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The sustainablity of Nigerian cocoa sector through good agricultural practices

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ABSTRACT: The goal of sustainability requires addressing philosophical, economical and sociological issues as well as environmental and scientific questions. Sustainable agriculture embraces all agricultural systems that are socially acceptable, economically viable and environmentally safe. It is an important element of the overall effort to make human activities compatible with the demands of the earth's eco-system. While sustainable agriculture is based on long-term goals and not a specific set of farming practices, it is usually accompanied by a reduction of purchased inputs (pesticides and fertilizers) in favor of managing on-farm resources. Cocoa accounted for a greater part of the foreign exchange generated for the country between 1950s and 70s. Nigeria is currently the 5th world producer of cocoa, with an estimated production of 165,000 metric tons in 2006/07. The high cost of production, limited availability of inputs and lack of workable credit facilities has led to the dwindling productivity and very minimal profit margins for small holders cocoa farmers in Nigeria. Many of them have virtually abandoned their cocoa farms, investing minimal time and money to maintain the farms. This neglect has exacerbated many pest and disease problems such as the cocoa swollen shoot virus (CSSV), black pod disease and the cocoa mirids. However, due to the recent global economic meltdown, decline in oil prices and reserves and domestic food insecurity, there is an urgent need to resuscitate the cocoa sector through a viable sustainable GAP approach as a veritable means of boosting the nation's economy.

Key words: Food safety, food quality, food security, sustainability, pests, diseases, pesticides

Introduction

The word sustainable, is from the Latin word "sustinere", meaning to keep in existence, and implies permanence or long-term support. A sustainable agriculture is one that, over the long term, enhances environmental quality and the resource base on which agriculture depends; provides for basic human food and fiber needs; is economically viable; and enhances the quality of life for farmers and society as a whole (American Society of Agronomy, 1989). As it pertains to agriculture, sustainable describes farming systems that are capable of maintaining their productivity and usefulness to society indefinitely. Such systems must be resource-conserving, socially supportive, commercially competitive, and environmentally sound (Ikerd, 1990). Sustainable agriculture was addressed by the U.S. Congress in the 1990 "Farm Bill." Under USA law, the term sustainable agriculture means an integrated system of plant and animal production practices having a site-specific application that will, over the long term:

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- satisfy human food and fiber needs
- enhance environmental quality and the natural resource base upon which the agricultural economy depends
- make the most efficient use of non renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls
- sustain the economic viability of farm operations, and
- enhance the quality of life for farmers and society as a whole.

Thus, the official, or legal, definition has five parts, emphasizing productivity, environmental quality, efficient use of nonrenewable resources, economic viability, and quality of life. Under this definition, a farm that emphasizes short-run profit, but sacrifices environmental quality, would not be sustainable in the long run. From the other end, pursuing environmental quality without ensuring viability of short-run returns also would be unsustainable. A farm that is very productive but uses large quantities of a nonrenewable resource, such as fossil fuel or a non-rechargeable aquifer, to achieve and maintain that productivity would not be considered sustainable in the long run (Norman *et al*., 1997).

Sustainable agriculture is a philosophy based on human goals and on understanding the long-term impact of our activities on the environment and on other species. Use of this philosophy guides our application of prior experience and the latest scientific advances to create integrated, resource-conserving, equitable farming systems. These systems reduce environmental degradation, maintain agricultural productivity, promote economic viability in both the short and long term, and maintain stable rural communities and quality of life. (Francis and Youngberg, 1990; Francis *et al*., 1990). Sustainable agriculture is one that produces abundant food without depleting the earth's resources or polluting its environment. It is agriculture that follows the principles of nature to develop systems for raising crops and livestock that are, like nature, self-sustaining (Earles, 2005).

