

SUSTAINABLE AGRICULTURE PRACTICES AND THEIR MANAGEMENT IN A GREEN ECONOMY IN NIGERIA

BY

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Abstract

Conventional agriculture systems of production often lead to environmental degradation, economic problems and even social conflict. The efficacy of agriculture systems conducive to the economic, environmental and social sustainability of farming operations has been demonstrated, yet the adoption of sustainable agricultural practices is not widespread. This paper reviewed the various sustainable agriculture practices and their management with the view to encouraging its adoption of sustainable agriculture. The goals and objectives of sustainable agriculture were highlighted. The different sustainable agriculture practices were discussed. It was discovered that there was little information on sustainable agriculture practices available to Nigerian farmers, and that Nigeria is lagging behind other developing countries in policies that should encourage the adoption of sustainable agriculture.

Keywords: Sustainable, agriculture, practices, management, green economy.

Introduction

For decades, the world have pushed for the production of the bulk of its food through industrial agriculture, a system dominated by large farms growing the same crops year after year, using enormous amounts of chemical pesticides and fertilizers that damage soil, water, air, and climate. This system is not built to last, because it wastes and degrades the resources it depends on. However, a growing number of innovative farmers and scientists are now taking a different path, moving toward a farming system that is more sustainable environmentally, economically, and socially (Caswell, Fuglie, Ingram, Jans, & Kascak, 2001). This move has room for farms of all sizes, producing a diverse range of foods,

fibers, and fuels adapted to local conditions and regional markets, it uses state-of-the-art, science-based practices that maximize productivity and profit while minimizing environmental damage. Sustainability means the whole system is more resilient to droughts, floods, and other impacts of climate change that farmers are already seeing. Though, the move to this type of system (that is sustainable system) often involves some up-front costs, smart public policies can help farmers make the shift. It will in the long run be beneficial.

A growing body of scientific evidence has shown that a more sustainable model can be just as productive and profitable over time and can meet our needs for a long time to come (Horrigan, Lawrence, and Walker, 2002). Practitioners of

sustainable agriculture seek to integrate three main objectives into their work: a healthy environment, economic profitability, and social economic equity. Every person involved in the food system; growers, food processors, distributors, retailers, consumers, and waste managers can play a role in ensuring a sustainable agricultural system.

Agriculture has changed dramatically, especially since the end of World War II. Food and fiber productivity soared due to new technologies, mechanization, increased chemical use, specialization and government policies that favoured maximizing production both at national and international levels. These changes allowed fewer farmers with reduced labour demands to produce the majority of the food and fiber mostly in the developed world.

Although these changes which include mechanization and increased chemical use have had many positive effects and reduced many risks in farming, there have also been significant costs. Prominent among these are topsoil depletion, groundwater contamination, the decline of family farms, continued neglect of the living and working conditions for farm labourers, increasing costs of production, and the disintegration of economic and social conditions in rural communities (USDA-National Agriculture Statistics Service, 2005).

A growing movement has emerged during the past two decades to question the role

of the agricultural establishment in promoting practices that contribute to these social problems. Today this movement for sustainable agriculture is garnering increasing support and acceptance within mainstream agriculture. Not only does sustainable agriculture address many environmental and social concerns, but it offers innovative and economically viable opportunities for growers, labourers, consumers, policymakers and many others in the entire food system (Hooks, Napier, & Carter, 1983).

The world is transforming with the evolution of technology, climate, politics and economics, there are interconnected practices which positively balance environmental and social goals for the good of nature, citizens, and businesses; leading the way in this evolution is the **green economy**. This is an economic model that prioritizes the success of human well-being and social equity, while reducing environmental risks and ecological scarcity. It is the practice of sustainable development through the support of public and private investment to create infrastructure that fosters social and environmental sustainability.

