



Full Length Research Article

**SUSTAINABLE AGRICULTURAL DEVELOPMENT IN NIGERIA IN THE 21ST CENTURY:
THE ROLE OF THE UNIVERSITY**

***Malik, Abdulganiyu, A. and Dikko Aliyu, H.**

Department of Animal Production, Federal University of Technology, P. M. B. 65, Minna, Niger State, Nigeria

ARTICLE INFO

Article History:

Received 30th November, 2014
Received in revised form
31st December, 2014
Accepted 19th January, 2015
Published online 27th February, 2015

Key words:

Sustainable,
Programmes,
Agricultural Development,
Challenges,
Universities.

ABSTRACT

In 1914, approximately 1.6 billion people lived on the earth surface. By the year 1955, that number had grown to 5.7 billion. Today, in 2015, the world population is approaching 7.2 billion people. Each year, the human race is expected to increase by nearly 100 million, necessitating the need for more food production, especially of quality animal protein. In Nigeria, about 65 % of the over 140 million people are engaged in agriculture directly and indirectly, and mostly live in the rural areas; yet, the country cannot adequately feed its populace with agriculturally-produced foods using available modern technology. Also, consumption of animal protein in Nigeria and in Sub-Sahara Africa is grossly inadequate. This is because Nigeria's agricultural development is stunted by a myriad of teething problems and challenges. Sustainable food production is indeed a big problem in Nigeria and the sub-Sahara Africa. The role of the universities would be to rise up to the challenge of developing a more viable strategy for holistic developmental process in the rural areas that will be at par with the monumental scientific discoveries of the 21st century. Hence, the university should act as advisors, implementers and partners in the implementation of rural agricultural development programmes and plans.

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INTRODUCTION

“.....the university should function as a *university* and not merely as a pool of technical talent or an employment institution. Its unique role is not only to *apply present knowledge* but to *advance the state of knowledge*; not only to *supply experts today* but to *train the next generation of experts*.”

JOHN. W. GARDNER (1912 -)

In 2008, the world population reached a staggering 6.7 billion and at that rate of growth, we are adding 80 million more people each year (Kay, 2008). This large population of the human race needs to be fed with food and clothed with fibre produced from agriculture. Hence, sustainable agriculture is important in today's world if we are to provide food and shelter to the population of tomorrow. According to Dr. Norman Borlaugh (a Nobel Peace Laureate, regarded as the father of the GREEN REVOLUTION), the world will have to increase food production by 50 % in 30 years, just to feed the world at today's substandard level; and double it to provide

everyone with the quality and abundance of food enjoyed in America today (*Washington State University, 1995*). Based on the analysis of this great scientist, the world population stood at 1.6 billion people when he was born in 1914. In 1955, it stood at 5.7 billion. He says: “We are adding 100 million people each year, a billion per decade. That is the problem you young people are going to be wrestling with throughout your careers” (Stout, 2007).

In December 2008, the number of undernourished people worldwide stood at 963 million; with sub-Sahara Africa and Southeast Asia being the worst hit (*The World of Agriculture, 2009*). Currently, sub-Saharan Africa is globally underfed: the average daily consumption per inhabitant is 5.8 g of meat protein, that is to say 2.3 g less than the world average; and 2.9 g of milk protein, that is to say, also 2.3 g less than the world average (Tacher *et al.*, 2000). Nigeria is regarded as the most populous country in Africa, with a land mass of 923, 766 km² and a population of about 140 million – with an annual growth rate of 2.3 % (*Encarta Encyclopaedia, 2009*). In Nigeria, up to 65 % of the people are engaged in agriculture and mostly live in the rural areas. Yet, the country cannot adequately feed its over 140 million population. Why? It is a fact that sustainable food production is indeed a big problem in Nigeria and the

***Corresponding author: Malik, Abdulganiyu, A.**

Department of Animal Production, Federal University of Technology,
P. M. B. 65, Minna, Niger State, Nigeria

sub-Saharan Africa. It is a big problem that needs to be tackled urgently and holistically.

