
AGRICULTURAL ENGINEERING PROFESSION AND FOOD SECURITY IN NIGERIA: A
REVIEW

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ABSTRACT

Food security is currently a fundamental issue in Nigeria as the country faces serious challenge in meeting food needs of its growing population. Though large expanse of arable land, favorable climatic conditions the nation has not been able to translate these to increased food production. Over 90% of agricultural production in Nigeria is rain-fed. Smallholders, mostly subsistence producers account for 80% of all farm holdings such that crop and livestock productions remain below potentials. Majority of Nigeria's agriculture is still at subsistence level; this is grossly inadequate in food production. This paper highlights the relevance of appropriate technology to production, processing and preservation of food, advances in biotechnology, renewable energy and waste management for environmental sustainability. Neglect or low level of appreciation for agricultural engineering is partly responsible for food insecurity in Nigeria. The role of agricultural engineers in the development and application of relevant agricultural implements to boost food production and the need for government at all levels to recognize and encourage the profession is emphasized. This will ultimately lead to greater productivity and guarantee food security for the nation.

KEYWORDS: Crop processing; Farm mechanization; Indigenous technology; Subsistence farming; Soil and water conservation.

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INTRODUCTION

Food security refers to household's physical and economic access to sufficient food and is one important goal a nation must pursue with passion in order to combat hunger and malnutrition among citizens. Macnamara (1973), defined hunger as a situation in which there is inadequate quantity of available food while malnutrition is consistent consumption of unbalanced diets. Hunger and malnutrition are results of food crisis in sub-Sahara African countries, Nigeria inclusive. Salvatore and Dowling (1977) asserted that this explains why many African nations are being ravaged by infant mortality, unemployment, poverty, sickness and diseases. These deprive the society of its greatest future potentials (future productive human resources).

Nigeria is blessed with 98 million hectares of arable land and additional 2.5million hectares of Irrigable land, out of which 83 million hectares are suitable for cultivation but with only 30 to 34 million hectares presently under cultivation. The nation has one of the best agro – ecology to grow variety of crops (Ashaye, 1983; Oni, 1996; FMA, 2001; EEPC, 2003, Oriola, 2009). However, it has been reported that the country has not been able to take best advantage of her climatic conditions, the large expanse of land and ever increasing teaming population to make her sufficient in food production, despite the fact that variety of crops thrive well with maximum yield in different Eco zones of the country. Nigeria is one of the food-deficit countries in sub-Sahara Africa, (Arthur, 2009). A country is food-secure when a majority of its population has access to food of adequate quantity and quality consistent with decent existence at all times (Reutlinger, 1985; Idachaba, 2004). Oriola (2009) asserted that food security entails producing food that will go round every citizen both in quantity and quality. To achieve this, agricultural production



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needs to be enhanced with adequate knowledge of the environment, climatic conditions, and appropriate mechanization among others. The Nigerian agriculture is plagued with drudgery, aged and ageing farmers. These small – holding farmers, who depend on manual labour to carry out their various farming operations, cannot produce enough food for the increasing population of this nation. Toye (1983) submitted that in a situation where some nations have turned desert land into agricultural paradise, Nigeria has no business remaining a starving giant in terms of food production. To corroborate above claim, Adebayo (1983) asserted that manual labour predominates Nigerian agriculture, from tillage to harvesting and processing. He further added that for meaningful agricultural development, there was need to replace manual labour with modern farming techniques.

For Nigeria to overcome the challenge of food inadequacy, she must embrace appropriate agricultural technologies developed by the indigenous agricultural engineers. This will, in the long run, contribute to the improvement of the national economy. This paper examines the prospects of achieving food security in Nigeria and the relevance of agricultural engineering profession in this pursuit.

MATERIALS AND METHODS

The method adopted for this study was the review of literatures and qualitative research technique on food security issues in Nigeria. Related literature from various sources such as internet, newspapers, official documents and publications were reviewed and analyzed to draw conclusions for this work.