Over the last decade, the green economy concept has emerged as a fundamental policy framework for sustainable development in developing countries. Indeed, the UN Conference on Sustainable Development in Rio Degenerio in 2012 (Rio+20) defined the green economy as one of the several

approaches and tools for achieving sustainable development (UN, 2012). A green economy may also be defined as a low carbon resource efficient, and socially inclusive economy. According to United Nation Environment Programme (UNEP, 2011) a green economy is one that result in improved human well being and social equity, while significantly reducing the environmental risks and ecological scarcities. In a green economy, growth in employment and income are driven by public and private investment activities, infrastructure and assets that allow reduced carbon emissions and pollutions, enhanced energy and resource efficiency, prevention of loss of biodiversity, and ecosystem services.

According to the Rio+20 Outcome Document, a green economy should “contribute to eradicating poverty, as well as sustained economic growth, enhancing social inclusion, improving human welfare, and creating opportunities for employment and decent work for all, while maintaining the healthy functioning of the Earth’s ecosystem” (United Nations Economic Commission for Africa, UNECA. (2020)). Though implementation is at different stages, several African countries (such as Ethiopia, Kenya, Rwanda, Senegal, Mozambique, & Tunisia) have adopted green economy strategies or policies. Green policies are mainly implemented in agriculture, energy and mining, industry and manufacturing, transport infrastructure, construction and green

building, water and the environment, urban infrastructure development and waste management. For instance, some countries (Ghana, Kenya, & Uganda) have invested in climate technologies and technology parks.

This paper is an effort to identify the ideas, practices and policies that constitute the concept of sustainable agriculture in a green economy in Nigeria.

This is done so for two reasons:

1. To clarify the research agenda and priorities of our program, and
2. To suggest to others practical steps that may be appropriate for them in moving toward sustainable agriculture.

Concept of Green Economy

Green economy is an economy- wide and inclusive approaches, encompassing social aspects of life such as sustain decent jobs and poverty eradication. The term green economy has generated many interpretations over the past decades because the concept vague and the ways in which social and environmental objectives are to be achieved often remain unspecified or rhetorical in official documents (Okereke and Ehresman, 2015). The UN defines green economy as economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. This multidimensional nature of green economy is about evidences that

transition is not about greening certain selective areas, but it is about setting a new green system with green markets, green institutions, green markets, green institutions, green regulation and green behaviours.

According to UNEP, green economy is involving investments from both government and private sectors leading to development that is focused on decreasing carbon emissions, controlling pollution, boosting up resources and energy efficiency and preventing the biodiversity losses (Balaban, 2019) Greening the economy is an inclusive pattern demands for models adopted to each country context based on their specific political economic and social realities, integrating strong political commitment, with long-term societal transformation to mind a greener and more inclusive development .

Concept Sustainable Agriculture

The definition of sustainable agriculture is hard to put down. It is both a philosophy and set of concrete farming practices by conscientious and prosperous farmers from the beginning. The term sustainable agriculture did not come into light until the 1980s. A more organized definition of sustainable agriculture was proposed in the 1990 Farm Bill of the US congress as an integrated system of plant and animal practice that work toward the attainment of the following goals:

- Satisfy human food and clothing needs
- Enhance environmental quality and natural resource
- Use renewable resources more efficiently
- Take a better advantage of on-farm resource
- Employ natural and biological pest control approaches
- Sustain economic viability of farming
- Enhance the quality of life of farmers and the society
- Produce sufficient high- quality and safe food
- Build on available technology, knowledge and skills in ways that suit local conditions and capacity. (USDA---

Also, according to Norman, Janke, Freyenberger, Schurle, & Kok, (1997), the goal of sustainable agriculture is to meet society's food and textile needs in the present without compromising the ability of future generations to meet their own needs. There are many practice commonly used by people working in sustainable agriculture and sustainable food systems. Growers may use methods to promote soil health, minimize water use, and lower pollution levels on the farm. Consumers and retailers concerned with sustainability can look for values-based foods that are grown using methods promoting farm worker wellbeing, that are environmentally friendly, or that strengthen the local economy. Researchers in sustainable agriculture

often cross disciplinary lines with their work: combining biology, economics, engineering, chemistry, soil and environmental management, community development, and many others. However, sustainable agriculture is more than a collection of practices. According to Cary, Webb, & Barr, (2001) sustainable agriculture is also process of negotiation: a push and pull between the sometimes competing interest of an individual farmer or of people on a community as they work to solve complex problems about how we grow our food and fiber.