Sustainable agricultural development in Nigeria

According to Ress (1989), "sustainable development is positive socio-economic change that does not undermine the ecological and social systems upon which communities and social systems are dependent." In relation to agriculture, sustainability means changing agricultural system so that farmers are able to produce food indefinitely (Rodale, 1988). Hence, sustained agricultural development implies a sustained increase in the level of production and productivity over a reasonable length of time and the subsequent improved wellbeing of farmers as reflected in their higher per capita income and standard of living. Sustainable agriculture ensures adequate food security for the ever increasing human population.

Over the years, agricultural development has been on a downward trend in Nigeria. This negative trend is attributed to the apathy from the people, the discovery of oil just before independence; and the after effects of the civil war of the late 60's (Alademerin and Adedeji, 2010). Until the Nigerian civil war of 1967 – 1970, agriculture dominated Nigeria's economy providing more than 85 % of the country's foreign exchange earnings and abundant and cheap food for the people. By 1984, the pattern of Nigeria's economic structure had changed dramatically, and agriculture's percentage share of GDP between 1965 and 1984 had diminished. By 1984, oil held the principal position of the economy; and this unfortunately had been the pathetic story till today. "The Nigerian economy is largely dependent on its oil sector, which accounts for more than 80 % of government revenue, over 95 % of total exports, and over 90 % of the country's foreign exchange" (Dorayi, 2007).

Today, agriculture is in a comatose state in Nigeria; severely affected by the problems caused by years of neglect, contradictory and ill-thought-out government policies and programmes which lack consistency (Alademerin and Adedeji, 2010). In the past, several government projects and programmes aimed at improving food production and security were initiated. These include NAFPP (National Accelerated Food Production Programme), OFN (Operation Feed the Nation), GR (Green Revolution), RBDAs (River Basin Development Authorities), ADPs (Agricultural Development Projects), NALDA (National Agricultural Land Development Authority), DFRRI (Directorate of Food, Roads and Rural Infrastructures), BLP (Better Life Programme), FSP (Family Support Programme), NDE (National Directorate of Employment), etc.

Unfortunately, these various government programmes targeted at the poor farmers have not brought about the much trumpeted agricultural revolution in Nigeria – in terms of millions of people to feed and the produce to meet industrial needs. Rather, they have turned into an avalanche of failed projects; and used as conduit pipes for government officials to cart away millions of dollars to foreign accounts. The reality on the ground today is that farmers in Nigeria are "chained" and "heavily constrained". With their needs largely neglected

by governments and research institutes alike, the poor farmers have gained little from the overall process of rural development and in many cases have remained unable to break out of the low-income poverty circle. Yet, it is precisely this largely ignored group of traditional farmers, cultivating low-yield crops under harsh conditions, who hold the key to future increases in the nation's and world food production (Alademerin and Adedeji, 2010).

That is why the university has an important role to play in serving as a centre for locally-based research technologies; and to provide good linkages between research institutes, governments, rural organizations and farmers, and ensure food sufficiency. This is because there is no substitute for food and no better alternative to agriculturally-produced goods. Without food in the stomach, there is instability and chaos. Even in international politics, food is used as a great instrument of subjugation and also an important weapon of war. For example, in an effort to avoid the 1991 Gulf War, America and its allies withheld food and essential products from Iraq in an international trade blockade... not "... Iraq in an international trade blockade. Also, lack of enough affordable food (such as wheat, rice and corn) was believed to have contributed immensely to the demise of the former Soviet Union! Therefore, food is of paramount importance to human survival so agriculture is practised in every part of the world.

Opportunities in the agricultural profession of the 21st century

Today, at the dawn of the 21st century, agriculture has grown in leaps and bounds into specialized sciences. The major opportunities for specialization open to practitioners in the profession include the following:

A. Crop Husbandry

This includes all sciences relating to the production, care and management of crops. They are:

Horticulture and Landscaping - the scientific study of fruits (pomology), vegetables (olericulture), ornamental plants (floriculture) and landscape architecture.

Agronomy - the scientific study of the production of arable crops (arable farming) and plantation crops (plantation agriculture).

Entomology - the scientific study of insect pests and their control.

