

# Impact of Conversion of Agricultural Education Beef Cattle Farm into Sustainable Mixed Farming System

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**Abstract**—This study evaluates Impact of the Conversion of Agricultural Education Department Beef Farm in the College of Education Katsina-Ala, Benue State into a Sustainable Mixed Farming System. Using a Quasi-experimental Pre and Post-Data Conversion design. Three objective, three research questions and three hypotheses were formulated for the study. Data were collected from farm records, questionnaire and observation. Results indicate significant improvement in farm productivity, environmental sustainability, economic returns and educational outcomes. The findings suggest that integrated farming systems enhance resources efficiency, promote sustainability and enrich experiential learning in educational contexts.

**Keywords**— Agricultural education, conversion, educational outcome, mixed farming systems, sustainability.

## I. INTRODUCTION

Resources of Educational Institution are indicators of what such institution are engaged in, their actual carrying capacity and therefore ensure the quality of the programme offered in such institutions. The importance of resources in running academic programmes in tertiary institutions in Nigeria has necessitated the establishment of regulatory agencies. These agencies and many others prescribe minimum standard in terms of human resources, infrastructures, equipment and associated facilities in the minimum academic standard for establishing, governing and managing tertiary institution in Nigeria (NCCE, 2020). Resources to be managed and upgraded for the attainment of the objectives of Agricultural Education programmes in Colleges of Education in Nigeria includes among others College farm are expected to be of high standard and properly maintained, and should be subjected to regular maintenance and be upgraded at regular intervals to achieve the goals and objectives of the programme. In support of this view Education Sector National Technical Working Grand ESNTWG (2017) reported the alarming inadequacies of infrastructural facilities in tertiary institutions. The group added that tertiary institutions have been expanding their enrollment in response to demand but without expanding and modernizing their facilities and resources. The ugly situation of their resources will definitely affect the quality of the institution educational programme because students needed to be prepared in both the pedagogical and technical area of agriculture. Teachers can therefore identify appropriate initiative for the acquisition and sustainable utilization of resources including College farms, the group added.

The extensive cattle production system in combination with large mono-culture of crops had led to extensive deforestation, soil erosion and loss of biodiversity and conflict with crop farmers in Nigeria. The financial and energy inefficiency of the livestock production system due to deterioration of their health and production have negative impacts on their environment, combined with increasing scarcity of capital and other inputs triggered the quest for new approaches in animal husbandry aimed at on farm feeding and diversification of animal production. The Green Alternative National Agricultural Promotion Policy (2016-2020) highlighted the low productivity of the livestock sector in Nigeria and outlined major structural and technological challenges facing the sector dominated by nomadic herdsman. According to National Livestock Transformation Plan 2019-2028, the achievement of its goals depends on a coalition of the public sector which consists of Ministries, Departments and Agencies (MDAS). According to the plan, the potentials of farmer and student will be build to improve harvest of key fodder crops, promote crop and legume such as cassava, soya beans, cabbage, carrot, cucumber, yam, groundnut that are key to cattle production and other parts of the livestock industry. The problem also challenged researchers to search in order to develop efficient, environmental sustainable and self-sufficient farming system that will serve as a more productive and sustainable model based on principle of mixed farming combining beef cattle to be raise in zero grazing system where exotic breed of high milk and beef producing cow are crossbreed with local cattle Bunaji (while Fulani) or Sokoto Gudali to produce cattle that have high milk and beef production and at the same time adaptable to our environmental condition.