The concept fosters stable and continuous production, with enough resources in the future. Its practices accord with the five principles of sustainable agriculture outlined by FAO (2005), which include but not limited to:

- i. Boost food chain productivity.
- ii. Protect and spare the environmental resources.
- iii. Improve people's wellbeing and economic growth.
- iv. Foster ecosystems and communities' resilience.
- v. Support with governmental initiatives and regulations.

It is important to point out that researching toward the goals of sustainable agriculture is the responsibility of all participants in the system, including farmers, labourers, policymakers, researchers, retailers, and consumers.

Sustainable Agriculture Practices

This requires the adoption of some specific strategies for realizing the broad themes or goals of sustainable agriculture practice. The strategies are grouped according to three separate though related areas into: farming and natural resources, plant and animal production practices, and the economic, social and political context. These groups represent a range of potential ideas for individuals committed to interpreting the vision of sustainable agriculture within their own circumstance.

Farming and Natural Resources

When the production of food and fiber degrades the natural resource base, the ability of future generations to produce and flourish decreases. Derpsch, (1998) opined that the decline of ancient civilizations in Mediterranean region, pre-Columbian south west U.S. and Central America is believed to have been strongly influenced by natural resource degradation from non-sustainable farming and forestry practices. Similarly, in Nigeria, the increase in farmers-headers clashes in recent years is due to the lost of farming and grazing resources occasioned by non-sustainable farming and grazing practices among the farmers and headers in the country.

Sustainable Water Usage

Water is the principal resource that has helped agriculture and society to prosper, and it has been a major limiting factor

when mismanaged. Water supply and use have been through extensive water storage and transfer system that has been established through the various river basins development authorities across the country which has allowed crop production to expand to very arid regions. In dry seasons, limited surface water supplies have prompted overdraft of ground water and consequent intrusion of salt water, or permanent collapse of aquifers.

Several steps should be taken to develop drought-resistant farming systems even in “normal” years, including both policy and management actions:

- i) Improving water conservation and storage measures,
- ii) Providing incentives for selection of drought- tolerant crop species,
- iii) Using reduced- volume irrigation systems,
- iv) Managing crops to reduce water loss.

Consideration should also be given to water quality. The most important issues related to water quality involve salinization and contamination of ground and surface waters by pesticides, nitrates and selenium. Salinity has become a problem wherever water of even relatively low salt content is used on shallow soils in arid regions and/or where the water table is near the root zone of crops. Tile drainage can remove the water and salts, but the disposal of the salts and other contaminants may negatively affect the environment depending upon where

they are deposited. Temporary solutions include the use of salt-tolerant crops, low-volume irrigation, and various management techniques to minimize the effects of salts on crops. In the long-term, some farmland may need to be removed from production or converted to other uses. Other uses include conversion of row crop land to production of drought-tolerant forages, the restoration of wildlife habitat or the use of agro-forestry to minimize the impacts of salinity and high water tables.

Sustainable Energy Utilization

Modern agriculture is heavily dependent on non- renewable energy sources, especially petroleum. The continued use of these energy sources cannot be sustained indefinitely, yet to abruptly abandon our reliance on them would be economically catastrophic. However, a sudden cutoff in energy supply would be equally disruptive. In sustainable agricultural systems, there is reduced reliance on non- renewable energy sources and a substitution of renewable sources or labor to the extent that is economically feasible.

Effect of Agricultural on Air

Many agricultural activities affect air quality. These include smoke from agricultural burning; dust from tillage, traffic and harvest; pesticide drift from spraying; and nitrous oxide emissions from the use of nitrogen fertilizer. Options to improve air quality include:

- incorporating crop residue into the soil
- using appropriate levels of tillage,
- and planting wind breaks, cover crops or strips of native perennial grasses to reduce dust.
- management of the soil to enhance and protect soil quality;
- efficient and humane use of inputs; and
- consideration of farmers' goals and lifestyle choices.