PRESENT FOOD SECURITY SITUATION IN NIGERIA

Recent estimates put the number of hungry people in Nigeria at over 53 million, which is about 30 percent of the country's total population of roughly 150 million; and 52 percent live under the poverty line. These are matters of grave concern largely because Nigeria was self-sufficient in food production and was indeed a net exporter of food to other regions of the continent in the 1950s and 1960s. Kamoru and Babatunde, (2007), assessed food security situation in Nigeria by tracing the trends in food supplies since independence and they concluded that the problem of food inadequacies started during the civil war (1967 - 1970) when agricultural inputs and machinery as well as other items were deliberately curtailed to conserve foreign exchange. According to Akinyele (2009), food security is currently both a fundamental objective and an expected outcome of development policies in Nigeria, as the country currently faces a challenge in meeting the basic food needs of its population. The majority of Nigerians depend largely on subsistence agriculture, which is hardly sufficient to meet the food needs of the population. However, notwithstanding the many policies, programs, and investments by various local and international agencies operating in the country, food security and the nutrition situation are worsening (Nwajiuba, 2001).

Over 90% of agricultural production is rain-fed. Smallholders, mostly subsistence producers account for 80% of all farm holdings. Both crop and livestock productions remain below potentials. Although the average agricultural growth rate was 7% between 2006 and 2008, this growth lies below the 10% necessary for attaining food security and poverty reduction (Nwajiuba, 2011). Among other factors, inadequate access to and low uptake of high quality seeds, low fertilizer use and generally inefficient production systems lead to shortfalls. As a result, Nigeria's food import bill has been on the rise. Nigeria's large, growing population has become dependent on imported food staples. This includes commonly consumed staples such as rice, wheat and fish. This was not the case prior to the boom in petroleum exports starting from the early 1970s. It is clearly evident that the present agricultural production cannot meet the food requirement of this country. Appropriate agricultural technology will increase productivity. Oriola, (2009), concluded that if the nation is to escape famine and reduce poverty, crop production must not only be boosted but the political will by government should be there.

THE ROLE OF AGRICULTURAL ENGINEERING IN TACKLING FOOD SECURITY

Agricultural engineering has important roles to play in solving Nigeria's food insecurity problem. According to Makanjuola (1977), Agricultural Engineering is that field of engineering in which the physical and biological sciences are utilized to find and apply better ways of exploiting natural resources for the production, handling, processing and storing of food and fodder. It is also concerned with finding better ways for carrying out such allied activities as rural housing and living. Agricultural Engineering consequently involves the design, development, testing, manufacturing, marketing, operation, maintenance, and repair of all agricultural tools, implements, machines



and equipment which are used in mechanizing agricultural operations with the objective of raising the productivity of human labour and land in the face of prevailing economical, human and social realities of the time and place concerned.

According to Babajide (2012), Agricultural engineering in recent times has played very important roles in raising the productivity of Nigerian agriculture, enhancing the overall quality of life, especially in the rural areas, and boosting Nigeria's overall economic development. Sub-divisions of Agricultural Engineering:

- a) Farm Power and Machinery
- b) Soil and Water Conservation Engineering
- c) Crop Processing and Storage
- d) Farm Structures and Environmental Control
- e) Instrumentation Engineering.

Each of these sub- divisions has important roles to play in providing an enabling environment where Nigeria as a nation can provide enough food to feed her citizens. There is a lack of awareness on the necessity of technology in agriculture hence the impact of technology is little.

ROLE OF FARM POWER AND MACHINERY IN FOOD SECURITY

Agriculture contributed 41.84% to Nigeria's GDP in 1989 (NIPC, 2010). Nigerian agriculture is still characterized by overwhelmingly small holdings, farm lands are rain fed, fertilizer use, agricultural activities are manually carried out and improved seed variety not adopted (Akinola et al., 2009). This calls for mechanization of agricultural production operations from land clearing, sowing, harvesting, and processing to storage of food. Attempts to minimize drudgery and save time involved in these operations have yielded some results but much is still desired. The objectives of the agricultural mechanization policy of Nigeria presented in the Agricultural Policy for Nigeria (1989) are: reduction of the drudgery of agriculture by providing mechanical power to replace some of the labour required in agricultural business and reduction of the high cost of agricultural production which arises from high labour wage rates and the share of labour cost in the total cost of agricultural production.