### *Statement of the Problem/Justification*

The College of Education operates cattle farm as one of the physical resource prescribed by the National Commission for Colleges of Education in fulfillment of the basic requirement for accreditation. The physical resources are to be managed and upgraded to meet the current trend of development for the attainment of the objectives of Agricultural Education programme in Nigeria whose philosophy and objectives is tie with the National Philosophy and Agriculture for self-reliance based on the provision of teachers endowed with the balance approach between principles and practice of agriculture for academic and

vocational needs (NCCE, 2020). The objectives of the programme among others is to equip the student-teacher with adequate knowledge and ability to establish, manage a model school farm effectively and acquire skills for effective transmission of Agricultural information and skills to the student in the context of their environment. It is clear that new avenues are developed that offer a peaceful pathway into modernized farming system, with high quality and productive animal and cost competitive crops, animal feeds sources and an economic activity that enhances, individual or College income and contributes to high quality student education and also conform with the National Green Agricultural Plan. However, our College farm remain as it was when it was established in the 1970s, This State of the farm is no more a demonstration farm for the students to learn but farm that rather discourage students to learn agriculture as a course because it's not imparting knowledge to students as required in the 21<sup>st</sup> Century. The farm often faces sustainability challenges, including environmental impacts from manure management, resource inefficiencies and limited diversification of learning activities. Although conversion to mixed farming have potential benefits like enhanced soil fertility, Diversification of income, resource efficiency, risk mitigation, sustainable practices among many other benefit. However, empirical data on the impacts of conversion of College of Education beef cattle farm for on productivity, environmental sustainability, economic viability and educational outcome are scare. This research study which evaluates the impact of conversion of College of Agricultural Education beef farm in the Education Katsina-Ala, Benue State will provide data for meaningful improvement across these dimensions providing evidence base guidance for stakeholders.

#### *Purpose of the study*

This study assesses the impact of conversion of College of Education Katsina-Ala, agricultural education cattle farm into sustainable mixed farming system on productivity, sustainability metrics and educational outcome.

#### *Objectives were to:*

1. determine the effect of conversion of the College of Education Cattle farm into sustainable mixed farming system on overall farm productivity.
2. describe the influence of the conversion on environmental sustainability indicators in the College of Education Katsina-Ala Benue State.
3. describe how the conversion of the beef cattle farm to a sustainable mixed farming system affect educational outcome of the students and trainers in College of Education Katsina-Ala Benue State.

#### *Research Questions*

This research sought answers to the following questions in accordance with its specific goals.

1. What is the effect of converting College of Education Katsina-Ala beef cattle farm into mixed farming system on overall College farm productivity?

2. How does the conversion of the College of Education Katsina-Ala farm into sustainable mixed farm influences environment sustainability?
3. How does the conversion of the College of Education Katsina-Ala beef cattle farm to a sustainable mixed farming system affect educational outcome of students?

#### *Hypotheses*

In line with the research questions, the following null hypotheses were formulated.

- H<sub>1</sub>: the conversion of College of Education Katsina-Ala beef cattle farm to a sustainable mixed farming system has no significantly effect on the farm productivity.
- H<sub>2</sub>: The conversion of the College of Education Katsina-Ala beef cattle farms to a sustainable mixed farming system has no significant impact on environmental sustainability in the College.
- H<sub>3</sub>: Education outcome are not positively affected by the conversion of College of Education beef cattle farm to a sustainable mixed farming system.

## II. LITERATURE REVIEW

### *Theoretical Framework*

The study is centered on the theory of production as the transformation of factor inputs such as land, labour, capital, water resources and cattle beef, crops and management, through the farm firm or producing unit to other goods and services Olayides and Heady (2006) in (Suliyat et al., 2023) the objectives are for profit maximization, output maximization, cost minimization or the maximization of satisfaction. The theory of production present the theoretical and empirical framework that facilitates the application of alternative methods so that anyone or combination of the farms objectives can be attained in the production. The relationship between impacts and output could be either one factor-one product, many factor-one product, one factor-two products and many factor-many product, but the focus of this study is on many factors many product beef cattle, crop yield, education outcome, sustainable agriculture and environment.

The Philosophy of the Nigeria Certificate of Education (NCE) Program in Agricultural Education in Nigeria is aligned with the National Philosophy on agriculture for self-sufficiency, which is based on the provision of teachers who have a balanced approach between the theory and practice of agriculture for academic and vocational needs. According to the National Commission for Colleges of Education (NCCE), (2020), the program aims to:

Give graduates the proper mindset, skills, understanding, and professional proficiency in vocational agriculture.