Sustainable Usage Soil

Soil erosion continues to be a serious threat to our continued ability to produce adequate food. Numerous practices have been developed to keep soil in place, which include:

- Reducing or eliminating tillage
- Managing irrigation to reduce runoff
- Keeping the soil covered with plants or mulch.

Plant Production Practices

Sustainable production practices involve a variety of approaches. Specific strategies must take into account topography, soil characteristics, climate, pests, local availability of inputs and the individual grower's goals.

Despite the site-specific and individual nature of sustainable agriculture, several general principles can be applied to help growers select appropriate management practices:

- selection of species and varieties that are well suited to the site and to conditions on the farm;
- diversification of crops (including livestock) and cultural practices to enhance the biological and economic stability of the farm;

Selection of Site, Species and Variety

Preventive strategies, adopted early, can reduce inputs and help establish a sustainable production system. When possible, pest-resistant crops should be selected which are tolerant of existing soil or site conditions. When site selection is an option, factors such as soil type and depth, previous crop history, and location (e.g. climate, topography) should be taken into account before planting.

Mixed Cropping

Diversified farms are usually more economically and ecologically resilient. While monoculture farming has advantages in terms of efficiency and ease of management, the loss of the crop in any one year could put a farm out of business and/or seriously disrupt the stability of a community dependent on that crop. By growing a variety of crops, farmers spread economic risk and are less susceptible to the radical price fluctuations associated with changes in supply and demand.

Properly managed, mixed cropped farm can also buffer a farm in a biological sense. For example, in annual cropping systems, crop rotation can be used to suppress weeds, pathogens and insect

pests. Also, cover crops can have stabilizing effects on the agro- ecosystem by holding soil and nutrients in place, conserving soil moisture with mowed or standing dead mulches, and by increasing the water infiltration rate and soil water holding capacity (Vanclay and Lawrence, 1994). Cover crops in orchards and vineyards can buffer the system against pest infestations by increasing beneficial arthropod populations and can therefore reduce the need for chemical inputs. Using a variety of cover crops is also important in order to protect against the failure of a particular species to grow and to attract and sustain a wide range of beneficial arthropods.

Soil Management

A common philosophy among sustainable agriculture practitioners is that a “healthy” soil is a key component of sustainability; that is, a healthy soil will produce healthy crop plants that have optimum vigor and are less susceptible to pests (Nowak, 1991). While many crops have key pests that attack even the healthiest of plants, proper soil, water and nutrient management can help prevent some pest problems brought on by crop stress or nutrient imbalance. Furthermore, crop management systems that impair soil quality often result in greater inputs of water, nutrients, pesticides, and/or energy for tillage to maintain yields.

In sustainable systems, the soil is viewed as a fragile and living medium that must be protected and nurtured to ensure its

long-term productivity and stability. Methods to protect and enhance the productivity of the soil include:

- using cover crops, compost and/or manures
- reducing tillage
- avoiding traffic on wet soils
- maintaining soil cover with plants and/or mulches

Our soils are characterized hot temperature and high amount of moisture which do not favor the buildup of organic matter (Esu, 2005). Regular additions of organic matter or the use of cover crops can increase soil aggregate stability, soil tilth, and diversity of soil microbial life.

Efficient use of inputs

Many inputs and practices used by conventional farmers are also used in sustainable agriculture. Sustainable farmers, however, maximize reliance on natural, renewable, and on-farm inputs. Equally important are the environmental, social, and economic impacts of a particular strategy. Converting to sustainable practices does not mean simple input substitution. Frequently, it substitutes enhanced management and scientific knowledge for conventional inputs, especially chemical inputs that harm the environment on farm and in rural communities. The goal is to develop efficient, biological systems which do not need high levels of material inputs.

Growers frequently ask if synthetic chemicals are appropriate in a sustainable

farming system. Sustainable approaches are those that are the least toxic and least energy intensive, and yet maintain productivity and profitability. Preventive strategies and other alternatives should be employed before using chemical inputs from any source. However, there may be situations where the use of synthetic chemicals would be more “sustainable” than a strictly non-chemical approach or an approach using toxic “organic” chemicals (Young, 2003). For example, one grape grower switched from tillage to a few applications of a broad spectrum contact herbicide in the vine row. This approach may use less energy and may compact the soil less than numerous passes with a cultivator or mower.