Plant Pathology - the study of the diseases of crops and their control using biological, mechanical and chemical methods. Plant pathology encompasses bacteriology, virology, nematology and mycology, etc.

Food Storage, Preservation, Processing and Packaging - this deals with the study of on-farm storage of farm produce after harvesting as well as the preservation, processing and packaging of farm produce to obtain tinned or canned food products; production of beverage drinks, baby foods and fruit juices, etc.

Forestry and Silviculture - the scientific management of forest trees to produce timber for furniture, pulp for paper making and other forest products such as resins, gum Arabic and fuel, etc.

Plant Breeding and Genetics – deals with the application of the laws of genetics and heredity to produce crops that are high yielding, resistant to diseases and are adaptable to the local environments.

Weed Science – the scientific study of weeds and their control using herbicides (pre-emergence and post-emergence); or their control using cultural, mechanical or biological methods. Weed science and plant pathology are sometimes classified under crop protection.

B. Animal Husbandry

This deals with the scientific study and management of farm animals in terms of feeding (or nutrition), housing, healthcare and breeding. It includes:

Poultry Science – the scientific study and rearing of poultry birds such as chicken, duck, turkey, guinea fowl, peacock and ostrich, etc.

Ruminant Science – the management of animals that “chew the cud” or regurgitates e.g. cattle, sheep, goat and buffaloes, etc. Ruminant science is sometimes broadly divided into beef science and dairy science.

Animal Nutrition – the scientific study of feeds and feeding.

Animal Breeding – involves the use of the principles of genetics and cross breeding to produce animals of high meat and milk yield, and to produce animals of high fecundity and are disease resistant.

Piggery or Swine Science – deals with the study and management of swine to produce pork, bacon or ham.

Cuniculture – the scientific rearing of rabbit for meat or income.

Horse, Donkey and Camel rearing – the rearing of horse, donkey and camel for work, show or transportation purposes.

Grass cutter rearing – the rearing of grass cutter or cane rat for delicious bush meat or as a profitable source of income.

Apiculture or Beekeeping – the science and practice of rearing bees to obtain honey and other bee products such as beeswax, pollen, royal jelly, propolis and bee venom. Honey alone has been found to cure over 40 different diseases. It can also be used to produce honey wine, honey beer (mead) and flavoured honey.

Heliculture or Snail rearing – the science and practice of rearing snail for meat and for income. The meat of snail have been found to be nutritious, high in iron content (for red blood cells formation) and low in sodium and fat content and hence an ideal meat for hypertensive patients.

Guinea Pig Production – though mainly used for experimental biological and nutritional research, its meat is also relished by humans.

Generally, rabbit, guinea pig, snail and grass cutter are regarded as micro livestock.

Sericulture – this is the scientific rearing of silkworm to produce silk of high commercial value by feeding them with mulberry leaves.

Wild Life Management – the management of game or wild life animals in Game Reserves or Wild Life Parks e.g. at Yankari Game Reserve in Bauchi State or Borgu Game Reserve in Niger State.

Veterinary Science – the study of the diagnosis and treatment of livestock diseases such as rinderpest, foot and mouth disease, contagious bovine pleuropneumonia, Newcastle disease and coccidiosis, etc.

Food Science and Nutrition – deals with the preparation, processing, storage and packaging of food into useful and consumable products of nutritional value and importance.

C. Agricultural Economics

This is a branch of agriculture that deals with agricultural business management practices such as farm management, agricultural banking and finance, agricultural insurance and project monitoring and evaluation.

Farm Management – the practice of supervising, directing and co-ordinating farm activities and farm enterprises for the purpose of making profit.

Agricultural Banking and Finance – deals with the sourcing of fund for agricultural business enterprises.

Agricultural Insurance – deals with the business of insuring agricultural farms and business enterprises against natural hazards such as flood, drought, disease outbreaks or fire disasters, etc.

Project Evaluation and Appraisal – this deal with the carrying out of project feasibility studies, project monitoring, and project evaluation and appraisal.

