are not safe from thieves, especially at night. Rachel Goedken once told me, "If I learned one thing in Nigeria, it is that you do not travel the Kano-Zaria road at night" Markets also have poor infrastructure, which prevents those who can sell not to make as much as they could.

Here is where the cassava is introduced. It is a tuber grown extensively in tropical and subtropical regions, originally from Central America, but introduced by Portuguese explorers. Phyllis and Emory VanGerpen, missionaries in Nigeria for several decades say, "Cassava is incredible. Easy to grow and easy to sell." The cassava is a tuber that is grown extensively, not only in Nigeria, but all over the world. It can be grown both economically and easily, and it commands good prices (Fermont). In fact, Nigeria is the number one producer of cassava, producing 31 million metric tons a year, 95% of which is used for human consumption (Yakasai). However, it lacks any real nutritional value. According to M.T. Yakasai from the Department of Agricultural Economics and Extension from Kano University of Science and Technology, "The cassava crop consists of 15% peel and 85% fresh tuber flesh. The tuber consists of 20-30% starch, 62% water content, 2% protein, 1-2% fibre with trace of vitamins and minerals." Yakasai also goes on to give a warning, saying that "it's noteworthy to mention here that cassava also contains 2 cyanogenic glycoside named linamarin and lotaustralin which are highly toxic to human and animals." The cassava is also used for purposes other than human and animal consumption, namely starch, ethanol, monosodium glutamate, paper, and textiles. In addition, all wheat flour produced includes 10% cassava flour to help in the local and international markets. If the cassava could be exploited as a fertilizer, or as another means of returning nutrients to the soil, crops with better nutritional value might be easier to grow for the average farmer.

There are many issues that stand in the way, of course. Nigeria's land varies drastically, the north being mostly short grass savanna and full grass savanna, and the south being mostly fresh water swamp or rain forest. A single type of fertilizer would not work the same in the short and full grass savannas of the north as it would in the fresh water swamp and rain forest south. Even with a readily available, universally usable fertilizer, fertilizer technology is not given the awareness that is necessary, and therefore has an extremely low demand. Afusa Banful, Victor Oboh, and Ephraim Nkonya say in their article "Constraints to Fertilizer Use in Nigeria," that this is because of "the physical absence of the product at the time that it is needed, rather than lack of affordability or farmers' lack of knowledge about the benefits or the use of fertilizer ." The government could play a hand in helping the farmers by perhaps assisting in spreading fertilizer awareness by creating free and accessible classes. Insofar as climate change, a single fertilizer might not even be effective a couple years down the road. Even if the fertilizer were made from cassava, the fertilizer still might not be economically accessible to every farmer or, as Banful says, present when it is actually most needed.

Many farms across the globe use crop rotation regularly. In America, many farmers plant soybeans one year and corn the next to replenish nutrients such as nitrogen into the soil. As could be expected, many other countries including Nigeria use the same procedure. There, instead of corn and soybeans, they plant cassava one year and maize the next. Cassava, like soybeans, returns nitrogen to the soil, which maize, a plant similar to corn, needs to grow. Even after rotating these crops, the soil remains lacking in two other

nutrients. Potassium and phosphorus are needed heavily, but very few plants return it to the soil. Why is potassium important to the soil? Potassium deficiency in plants causes other diseases such as Chlorosis, and can cause stunted growth, poor resistance to temperature changes and drought, poor resistance to pests, unhealthy roots, and defoliation. Phosphorous, which is used in cell division and new tissue development, can cause abnormal dark-green color and stunted growth in deficient plants. (Potassium).

Cocoa, which is also grown extensively in Nigeria, produces a compost that is high in potassium (Revista). A study was conducted using an extract of the compost, and its result showed that “after 120 days of the extract application in the soil, it was found that pH, bases saturation and Ca, mg, K, Zn and available Mn increased” (Revista). If the same extract, or even just the compost, could be applied to both the Cassava and the Maize, it would boost the amount of nutrients, namely calcium, magnesium, potassium, zinc, and manganese in the soil that would help both the cassava and the maize to grow. In addition to providing the nutrients that are desperately needed, the compost could also add other nutrients to the soil. Calcium helps with counteracting organic acids; magnesium is necessary for photosynthesis; zinc regulates sugar consumption and the regulation of plant growth; and manganese is involved with the breakdown of carbohydrates and therefore nitrogen metabolism.

Nigeria, which is the world’s fourth largest cocoa producer, plans to produce 100 million metric tons of cocoa by the year 2018 on less than a quarter of the cultivatable three million hectares of land (Ohuocha). About 70% of all cocoa produced in Nigeria annually comes from the rainforest and swamp area in the southwest. It is exported mainly in the form of beans, given the extremely limited ability to process it within the country. Any low or declining yields are caused mainly by a lack of agricultural mechanization, and most challenges in the modern cocoa industry are mainly with the concern of the decreasing levels of labor forces and aging trees producing extremely small yields. Cocoa is also much easier to export as compared to importing, what with frequent changes in policies, tariffs, duties, procedures, and unclear and even inconsistent interpretation of rules by the NCS, or Nigerian Customs Service (Analysis).

Since crop rotation is already heavily practiced, the introduction of the compost into the rotation should not be that hard as long as it is not only affordable, but readily available in a way that farmers could not only be informed about when they actually need it; they also need to have the ability and means to use it . Environmentally speaking, it would allow for cocoa farmers to reduce the waste produced from their crops into an available fertilizer that could be marketed to other farmers. Since cocoa compost is, at least in theory, an all-natural product, it should not have any incredibly negative impacts on the environment in the way a chemical or synthetic fertilizer would. Economically speaking, the cocoa farmers could make more money from the sales, and it would help food security for the average farmer who grows cassava and maize.

Only 3% of cocoa produced annually in Nigeria is domestically consumed as foodstuffs; however, it is predicted that it will increase to 35% by 2016. The Cocoa Research Institute has been working on developing newer cocoa products to help increase the use of cocoa domestically in Nigeria. They have developed cocoa products such as cocoa cream, liquor, bread, cakes, and even biscuits. There is a possibility that a strong increase in cocoa consumption could be lessened by an inadequate or poor performing cocoa processing industry. The Cocoa Association of Nigeria, or CAN, focuses mainly on increasing the local consumption of cocoa and was the only country from West Africa to be included as a member of the International Cocoa Organization, or ICCO. Nigeria is also included in COPOL, or The Alliance of Cocoa Producing Countries. It began with Ghana, Nigeria, Brazil, Ivory Coast, and Cameroon, but now includes other countries such as the Dominican Republic, Malaysia, Gabon, and Togo. It even includes the two Atlantic Islands near the Gabonese coast, Sao Tome and Principe. Economically, COPAL has meetings and workshops dealing with cocoa and other cocoa industry-related

problems and monitors production in member countries. Scientifically, COPAL works with scientific research on all things cocoa and meets triennially at the International Cocoa Research Conferences.

Nigeria's diverse climate and culture makes it difficult to solve the problem of food security. There are many problems that the people there face which could be solved by the use of cocoa compost: poverty, lack of reliable food sources, and infertile soils, to name just a few. Farming can be expensive, and in the cases of many women who run their own farms, too expensive to be accomplished. However, with the astonishing number of people who live in poverty and who go hungry every day, something must be done. With the utilization of the commonly practiced crop rotation between cassava and maize, and with the addition of cocoa compost, the land might be able to grow worry-free at last.

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