Consideration of farmer goals and lifestyle choices

Management decisions should reflect not only environmental and broad social considerations, but also individual goals and lifestyle choices. For example, adoption of some technologies or practices that promise profitability may also require such intensive management that one’s lifestyle actually deteriorates. Management decisions that promote sustainability, nourish the environment, the community and the individual (Antle, and Diagana, 2003).

Animal Production Practices

In the early part of this century, most farms integrated both crop and livestock operations. Indeed, the two were highly

complementary both biologically and economically. The current picture has changed quite drastically since then. Crop and animal producers now are still dependent on one another to some degree, but the integration now most commonly takes place at a higher level--between farmers, through intermediaries, rather than within the farm itself. This is the result of a trend toward separation and specialization of crop and animal production systems. Despite, this trend, there are still many farmers, particularly in southern part of the country that integrate crop and animal systems--either on dairy farms, or with range cattle, sheep or hog operations.

Management Planning

Including livestock in the farming system increases the complexity of biological and economic relationships. The mobility of the stock, daily feeding, health concerns, breeding operations, seasonal feed and forage sources, and complex marketing are sources of this complexity. Therefore, a successful ranch plan should include enterprise calendars of operations, stock flows, forage flows, labor needs, herd production records and land use plans to give the manager control and a means of monitoring progress toward goals.

Animal Selection

The animal enterprise must be appropriate for the farm or ranch resources. Farm capabilities and constraints such as feed and forage sources, landscape, climate

and skill of the manager must be considered in selecting which animals to produce. For example, ruminant animals can be raised on a variety of feed sources including range and pasture, cultivated forage, cover crops, shrubs, weeds, and crop residues. There is a wide range of breeds available in each of the major ruminant species, i.e., cattle, sheep and goats. Hardier breeds that, in general, have lower growth and milk production potential, are better adapted to less favorable environments with sparse or highly seasonal forage growth.

Animal nutrition

Feed costs are the largest single variable cost in any livestock operation. While most of the feed may come from other enterprises on the ranch, some purchased feed is usually imported from off the farm. Feed costs can be kept to a minimum by monitoring animal condition and performance and understanding seasonal variations in feed and forage quality on the farm. Determining the optimal use of farm-generated by-products is an important challenge of diversified farming.

Reproduction

Use of quality germplasm to improve herd performance is another key to sustainability. In combination with good genetic stock, adapting the reproduction season to fit the climate and sources of feed and forage reduce health problems and feed costs.

Herd Health

Animal health greatly influences reproductive success and weight gains, two key aspects of successful livestock production. Unhealthy stock waste feed and requires additional labour. A herd health program is critical to sustainable livestock production.

Grazing Management

Most adverse environmental impacts associated with grazing can be prevented or mitigated with proper grazing management. First, the number of stock per unit area (stocking rate) must be correct for the landscape and the forage sources. There will need to be compromises between the convenience of tilling large, unfenced fields and the fencing needs of livestock operations. Use of modern, temporary fencing may provide one practical solution to this dilemma. Second, the long term carrying capacity and the stocking rate must take into account short and long-term droughts. Especially in Mediterranean climates such as in California, properly managed grazing significantly reduces fire hazards by reducing fuel build-up in grasslands and brushlands.

Confined Livestock Production

Animal health and waste management are key issues in confined livestock operations. The moral and ethical debate taking place today regarding animal welfare is particularly intense for confined livestock production systems.

The issues raised in this debate need to be addressed.

Confinement livestock production is increasingly a source of surface and ground water pollutants, particularly where there are large numbers of animals per unit area. Expensive waste management facilities are now a necessary cost of confined production systems. Waste is a problem of almost all operations and must be managed with respect to both the environment and the quality of life in nearby communities. Livestock production systems that disperse stock in pastures so the wastes are not concentrated and do not overwhelm natural nutrient cycling processes have become a subject of renewed interest.