Tree crops, of which cocoa is a major component plays critical role in sustaining biodiversity, sound management of natural resources and have an excellent potential to improve the income of households and to provide additional pathways for the diversification and intensification of food crops systems (FGN, 2007). Cocoa was one of the major foreign exchange earners before the discovery of crude oil in 1957. It accounted for a greater part of the foreign exchange generated for the country between 1950 and 1970 (FGN, 2007). Nigeria is currently the 5th world producer of cocoa behind Cameroon, with an estimated production of 165,000 metric tons in 2006/07 (ICCO, 2007; FAO, 2007). The high cost of production, limited availability of inputs and lack of workable credit facilities has led to the dwindling productivity and very minimal profit margins for small holders cocoa farmers in Nigeria. Many of them have virtually abandoned their cocoa farms, investing minimal time and money to maintain the farms. This neglect has exacerbated many pest and disease problems such as the cocoa swollen shoot virus (CSSV), black pod disease and the cocoa mirids.

Good Agricultural Practices (GAP) approach generally aims at applying available knowledge to addressing environmental, economic and social sustainability dimensions for on-farm production and post-production processes, resulting in safe and quality food and non-food agricultural products (FAO, 2003). However, based on generic sustainability principles, it aims at supporting locally developed optimal practices for a given production system based on a desired outcome, taking into account market demands and farmers constraints and incentives to apply practices (FAO, 2003). It could also be defined as agricultural practices, which produce a quality crop while protecting, sustaining or enhancing the environment with regard to soil, water, air, human, animal and plant life (CORESTA, 2005).

However, due to the recent global economic meltdown, decline in oil prices and reserves and domestic food insecurity, there is an urgent need to resuscitate the cocoa sector through a viable sustainable GAP approach as an alternative means of boosting the nation's economy. Following the world summit on sustainable development (WSSD) in September 2002, a plan of implementation and voluntary partnership/initiatives were launched by governments, international agencies, the private sector, non-governmental organizations (NGOs) and civil society organizations (CSOs). The agreement focused on actions to promote sustainable agriculture and natural resources management contributing to food security (access to sufficient, safe and nutritious food) and improved livelihoods. Ever since then agriculture is expected to assure food security in a range of settings, now and in future, and is increasingly called upon to reduce any negative ecosystem impact while producing positive environmental, social and economic benefits (FAO, 2003).

The International Cocoa Agreement, which came into effect in October 2003, provides that due consideration be given to the sustainable management of cocoa resources with a view to achieving a sustainable cocoa economy. It aims to help provide for economic returns to all stakeholders in the cocoa economy, to be achieved by applying the principles of sustainable development. The International Cocoa Organization (ICCO) has since then been implementing the concept of sustainable cocoa economy, which entails sustainable cocoa production and consumption. The concept of sustainable cocoa production encompasses the three pillars of sustainability (economic, social and environmental), which enable farmers to efficiently use and manage farming resources to maintain and/or increase farming productivity at levels that are economically viable, environmentally sound and socially acceptable (ICCO, 2009). The ICCO programme on sustainable cocoa production includes the establishment of sustainable and competitive cocoa farming systems; diversification of cocoa farms; rehabilitation of old cocoa farms; production and delivery of good quality cocoa through more efficient post-harvest techniques; efficient functioning of farmers' organizations; promotion of cocoa consumption etc. However, their priority area is focusing on improving farm productivity, achieving better physical quality of cocoa produced and realizing diversification of production to enhance the competitiveness of cocoa and the income position of farmers (ICCO, 2009).

In Nigeria, the concept of GAP should be directed at ensuring sustainable, economically viable production and processing of high quality cocoa. GAP should be conceptualized in a way to ensure economic viability for cocoa farmers and a safe working environment. The world today is focusing greater attention upon the impact cocoa practices are having on the environment, with an increased emphasis on more sustainable methods of its production. These therefore, have formed the basis of this review paper, which takes a holistic look at the sustainability of Nigerian cocoa economy through good agricultural practices.