Small-scale farmers are estimated to account for the cultivation of about 90% of the total cultivated land area in Nigeria, producing about 90% of the total agricultural output (CTA, 1997). This category of farmers still depends on manual labour to carry out their various farming operations. However, with labour demand at critical crop production stages, high labour cost and food demand for the teeming population of over 140 million with an annual growth rate of 2.5%, the introduction of agricultural labour saving devices to Nigerian agriculture is indispensable. Mrema and Odigboh (1993) reported that about 86% of land preparation operations in Nigeria are carried out with hand tools. The output of a human being is 0.07 kW which is limited by stress at high temperature and humidity conditions in tropical country like Nigeria. Thus, an average peasant farmer in Nigeria owns a farm less than 2ha which is barely enough to produce what is needed to feed his family (Anazodo et al, 1989; Odigboh and Onwualu, 1994; Odigboh, 1983). There are many factors responsible for this. The major one is lack of appropriate labour saving agricultural tools and machines.

According to Babajide (2010), application of machines to farm production Nigeria, in a noticeable degree started about 40 years ago but over the recent 10 years has increased remarkably Agricultural equipment innovations are relevant in transforming livelihoods in Nigeria and curtail food insecurity.

Nigerian Agricultural Engineers have developed many machines and equipment for agricultural operations from tillage to processing. Some examples of indigenous machines and equipment produced by Nigerians to enhance agricultural productions are ; Batch process cassava peeling machine (Odigboh 1991), Proda Cassava peeling machine, Proda Garri Frying machine, Reciprocating Triple – sieve multi- grain separator, Passive Solr heated Poultry Chick Brooder, Grain Hammer mill (Anazodo et al, 1987), Rotary Power Weeder (Adekanye, 2010), Maize planter (Akpaleji et al, 1995), Melon Washer (Uzoho et al, 1998) and many other agricultural machines and equipment abandoned in workshops of our institutions. These machines are indigenous, readily available, and cost less than imported ones.



ROLE OF SOIL AND WATER CONSERVATION IN FOOD SECURITY

According to Olufayo (2011) this aspect of Agricultural Engineering has direct link with our environment which is unique to us. Soil and Water Conservation Engineering comprises of all aspects of Irrigation and Drainage, Water resources, Soil erosion and Degradation. More than a third of all food production now comes from the one – sixth of the arable land that is irrigated (FAO, 1994).

Musa (2001) asserted that there are a number of reasons why water and not land may become the most important constraint for food production. The first is connected with Nigeria's extreme inter – and intra – annual climate variability. Second, there is strong indication that discharge from West Africa's river systems, including the river Niger, have significantly dropped over the past 25 years. Third, population growth and growing urbanization will probably increase water demand for domestic, industrial and environmental uses, and thus reduce the availability of water for food.

FAO projected that Nigeria would be unable to feed itself on rainfed agriculture alone by the year 2000 (FAO, 1981). There is a need for a total reform in irrigation farming if food security must be a reality. One of the strategies of achieving this, according to Musa (2001), is the expansion of irrigated land by 115%. This is practically impossible without the application of Soil and Water Conservation Engineering. Oriola (2009) opined that a reform in Irrigation agricultural system will stimulate growth in food production which can still stimulate wider growth in both farm and non-farm rural economy, and in turn contribute to poverty reduction in the country. Ojediran (1990) reported an enhanced growth in root and shoot length of wheat by proper irrigation scheduling. Kerr and Kolavalli (1999) presented a framework of how irrigation can influence higher productivity, protect the environment and attain food security. Soil and Water Conservation Engineering has definite roles to play in attaining food security.