Equip the student teacher with adequate knowledge and ability to establish and manage a model school farm effectively are among the competencies to be acquired while in the College.

Another theory that guided this study was the input-output system theory which postulates that an organized enterprise does not exist in a vacuum; it is dependent on its environment in which it is established. The quality of the input determines the quality of the output, according to this theory. Buameh and

Ayagre (2013) concluded that, inputs from the environment are received by the organization which transforms them into output. As adapted in this study. Students (input) are admitted into Agricultural Education in College of Education Katsina-Ala, where they get into the College, they department transforms them through teaching and practicals. The College of Education is the absorbers, processors and generators and the agricultural education have several independent factors such that change in any factor within the organization (department) has an influence on all the other organization or sub system component. Thus a conversion of the beef cattle farm to a sustainable mixed farming system will affect the educational outcome of the students (inputs). All system must work in harmony in order to achieve the overall goals, high quality education for the students.

### *Conceptual Framework*

The production theory posits that a farmer selects a combination of variable inputs and outputs that maximizes profit while constrained by technology. Agronomics sees the mixed crop-livestock system as ideal, but there is a gap between conceptual model and the real world. There are difference between specialized livestock farms, integrated crop livestock farm and mixed crop-livestock farms. The upshot according to Veysset, Lhern, Bebin & Roulenc (2014), whether on the economic front or the environmental front, conventional beef cattle farms as the one in the College appear unable to translate a mixed crop system strategy into economic of scope. Organic agriculture, a prototype mixed farming system meet all the principle of agroecology. The general consensus is that mixed farming is an economically and environmentally sustainable farming system, and this agreement is mostly based on the potential advantages of a mixed crop livestock system over specialized systems, according to Ryschawy (2012). Zekerim and Mukhtar (2015) reported that Integrating Crops and livestock could limit natural resource degradation reducing leaching through adapted crop rotations, increase the profitability and stability of farm income, less input use, product diversification, increase environmental sustainability, animal manure recycling, soil fertility and carbon sequestration. The theoretical models of sustainable mixed farming are thus considered eco-efficient (both ecologically and economically) and therefore meet the core principle of agroecology (Oguejiofor, 2019). Sustainable mixed farming system and their advantages are well characterized for smallholder's farmers in the developing countries of Africa. Wangi, Cramer, Wailer (1996), stated that sustainable mixed farming system demonstrate complementarity in resource use, where input from one sector are supplied to others and animals make key contributions to increased production, income generation and improved sustainability of cropping system. The potential eco-efficient performance, in harmony with agroecology principles of mixed farming system entails strong interactions between plant and animal components of the system. Very little research has gone deeper than the conceptual level to evaluate the real efficiency of these systems which include dairy cattle.

This research has generated data that is compiled from real farm business.

The livestock subsector has always been an important component of Nigeria's economy (FAO, 2016) Beef is indeed a highly traded commodity and these suggest that there might be considerable opportunities for trade in beef especially in Nigeria, production and possibly export to the North African markets where it have relative geographical advantage in trade. However, there is deficiency in the intake of beef, which is an important source of protein in human diet (FAO 2016). These suggest that it is important to improve the manner in which inputs are used in beef cattle production system. Belt, Moor and Kirkegaard (2015) stated that improving production system is considered a possible strategy that could reduce economic cost of production, by use of better cattle breeds and enhancing other farm management practices including feeding efficiency, where there is minimal waste. Thus production efficiency occurs at the point where there is minimum cost of production (Rannath, Mukherjee, Singh, Shubha and Kumar, 2020). The level of profit efficiency of a particular farm is characterized by the relationship between observed production and some ideal or potential production. The agricultural sector has multifactor productivity and technical inefficiency but previous studies have either failed to account for farmers' management inability to adjust in the presence of broader economic change and/or technical efficiency intern of input use and production technology.