TERMS RELATED TO AGRICULTURAL SUSTAINABILITY

The following terms are commonly associated with sustainable agricultural systems:

1. **Agroecology:** This is the study of purely ecological phenomena within the crop field, such as predator/prey relations, or crop/weed competition (Hecht, 1987).
2. **Best Management Practices (BMPs):** These are established soil conservation practices that also provide water quality benefits. They include such practices as cover cropping, green manuring, strip cropping to control erosion; soil testing, targeting and timing of chemical applications to prevent the loss of nutrients and pesticides (Rawson, 1995).
3. **Biodiversity:** This is the sum of all the plants, animals, fungi and microorganisms in the world, or in a particular area; all of their individual variation; and all the interactions between them (Raven, 1994). Agrobiodiversity is a fundamental feature of farming systems around the world. Diverse ecosystems in nature have a higher degree of stability than those with only a few species. Farms with a diverse mix of crops have a better chance of supporting beneficial organisms that assist in pollination and pest management (Kuepper and Gegner, 2004).
4. **Carrying Capacity:** This is the theoretical equilibrium population size at which a particular population in a particular environment will stabilize when its supply of resources remains constant. It can also be considered to be the maximum sustainable population size; the maximum size that can be supported indefinitely into the future without degrading the environment for future generations (Muir, 2007).
5. **Integrated Farming Systems (IFS):** Farming research and policy programs have begun to recognize IFS by viewing farms and food production system as an integrated whole, through which more efficient use can be made of natural, economic, and social resources. Included in this concept are the goals of finding and adopting "integrated and resource-efficient crop and livestock systems that maintain productivity, that are profitable, protect the environment and the personal health of farmers and their families," as well as "overcoming the barriers to adoption of more sustainable agricultural systems. These systems can serve as a foundation upon which rural/ farming communities will be revitalized (Hesterman and Thorburn, 1994).

6. **Integrated Pest Management (IPM):** IPM is an ecologically based approach to pests (insects and micro organisms) control that utilizes a multi-disciplinary knowledge of crop/pest relationships, establishment of acceptable economic thresholds for pest populations and constant field monitoring for potential problems. Management may include such practices as "the use of resistant varieties; crop rotation; cultural practices; optimal use of biological control organisms; certified seed; protective seed treatments; disease-free transplants or rootstock; timeliness of crop cultivation; improved timing of pesticide applications; and removal or 'plow down' of infested plant materials (Waldron, 1989).

7. **Organic farming:** This is a production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators, and livestock feed additives. To the maximum extent feasible, organic farming systems rely upon crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation, mineral-bearing rocks, and aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients, and to control insects, weeds, and other pests (USDA, 1980).

8. **Low Input Agriculture:** Low input farming systems "seek to optimize the management and use of internal production inputs (i.e. on-farm resources) and to minimize the use of production inputs (i.e. off-farm resources), such as purchased fertilizers and pesticides, wherever and whenever feasible and practicable, to lower production costs, to avoid pollution of surface and groundwater, to reduce pesticide residues in food, to reduce a farmer's overall risk, and to increase both short- and long-term farm profitability (Parr *et al*., 1990). The term low-input agriculture has been defined as a production activity that uses synthetic fertilizers or pesticides below rates commonly recommended by the extension service. It does not mean total elimination of these materials. Yields are maintained through greater emphasis on cultural practices, IPM, and utilization of on-farm resources and management (Diver, 2008). The term is sometimes misleading, as to some it implied that farmers should starve their crops, let the weeds choke them out, and let insects clean up what is left. In fact, the term low-input referred to purchasing few off-farm inputs (usually fertilizers and pesticides), while increasing on-farm inputs (i.e. manures, cover crops, and especially management). (Norman *et al*., 1997).

However, it is worthy to note that none of these terms above are synonymous with sustainable agriculture; each relates to the concept in a different way. Some of the terms are conceptual in nature, or are strictly methodological or are combinations of both approaches. Several of these concepts and practices have very literal meanings that have been colored by their historic use and practitioners' experiences (Gold, 2007).

COMPONENTS OF AGRICULTURAL SUSTAINABILITY

Sustainable agriculture can be broken into economic, environmental and social components. However, the goals of these components overlap considerably thereby impacting and influencing each other. For instance any economic decision taken will also influence the environmental and the social components.