D. Agricultural Extension

This is a branch of agricultural science that deals with extending the latest information on new innovations and techniques of farming to farmers. Officers engaged in agricultural extension include the following: Field Extension Officers, Agricultural Co-operatives Officers, Project Monitoring and Evaluation Officers and Field Overseers.

E. Soil Science

This is a branch of agriculture that deals with the scientific study of soils. Soil science can be subdivided into the following areas:

Soil Physics – deals with the physical nature and properties of soil.

Soil Chemistry – deals with the chemical properties of soil.

Soil Microbiology – deals with the study of the micro-organisms in the soil.

Pedology – deals with pedogenesis, soil morphology and soil classification.

Edaphology – studies the way soil influence plants, and other living things.

F. Aquaculture and Fishery Science

This deals with the scientific study of fishes and other aquatic life found in both fresh water and marine environments. Areas of specialization in aquaculture and fishery science include:

Fish Biology, Hydrobiology and Limnology – studies the biology of fishes and other aquatic life forms.

Fish Breeding and Genetics – deals with producing fish species of desirable characteristics for consumption and rearing.

Fish Nutrition – deals with the scientific study of fish feeds and feeding.

Fish Toxicology – deals with the study of harmful substances and chemicals that could be toxic to fish.

Ichthyology – the scientific study of fresh water and marine fishes.

Oceanography and Marine Research – studies the ocean and its relationship to the aquatic animals, solid earth, ice and the atmosphere.

All these branches of agriculture are geared towards sustainable food production to cope with the ever-increasing world population.

Challenges of agricultural development in Nigeria and the roles of the university

In Nigeria today, up to 65 % of the population are engaged in agriculture and mostly live in the rural areas. Yet, Nigeria cannot adequately feed its over 140 million population. Whereas in America today, less than 2 % of the population are directly engaged in agriculture; and yet are exporting food to other countries. Each farmer in America produces enough food and fibre for 143 people due to agricultural mechanization. Mechanization leads to large scale production resulting in reduced prices of agricultural products due to the economies of large scale production. Hence, Americans spend an average of 10.3 % of their income on food compared to 18 % in Japan, 31.9 % in Mexico and 52.6 % in India (*The World of Agriculture*, 2009). I am sure in Nigeria today; the average Nigerian spends nothing less than 65-75 % of his income on food!

Nigeria has huge land resources. It is estimated that about 90 % of Nigeria's total land area is classified as agricultural land and can adequately support agriculture. Yet, due to a myriad of problems such as poor agricultural financing, inadequate supply of modern farm inputs (e.g. fertilizers, pesticides and high quality seeds, etc), use of poor farm tools, poor rural transportation and communication network, inadequate storage and processing facilities, poor agricultural education and extension services, imperfect marketing system and neglect of agriculture by the government; agriculture is yet to attain its full potential. Evidence of this neglect is reflected in the lack of food sufficiency that abounds in the country today. Nigeria had witnessed phenomenal growth in its number of universities. The first Nigerian university, University of Ibadan, was established in 1948. As at August, 2011, Nigeria have a total of 117 Universities - made up of 36 Federal Universities, 36 State Universities and 45 Private Universities (NUC, 2011).

In the developed countries of the world, the universities play pivotal roles in national, rural and agricultural development. It is a fact that the Land Grant Colleges of America contributed in no small way to the agricultural development of America as we see it today. The same can be said of China. China is the largest agricultural country in the world with its rural population accounting for over 80 % of the country. According to Kydd (2002), "in the last half-century, across the globe, small holder development has achieved some huge success. The South Asian Green Revolution, a process which started three decades ago, made a direct impact on poverty and a strategic contribution to wider processes of economic development". This giant leap in the agricultural development of the Asian Tiger was greatly facilitated by the unique roles played by its universities.