The low cattle productivity is partly attributable to the poor utilization of reproductive technologies in dairy cattle breeding and production (Oguejiofor, 2019). The low availability and high cost of livestock and animal product (milk inclusive) means that many Nigerians are unable to meet their minimum daily animal protein intake. The utilization of cattle with high genetic potential, high feed conversion rate, high milk production and the application of biotechnology have been globally recognized to significantly improve cattle breeding and the productivity of both beef and dairy cattle. The College of Education farm has cattle that are not improved or replaced since 1980. The low cattle genetic potential and productivity according to Saleh, Atala, & Omokore (2016) is worsened by poor use of modern reproductively techniques, and the lack of planned and selective breeding for improve genetic potential and maximal productivity. Instead, there is indiscriminate breeding in cattle herds resulting in decreased reproductivity potentials and the spread of diseases.

Assisted reproductive technologies (ART) are applied extensively in many part of the world in humans and animal to advance our knowledge of reproductive process and to promote reproductive efficiency. In livestock according to Ball and Peters in Oguejiofor (2019) oestrus synchronization and artificial insemination (AI) are powerful technologies capable of enhancing productivity.

### *National Animal Production and Research Institute*

In addition to NAPRI, several privately owned commercial cattle farms also use AI. Unfortunately, these efforts impact a small proportion on cattle population in Nigeria. Globally,

there is an intensive and increasing competition on the application of new technologies that will shape the future of animal breeding and production. Nigeria has a vast potential for cattle production, but unfortunately, this has not been realized.

Suitable environmental condition for the development of sustainable mixed farming system using dairy/beef cattle exist in Benue State particularly in College of Education Area. This includes; the high possibility of all year round production of productive species and a high diversity of grass species with potential use for agriculture. The natural advantage that could be exploited through the use of high yielding energy and protein crops and the inclusion of multipurpose leguminous trees like *Propolis glandulosa*, allow the design of the crop-livestock system promising.

Where either the environmental or socioeconomic circumstances were favorable, sustainable mixed farming practices have been widely implemented. College of Education, Katsina-Ala fulfil all the conditions. Lack of external input and the need for consumption of organic agricultural product often force farmers to adopt sustainable mixed farming system and to make a livelihood from the available cow dung, which can be use as manure for their crops. Despite the many advantages of low external input system sustainable farming it appear difficult to convert the large monoculture farm into integrated system because of lack of inputs, absence of appropriate infrastructure are major constraint.

This study provides understanding of the performance of sustainable mixed farming as well as for evaluation of different combination of crops and animal in a spatiotemporal framework. This study is a step toward a broader project of the National Livestock Transformation Plain (NLTP, 2019-2028). It aimed to evaluate the impact of the conversion of low input cattle farm of the College of Education into sustainable mixed farming system made up of not only cattle but more economical, highly improve and productive dairy and beef cattle as well as evaluation of different combination of crops in a spatiotemporal framework. It also identified potential integrated strategies for mixed farming as a basis for sustainable livestock production in Benue state and Nigeria.

#### *Empirical Studies*

The goal of Zekeri and Mukhtar's (2015) research was to shed light on the profitability of dairy product processing among small-scale producers and marketers in Kaduna State, Nigeria. An average processor was found to realize net income of ₦1,251.00 per liter, hence dairy product processing was found profitable in the study. This study is similar with Zekeric and Mukhtar study because it will also use dairy cattle but differs because it will be conducted in Benue State and in 2024.

According to a research by Ogejiofor (2009) on the prospects of using assisted reproductive technologies (ART) to improve cattle production in Nigeria, the country's low cattle productivity is a result of the inadequate use of ART in dairy and beef cattle breeding and production. The study emphasizes the possibilities and uses of ART in cattle production and

makes recommendations on how stakeholders in the Nigerian cattle business may take advantage of these prospects. This study is similar to the present study because the study deals with oestrus synchronization and Artificial Insemination (AI), which the present study also intend to use in dairy and beef cattle production but differs with the present study because this study will be localized in College of Education Katsina-Ala Benue State and in conjunction with crop production.