Economic sustainability: For a cocoa farm to be sustainable, it must be economically profitable. However, due to many factors, some sustainably operated farms may be either low or more profitable than their conventional farming counterparts. The following factors according to Preston (2003) are indicators that a farm is achieving economic sustainability:

- The family savings or net worth is consistently going up
- The family debt is consistently going down
- The farm enterprise is consistently profitable from year to year
- Purchase of off-farm feed and fertilizer is decreasing
- Reliance on government payments is decreasing.

Environmental sustainability: Sustainable agricultural practices should be ecologically sound with little or no adverse effect on the natural ecosystem. Preston (2003) noted the following factors as indicators that a farm is achieving environmental sustainability:

- There are no bare ground
- Clean water flows in the farm's ditches and streams
- Wildlife is abundant
- Fish are prolific in streams that flow through the farm
- The farm landscape is diverse in vegetation.

Social sustainability: There should be fair treatment and good quality life for those who work and live on the farm, as well as those in the local community. The following are indicators that a farm is achieving social sustainability (Preston, 2003):

- The farm supports other businesses and families in the community
- Money circulates within the local economy
- The number of rural families is going up
- Young people take over their parents' farms and continue farming.
- College graduates return to the community after graduation.

GOOD AGRICULTURAL PRACTICES (GAP) IN THE COCOA INDUSTRY

The concept of GAP has evolved in recent years in the context of a rapidly changing and globalizing food economy, resulting in commitments of a wide range of stakeholders in cocoa production, safety, quality, and the environmental sustainability of agriculture. GAP applies recommendations and available knowledge to addressing environmental, economic and social sustainability for on-farm production and post-production processes resulting in safe and healthy food and non-food agricultural products.

A good agricultural practice approach can contribute immensely to implementing sustainable agriculture and rural development while addressing the demand – side priorities of consumers and retailers, the supply side priorities of producers and laborers, and institutions and services that are bridging supply and demand. While a GAP approach may respond to the growing demands of increasingly globalized and integrated agriculture sectors, it is also very important for local and national markets. In this context, the term GAP is used to refer to private, voluntary and non-regulatory applications that are being developed in number of forms by the government to meet farmers and consumers' needs and specific requirements in the food production chain. It is also formally recognized in international regulatory frameworks and associated codes of practices to minimize or prevent the contamination of food.

The challenge is therefore to ensure that the expanding use of GAP takes into account the interest of the Nigerian small-holder cocoa farmers and processors with regards to their safety, economic power, sustainability of domestic production and livelihoods security. A broadly accepted approach using GAP principles, generic indicators and practices will help guide debate on national policies and actions and on the preparation of strategies to ensure that all stakeholders participate in and benefit from the application of GAP in the cocoa food chain.

KEY ELEMENTS OF GAP IN A SUSTAINABLE COCOA INDUSTRY

1. **Soil management:** Soil fertility and water management are very important to efficient and environmentally sustainable cocoa production. Skilful control of erosion greatly reduces the chances of surface and ground water pollution as well as preserve cocoa soil quality and fertility. In selecting sites for cocoa establishment, the soil type, fertility, slope, cropping history and drainage should be taken into serious consideration. Planting of cocoa in steeply sloping or undulated areas should be avoided unless conservation practices and devises, such as terraces and contours are provided. These will act as barriers to runoff, promote efficient water retention, reduce soil movement and erosion. Burning to eliminate crop residue or ground cover after clearing cocoa establishment sites should be avoided. This is because burning results in loss of good soil structure, diminishes organic content, thus decreasing water retention and cation exchange capacity of the soil. It has been reported that when topsoil is removed, or where it has been severely eroded, crop yields are from 20% to 65% lowered compared to non-eroded soils (Langdale *et al*., 1979; Massee, 1990). The soil nutrient status and fertilizer requirements should be determined by routine soil analyses at least every 10 years for sustainable soil management practices.