The Socio-economic and political context

In addition to strategies for preserving natural resources and changing production practices, sustainable agriculture requires a commitment to changing public policies, economic institutions, and social values. Strategies for change must take into account the complex, reciprocal and ever-changing relationship between agricultural production and the broader society.

The “food” extends far beyond the farm and involves the interaction of individuals and institutions with contrasting and often competing goals including farmers, researchers, input suppliers, farm workers, unions, extension workers,

processors, retailers, consumers, and policymakers. Relationships among these actors shift over time as new technologies spawn economic, social and political changes.

A wide variety of strategies and approaches are necessary to create a more sustainable food system. These will range from specific and concentrated efforts to alter specific policies or practices, to the longer-term tasks of reforming key institutions, rethinking economic priorities, and challenging widely-held social values. The following are the areas where change is needed:

1) Food and Agricultural Policy:

Existing Federal, State and Local government policies often impede the goals of sustainable agriculture. New policies are needed to simultaneously promote environmental health, economic profitability, and social and economic equity. For example, commodity and price support programs could be restructured to allow farmers to realize the full benefits of the productivity gains made possible through alternative practices. Tax and credit policies could be modified to encourage a diverse and decentralized system of family farms rather than corporate concentration and absentee ownership. Government, Universities of Agriculture, and the Agricultural research Institutes’ policies could be modified to emphasize the

development of sustainable alternatives. Marketing orders and cosmetic standards could be amended to encourage reduced pesticide use.

- 2) **Land use:** Conversion of agricultural land to urban uses is a particular concern in California, as rapid growth and escalating land values threaten farming on prime soils. Existing farmland conversion patterns often discourage farmers from adopting sustainable practice and a long-term perspective on the value of land. At the same time, the close proximity of newly developed residential areas to farms is increasing the public demand for environmentally safe farming practices. Comprehensive new policies to protect prime soils and regulate development are needed, particularly in California's Central Valley. By helping farmers to adopt practice that reduce chemical use and conserve scarce resources, sustainable agriculture research and education can play a key role in building public support for agricultural land preservation. Educating land use planners and decision-makers about sustainable agriculture is an important priority.

- 3) **Rural Community Development:** Rural communities in Nigeria are highly characterized by economic and environmental deterioration. Many are among the poorest locations in the nation. The reasons for the decline are complex, but changes in farm

structure have played a significant role. Sustainable agriculture presents an opportunity to rethink the importance of family farms and rural communities. Economic development policies are needed that encourage more diversified agricultural production on family farms as a foundation for healthy economies in rural communities. In combination with other strategies, sustainable agriculture practices and policies can help foster community institutions that meet employment, educational, health, cultural and spiritual needs.

- 4) **Consumers and the Food System:** Consumers can play a critical role in creating a sustainable food system. Through their purchases, they send strong messages to producers, retailers and others in the system about what they think is important. Food cost and nutritional quality have always influenced consumer choices. The challenge now is to find strategies that broaden consumer perspectives, so that environmental quality, resource use, and social equity issues are also considered in shopping decisions. At the same time, new policies and institutions must be created to enable producers using sustainable practices to market their goods to a wider public.

Conclusion

This paper is an effort to identify the ideas, practices and policies that

constitute the concept of sustainable agriculture in a green economy in Nigeria. This is done so for two reasons: (1) To clarify the research agenda and priorities of our program, and (2) to suggest to others practical steps that may be appropriate for them in moving toward sustainable agriculture. Conventional agriculture systems of production often lead to environmental degradation, economic problems and even social conflict. The efficacy of agriculture systems conducive to the economic, environmental and social sustainability of farming operations has been demonstrated, yet the adoption of sustainable agricultural practices is not widespread. This paper reviewed the various sustainable agriculture practices and their management with the view to encouraging its adoption of sustainable agriculture. The goals and objectives of sustainable agriculture were highlighted. The different sustainable agriculture practices were discussed. It was discovered that there was little information on sustainable agriculture practices available to Nigerian farmers, and that Nigeria is lagging behind other developing countries in policies that should encourage the adoption of sustainable agriculture.

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