The mixed crop-livestock farming system was the subject of research by Veysset, Lhern, Bebin, and Roulenc in 2014. The study reveals the farming as an economically and environmentally sustainable farming system producing profitable beef cattle and organic crops meeting the core principle of agroecology. The study is similar to this study because it also going to used dairy cattle and their resources to produce crops but differ with this present study because it is conducted in Nigeria.

### III. METHODOLOGY

#### *Research Design*

The study employed a Quasi-experimental design with pre and post conversion assessment. Data were collected for two years, one year before the farm conversion (base line) one year before the farm conversion of the farm. Dluba and Abdulhamid (2013) recommend the use of quasi experimental in comparative study.

#### *Population of the Study*

The population includes farm management staff Agricultural education students, farm input and output records at the Agricultural Education College of Education Katsina-Ala, Benue State.

#### *Sampling Technique*

Purposive Sampling was use to select the sample for the study, which were farm managers, educators, students, all available farm records for the pre and post conversion were use for the study. This is in line with Abdulhamid (2013) who stated that in experimental and quasi-experimental research any number of samples can be used.

#### *Instrument for Data Collection*

Structured Questionnaire was use for farm management Staff and Students. Farm records were analyzed for productivity, financial and environmental data. Observation: farm practicals and environmental condition were equally observed.

#### *Validation of Instrument*

Content Validity was established through expert review of the Questionnaire by agronomist, expert in education and environmental specialist. The adequacy and relevant of the question item were judged by experts. The experts were asked to answer the questions and indicate correct options.

#### *Pilot Study*

Pilot testing (Study) was conducted with a sub set of respondents and the research the pilot test to refine the questions in the questionnaire.

**Method of Data Collection**

Data were collected through structured, interview farm record and direct observation at six month interval of two years.

**Method of data analysis**

Paired t-test were use to compared pre and post test conversion data at 0.05. Descriptive statistics summarized the data.

H0<sub>1</sub>: The conversion of College of Education Katsina-Ala beef cattle farm into a sustainable mixed farming system has no significant effect of the farm productivity.

TABLE 1: t-test analysis showing the effect of the conversion of College of Education Katsina-Ala beef farm to a sustainable mixed farming system on the farm productivity.

*Farm productivity in respect to cattle weight gain and crop yield tons/ ha.*

Cattle weight gain + crop yield/tons/ha	N	$\bar{x}$	SD	Df	t-cal	t-cri	P-value
Pre-conversion	72	17.71	4.42				
Post-conversion period	106	20.28	3.04	1.76	3.34	1.96	0.02

Table 1 presents the t-test analysis on the effect of the conversion of the farm on its productivity. The table revealed a t-calculated of 3.34 and t-critical value of 1.96 at 176 degree of freedom and 0.002 significant level. The alpha value of 0.05 was found to be greater than the p-value of 0.002 which indicates that the conversion has effect on the productivity of the farm. This implies that the conversion of the farm to a sustainable mixed farm has significant effect on the productivity of College of Education Katsina-Ala farm. Therefore the null hypothesis which states that the conversion of College of Education Katsina-Ala beef cattle farm to a sustainable mixed farming system has no significant effect on the farm productivity was rejected.

H0<sub>2</sub>: The conversion of College of Education Katsina-Ala beef cattle farm to a sustainable mixed farming system has no significant impact on the environmental sustainability in the College.

TABLE 2: t-test analysis showing the difference in the environmental sustainability as a result of the conversion of College of Education beef cattle farm to a sustainable mixed farming system.