2. **Water management:** Maintenance of water stability is very important in sustaining both plant and animal life. Water supply sources should be safeguarded by not mixing or applying agrochemicals near open water courses nor allowing pesticides or fertilizers to enter water courses. The cocoa farmers should avoid pesticides and fertilizers that may have a high potential for leaching or over application of such materials. Buffer areas should be maintained between cocoa plantations and environmentally sensitive areas. According to CORESTA (2005), buffer strips when strategically placed in the agricultural landscape can effectively reduce movement of sediments, nutrients and agrochemicals within and from the farm fields.

3. **Variety selection:** The use of an improved variety forms the foundation for a successful crop from an agronomic, environmental, quality and economic perspectives. The underlying principle is to make sure that only certified, registered or approved cocoa varieties with traceable provenance and with due compliance to plant breeders rights are grown by farmers. Such varieties are known to possess high pest and disease tolerance or resistance profiles that match the local problems and are usually in line with international market requirements.

4. **Crop management:** This forms the framework of cocoa production and requires the implementation of acceptable agronomic and environmentally sound practices from site selection and planting to post harvest handling in order to achieve maximum production. Cocoa seedlings usually require low shading with plantain or cocoyam to enhance plant establishment within the initial years of transplanting into the field. Such shade plants should be thinned down from the third year to ensure the recommended planting spacing for good aeration and photosynthetic activities of the plants. Regular and proper weed slashing and pruning of the mature plants should be carried out at specific intervals to enhance luxuriant growth and cocoa yield.

5. **Crop Protection:** When pesticides are applied to cocoa plantations, a small but significant proportion can escape to water and air, or accumulate in foods, thus affecting human health and ecosystems. GAP can substitute natural controls for some pesticides, so reducing dependence on externally introduced substances. Hence GAP emphasizes practices that include use of resistant cultivars/varieties, crop sequences, associations, and cultural practices that maximize biological prevention of pest and diseases, adopt organic control practices where and when applicable. In addition, GAP seeks to determine interventions following consideration of all possible methods and their short and long-term effect on farm productivity and environmental implications in order to minimize the use of agrochemicals, in particular to promote integrated pest management (IPM). IPM is a systematic approach to crop protection that utilizes information to make better pest management decisions, with an emphasis on integrating all available methods (CORESTA, 2005). The concept of IPM does not mean completely eliminating agrochemicals but rather promotes their appropriate use as a defense against pests and diseases whose population cannot be maintained at acceptable levels using other alternatives. The underlying principle of agrochemical management in cocoa production is that their use should be only after all other alternative pest, weed and disease control measures have been utilized. The use should also be minimized with a view towards environmental acceptability and worker protection.

6 **Harvesting and processing:** Product value is a measure of the desired outputs of an agricultural system. Harvesting of cocoa should be carried out following relevant pre-harvest intervals and the pods sorted out before breaking and heaping them for fermentation, which should be done outside the farm. Fermentation of the beans should be in the prescribed manner and for the recommended duration of 6 days. The beans should be sun-dried to low moisture content (7.5%) on a raised platform for at least 13 days of good sunshine regime. Smoke should never be used to dry the beans. There should be no application of pesticides during drying or storage. The beans should be packaged in a clean hydrocarbon free jute bags and stored in well ventilated house/ware house.

7. **Capacity building:** Farmers constitute one of the most important sources of labour and management on the farm especially in cocoa economies that depend largely on the rural poor. Farm training is one of the most important elements of any GAP programme. It provides an opportunity to update cocoa

farmers on the latest technology and crop advancements. Farmers training is achieved by various methods around the world and a multitude of training tools and techniques are utilized. In Nigeria, the cocoa farmer's training needs is taken care of by the Farmer's Field School Programme jointly organized in all the 14 cocoa producing states by the National Cocoa Development Committee (NCDC), Cocoa Research Institute of Nigeria (CRIN) and the Sustainable Tree Crops Programme (STCP). The farmers should regularly be educated on good cultural practices and such practices passed over to succeeding generations.