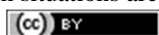
APPLICATION OF BIOTECHNOLOGY

Persley (2000) asserted that biotechnology is a technique that uses living organisms or substances from those organisms to make or modify a product, improve plants or animals, or develop microorganisms for specific uses. Biotechnology cuts across a number of fields, agricultural biotechnology however, appears to be the most crucial for African countries and especially for resource-poor farmers whose sole livelihood depends on agriculture. The technique of biotechnology alone cannot solve all the problems associated with agricultural production but it has the potential to address specific problems such as increasing crop productivity, diversifying crops, enhancing nutritional value of food, reducing environmental impacts of agricultural production and promoting market competitiveness (Abah et al., 2010). They further asserted that modern biotechnology could help in enhancing the competitiveness of agricultural products from the developing countries and thereby promoting their integration into the global economy. Biotechnology can be used to slow down the process of fruits spoilage. Enzymes produced by microorganisms provide an alternative to animal rennet – a cheese coagulant – and a cheaper alternative of comparable quality for cheese (Onwualu, 2011). It can reduce dependence on agrochemicals. Oil seeds can be modified to produce fatty acids for detergents, substitute fuels and petrochemicals.

POST HARVEST TECHNOLOGY AND FOOD SECURITY

Once agricultural products are harvested, deterioration sets in and unless processed into more stable product or stored properly, large part may be lost before reaching the consumers (Onwualu et al 2006). Agricultural Engineers, over the years, have developed several processing and storage techniques to improve the net economic value of agricultural products. These efforts are still on-going. Agencies like the National Centre for Agricultural Mechanization (NCAM), Nigeria Stored Product Research Institute (NSPRI) where the agricultural engineering profession has been accorded some recognition, have developed and tested simple processing equipment and storage structures. Studies to optimize drying processes and improve drying systems for some tropical crops have been carried out (Ojediran and Raji, 2010, 2011); Sorption studies to improve storage methods of various agricultural products are also on-going (Okunola and Igbeka, 2007). No doubt, the agricultural engineering profession is impacting on the lives of the citizenry in Nigeria but more can still be done.

It is observed that despite the many policies, programs, and investments by various local and international agencies operating in Nigeria, food security and the nutrition situations are worsening (Akinyele, 2009; Nwajiuba, 2001).



This made Nigeria to be one of the food deficient nations in sub- Sahara Africa. This largely results from dependence on subsistence farming; the small holding farmers, who depend on manual labour to produce their crops, cannot produce enough for the ever increasing population. Hence, lack of appropriate labour saving agricultural equipment is a major factor affecting food security in Nigeria.

FAO (1981) reported a need for a total reform in irrigation farming in Nigeria if food security must be a reality. Musa (2001) concluded that expansion of irrigated land by 115% is a mean of reforming irrigation farming. Oriola (2009) opined that a reform in Irrigation agricultural system will stimulate growth in food production which can still stimulate wider growth in both farm and non-farm rural economy, and in turn contribute to poverty reduction in the country. Application of Soil and Water Conservation Engineering will no doubt help in combating food challenges in Nigeria. Nigerian farmers must appreciate and adopt appropriate technologies developed by indigenous agricultural engineers.

Agricultural biotechnology is crucial to farmers as it can, among other benefits, reduce environmental impacts of agricultural production and enhance competitiveness of agricultural products. Application of post-harvest technologies developed by indigenous engineers will reduce post-harvest losses and add values to crops.

CONCLUSION AND RECOMMENDATIONS

Igbeka (2002) asserted that the task of the Agricultural Engineers is to mechanized agriculture in order to increase production and ensure food security. The following conclusions and recommendations are made;

1. Nigeria is naturally endowed with natural resources yet Nigerians are facing food crisis.
2. Agricultural activities are carried out majorly with simple hand tools which depend on human energy.
3. Appreciation, development and application of machines to agriculture will boost food production and help Nigeria to be food sufficient.
4. Focus of agriculture in Nigeria must change from subsistence to a commercial one.
5. The Local, State and Federal governments should give encouragement to the study of agricultural science and agricultural engineering. Furthermore, governments must create an enabling environment for Agricultural Engineers to put their professional trainings to practice
6. Engineering interventions developed by indigenous agricultural engineers must be embraced in all areas of agricultural production.

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