The Agricultural University of Hebei, for example, has been known to be providing remarkable extension services to rural farmers since the late 1970s. University professors, on the basis of their scientific research, have been providing farmers with practical advice and suggestions on improving crop production, developing skills in raising livestock and planting high yielding fruit trees. It is true that the Agricultural Extension and Rural Liaison Services (AERLS) of Ahmadu Bello University (ABU), Zaria, as well as the Institute of Agricultural Research and Training (IAR&T) of Obafemi Awolowo University (OAU), Ile-Ife, were very active in providing good extension and rural development services to farmers in the Northern and Western part of Nigeria respectively, especially in the 70s and 80s; but today, their impact on the rural farmers and rural agricultural development have significantly waned. According to Xiwen (1998) of South China Agricultural University, the following are the roles of the university in rural development:

Policy Formulation – helping the government and the farmers to prepare development strategies and formulate realistic and achievable policies. "There is need for agricultural revolution to be people-focused and people-oriented so as to increase food production, improve status and conditions of living of the rural farmers and also the national economy" (Alademerin and Adedeji, 2010). There is no institution more poised and capable of carrying out this assignment than the university.

Rural Development – participating in the development of the rural areas of the country. The agricultural development of China as we have it today was largely based on decades of development of Chinese small holder agriculture.

Agricultural Extension and Liaison Services – demonstrating the universities’ scientific research achievements to farmers through regular exhibitions, farmers’ shows and planned on-site farm demonstrations.

Education and Training – organizing training courses and giving lectures on modern agricultural knowledge and techniques to farmers through established university liaison committees and departments.

Information Dissemination Using ICT – Co-operating with farmers’ enterprises to transfer the university’s scientific research achievements to farmers and enterprises. This can involve the use of radio, TV broadcasts, teleconferencing, video shows and even internet services and webcasting.

Consultancy – serving as technical consultant for the development of farmers’ enterprises. This would be manned by a corp of technical experts from all fields and in all areas of specialization in agriculture.

Creativity and Invention – providing high quality products to farmers and developing new ways to contribute to education through continuous research and development (R&D).

From the above, it can be seen that the 21st century is a challenging time with new roles and functions for universities in rural development. Clearly, universities can provide support at three levels:

- (a) **Policy support at the national level** (e.g. advisory support, policy advocacy, policy implementation, etc).
- (b) **Technical support at the state level** (e.g. consultative support to research organizations or State Ministries of Agriculture, etc.).
- (c) **Implementation support at the local level** (e.g. through initiation of agricultural pilot schemes, establishment of demonstration plots and rural development projects at the local government level, and evolution of innovative agricultural strategies).

The Nigerian society can benefit greatly from the Chinese and Malaysian experience in implementing its poverty alleviation strategies through co-operation with its universities.

Roles of the faculties of agriculture of the Nigerian universities in agricultural development

The Faculties of Agriculture of the Nigerian universities in the 21st century should play pivotal roles in agricultural development by achieving the following feats:

- To have the facilities and the capability for research on laying hens, and production of enough table eggs for sale at cheaper prices to staff, students and the immediate community throughout the year.

- To have the facilities and the capability for research on broilers, and production of enough broiler chicken for sale to staff, students and the immediate community – not only during festivities but throughout the year.
- To have the facilities and manpower to carry out irrigation for dry season farming for production of common vegetables such as tomato, okro, pepper, spinach, lettuce, cabbage, cauliflower and carrot, etc. This should be produced in sufficient quantities for sale within and outside the university community.
- To have at least 100 heads of cattle, 200 heads of sheep and goats managed intensively; and fed throughout the dry season of the year with preserved hay and silage - produced in the university using local technology.
- To champion community development programmes at the grassroots (targeted at the farmers in the rural areas) and provide adequate extension services to farmers within the immediate community.

Conclusion

Based on the challenges of the 21st century, the Nigerian universities have to change their present mandate from being mere academics and some sort of research and extension, to developing a more viable strategy for holistic developmental process in the rural areas and act as advisors, implementers or partners in the implementation of rural developmental plans.

“Agriculture is an activity of general public interest, not only because it supplies food and raw materials but because it helps to conserve natural resources and the environment, provides employment opportunities, recycle wastes, and serves to maintain and enhance the quality and attractiveness of rural areas” (Titilola, 2001). Hence, sustainable agricultural development is a task that must be accomplished in Nigeria in the 21st century if we are to occupy our rightful place in the world.

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