8. **Socio economic issues:** This consists of items that are both directly and indirectly linked to cocoa production. The adoption of a cost-effective production of high yielding and excellent quality cocoa boosts the farmer's economic returns. The use of child labour for cocoa production is an extremely important socio-economic issue. The children in cocoa producing areas should be allowed to attend school, while assisting in their capacity towards effective cocoa farm management.

SPECIAL ISSUES FOR ACHIEVING SUSTAINABILITY THROUGH GAP

In implementing a GAP approach in the cocoa sector of the economy, a number of the priority areas identified boarders on information exchange and awareness creation, multi-stakeholder mechanisms, identification of drivers and motivators of change; application of tools and resource mobilization. Such areas are highlighted as follows:

- Training farmers in cocoa production, pest management, and marketing through the development of a comprehensive extension package that will be farmer driven and develop into an on-farm school activity.
- Ensure the participation of women in the program as trainers, nursery directors, and trainees – specifically for post-harvest and market training.
- Support the production and distribution of improved high yielding, early bearing and disease resistant cocoa seedlings by establishing cocoa seed gardens in cocoa producing states of the country. This is currently being embarked upon by CRIN in collaboration with cocoa producing states.
- Create demonstration plots for good agricultural practices, new technologies as training and extension sites.
- Government should create and enforce policies that ensure quality standards for cocoa bean export.
- Regional and sub-regional collaboration should be encouraged with organizations such as COPAL, ICCO, FAO, STCP, NAFDAC which will promote an avenue for the sharing of knowledge on GAP as it relates to cocoa, by providing access to information; putting in place a database and web portal with a strategy for dissemination of information though the socio-cultural environment peculiarity of individual countries has to be respected.
- The establishment of links between government agencies concerned with cocoa exports with established laboratories for product analysis.
- Workshops should be held periodically involving the stakeholders such as farmers, marketers (consumers and exporters), chemical manufactures, industrialist and policy makers on promoting good agricultural practices in the cocoa sector of Nigeria.
- There is an urgent need to perform a national survey to audit the current status of cocoa pesticides and pesticide use in Nigeria.

SUMMARY AND CONCLUSSION

In recent decades, sustainable farmers and researchers around the world have responded to the extractive industrial model with ecology-based approaches, variously called natural, organic, low-input, alternative, regenerative, holistic, biodynamic, biointensive, and biological farming systems. All of them, representing thousands of farms, have contributed to our understanding of what sustainable systems are,

and each of them shares a vision of "farming with nature," an agro-ecology that promotes biodiversity, recycles plant nutrients, protects soil from erosion, conserves and protects water, uses minimum tillage, and integrates crop and livestock enterprises on the farm (Earles, 2005). However, no agricultural system is sustainable if it is not also profitable, able to provide a healthy family income and good quality life. Sustainable practices lend themselves to smaller, family-scale farms. These farms, in turn, tend to find their best niches in local markets, within local food systems, often selling directly to consumers. (Earles, 2005).

The attainment of GAP goals for sustainable cocoa production is affected by many factors, including technology, social and economic developments, and associated government policies and programmes. These factors are amplified by globalization, which is progressively changing how and where food and farm products are produced, processed and traded.

Consumer concern is growing in all parts of the world over the environmental, economic and social sustainability, public health implications and safety of agricultural practices and products. Consumers are now more sophisticated and critical than in the past, demanding to know what has been used to produce their agriculturally derived products. They also want to know if some practices, which they find offensive, such as child labour, are practiced on cocoa farms.

Cocoa products processors and retailers must be prepared to match the anticipated market demands with the available supply of products in a lengthening food chain.

The farmers on their own part need to have the capacity to make new farming and technology choices to meet demands for a safe and healthy diet in response to new regulations and standards, changing global consumption patterns, improved market access (through provision of safe food) and potential value-added opportunities.

Finally the Government should provide the enabling policy and regulatory framework particularly concerning food safety, agricultural production inputs and trade, while seeking to meet food security objectives.

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