*Environmental sustainability indicators*

Water use/soil organic matter use efficiency	N	$\bar{x}$	SD	Df	t-cal	t-cri	P-value
Pre-conversion	106	20.28	3.01				
Post-conversion period	134	22.02	4.21	2.65	2.65	1.96	0.011

Table 2 shows that t-test analysis of the difference in the environmental sustainability in terms of soil organic matter and water use efficiency during the pre conversion period and after the conversion of the farm to sustainable mixed farming system. The table revealed that soil organic matter. and water were more efficient after the conversion of the farm  $\bar{x}$  = 22.02 than the pre conversion period  $\bar{x}$  = 20.28. The t-test analysis shows that, t-calculated (2.65) was greater than the t-critical

(1.96) at 238 degree of freedom and .011 significant levels. This shows that the conversion provide more effective environmental sustainability. Therefore, the null hypothesis which states that, the conversion of College of Education Katsina-Ala beef cattle farm to a sustainable mixed farming system has.

H0<sub>3</sub>: Educational outcome of the students are not significantly affected by the conversion of the College of Education Katsina-Ala beef cattle farm to a sustainable mixed farming system.

TABLE 3: t-test analysis showing the difference in the effect of the conversion of the College beef farm on the educational outcome of the students of Agricultural Education.

*Student engagement and knowledge assessment scores.*

Student engagement and knowledge assessment scores.	N	$\bar{x}$	SD	Df	t-cal	t-cri	P-value
Pre-conversion	125	19.048	2.10167				
Post-conversion period	129	27.2171	3.43912	2.52	22.756	1.96	0.000

Result in Table 3 indicate that the calculated t-value of 22.756 is greater than the critical t-value of 1.96 with degree of freedom 2.52 at significance 0.000 which is less than 0.05 alpha level of significance thus the null hypothesis that the educational outcome of the students are not significantly beef cattle farm to a sustainable mixed farming system was rejected. It was thus revealed that there exists significant difference in the educational outcome of the students following the conversion of the farm to a sustainable mixed farming system.

IV. DISCUSSION OF FINDINGS

The study revealed that conversion of the beef cattle farm to sustainable mixed farming system has significant effect revealed by the findings in Table 1 in which the calculated mean of 17.71 was recorded before the conversion while 22.10 was recorded when the conversion took place (post conversion period) The result of the t-test analysis also shows that conversion has significant effect on the productivity of College of Education Katsina-Ala farm this is because t-calculated (3.34) was greater than 1.96 at 5% level of significance (P=0.000). This finding agree with what was obtained by Catherine and Brain E (2013) who found that improvement of agricultural facilities aid performance and increase productivity.

Another finding of this study showed that conversion of College of Education beef cattle farm to sustainable mixed farming system improve environ environmental sustainability in College of Education Katsina-Ala Benue State. Table 2 showed a mean 17.71 during the pre conversion period intern of environmental Sustainability index's However, 20.28 which is greater than was recorded after the conversion. The t-calculated 3.34 was also greater that the t-critical 1.96 at 5% level of significance P=0.002. This therefore revealed that

conversion of the farm has significant effect on environment sustainability of the College of Education Katsina-Ala farm. This finding is in line with the work of Peterson and Deiss (2020) who found out that the diversification in mixed farming improve water and organic matter use efficiency. This also agreed with the findings Rannath *et al* (2020) that mixed farming is a viable option for sustainable agriculture.

The study also found out that the conversion the farm is more effective than the pre conversion in improving educational outcome. The finding conforms with Daluba (2013) which recommended the use of demonstration in teaching agriculture and the use of up to date facilities to improve learning.

#### V. CONCLUSION

Based on the findings of the study the following conclusions were drawn. The conversion of College of Education Katsina-Ala beef cattle farm into a sustainable farming system has positively impacted productivity, environmental sustainability economic reforms and improve educational outcome of the students.

#### Recommendations

Based on the findings and conclusion of the study the following recommendations are given.

1. There is need for every higher institution to upgrade their farm as it will help her students to learn the modern expect of farming system.
2. There should be provision by government and private individual for training and retraining of teachers for them to be effective in handling of equipment's of the modern farm setting.
3. Lecturers in Agricultural Education should be encouraged to use demonstration method of teaching so that the modern farm will not be a waste of resources.

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