

# SUSTAINABLE AGRICULTURAL DEVELOPMENT FOR FOOD SECURITY: A REVIEW

**Esubalew Abate Alemu (Dr.)<sup>1</sup>**

## ***Abstract***

*Agriculture has positive and significant contributions to food security, employment, export earnings, ecological balance, and etc. However, agriculture development encounters varied challenges. Among others, poor land and water management, backward cultivation techniques, shortage of information on marketing, poverty, natural resource degradation, population growth, poor support services and institutional constraints. The concept of sustainable agriculture comes in response to the declining natural resource base coupled with agricultural and other environmental non-friendly activities. Thus, the sustainability notion has encouraged key adjustments in the conventional agricultural system to make it more economically viable. In order to focus on sustainable agriculture, development of technologies and viable agricultural system that do not have undesirable effect on the environment and, more importantly, acceptable to the livelihood of farmers/pastoralists must be devised and promoted.*

Key words: Sustainable agriculture, food security, rural development, natural resource, technologies and practices

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<sup>1</sup> Institute of Development and Policy Research (IDPR), Addis Ababa University, Addis Ababa, Ethiopia

E-mail: [esubalewabate@gmail.com](mailto:esubalewabate@gmail.com) and [esubalew.abate@aau.edu.et](mailto:esubalew.abate@aau.edu.et), P.O.Box:1176, Addis Ababa, Ethiopia.

## **Introduction**

Agriculture is the means of living for more than 70% of Africans and contributes 15% to the GDP. The potential of Africa's agriculture is not well exploited in such a way that it benefits the growing population by creating job opportunities and wealth, and plummeting poverty. Furthermore, the low productivity of Agriculture in Africa is one of the factors to poverty and food insecurity. Nonetheless, Africa has about 25% of the fertile land of the world and, in 2000, 33% of the population of the continent was at risk of food shortage, and in 2015, 24.6% were food unsecured. Moreover, Africa's GDP grew by 6% per year between 2001 and 2008, but agricultural GDP grew only by 3.4% annually. The challenges to transform agriculture in Africa are: inadequate use of modern agricultural inputs and machinery, marginal access to credit and markets, and gender bias (ADB, 2016). However, the contribution of agriculture to the Ethiopian economy is relatively higher, as compared to the aforementioned data in Africa.

Meanwhile, either in Africa as a whole or particularly in Ethiopia, sustainable agricultural development is expected to produce abundant food without affecting the environment and damaging the existing resources. In addition, sustainable agriculture embraces farming practices (crop production and livestock husbandry) with the intention to address current and future needs for food, fiber, energy. Thus, sustainable agriculture provides emphasis to production systems which are gainful, ecologically sound, energy efficient and capable of advancing the living condition of the community.

Sustainable agriculture maintains the feasibility of farm businesses: assure food, fiber and energy needs, improves the available resource foundation

through soil conservation, nutrient recycling, biological pest management and biodiversity. It also benefits from the indigenous knowledge and skills of the local people, and is flexible to disturbance, outbreaks and unevenness, uses nonrenewable and other available possessions, and utilizes biological processes and different techniques of pest and disease control methods in production activities (Menalled, et al., 2008).

In addition, sustainable agriculture puts together environmental wellbeing, economic success, and social justice (Sullivan, 2003). Furthermore, environmental, economic and social issues are given equal attention in sustainable agriculture (Brodt et al., 2011).

The term sustainable illustrates that, to what extent the farms are competent of upholding the efficiency and worthiness to the general public for the foreseeable future. Thus, sustainable agriculture should be environmentally sound, resource-efficient, commercially viable and socially accommodating. In addition, sustainable agriculture is a dedication to assure food and fiber demands and to improve the living condition of the farming community (Abubakar and Attanda, 2013).

Sustainable agriculture can be considered as environmental management of intricate relations among people, animals, plants, soil, water and climate, with the aim of combining them in such a way that it is appropriate for the healthy, social, economic and environmental conditions of a farm (Sullivan, 2003).

### **The concept of sustainable agriculture**

The shift to sustainable agriculture is a course of action that needs a sequence of steps. In this process, three concerns should be addressed (Menalled, et al., 2008). First, it should be clear that agro-ecosystems are ecologically multifarious and work together and farmers' choice manipulate relations in the ecosystems. Farmers ought to be conscious of the additional cost in their preferences, such as inputs like artificial fertilizers and pesticides, which may perhaps complement ecological practice, but must not replace them. In this situation, farmers know the benefit of ecological processes (for instance, nutrient cycling and relationships between crop and weed, host and parasite and predator and prey) in shaping the farm and the stability in the farming systems.

Second, ecological issues in sustainable farming necessitate the realization of context based broad viewpoint. Besides, farmers need to consider neighboring land use and society's intentions to identify the target of the production arrangement and look for measures which will help achieve the objectives of the farm.

Third, sustainable farming aspires for the best use of ecosystem services such as yields, clean water and air, carbon seizure, amusement, wildlife and other organisms of value by the society as it is an optimization procedure that involves the entire stakeholders.

Energy flow, water and mineral cycles, and ecosystem dynamics are natural processes and if they work appropriately, will protect the available soil and water resources, and if one of these is changed, all others will be affected. Furthermore, when a farm enterprise is put up in line with these processes,

nature's principles will be valid and the sustainability of the farm will be ensured (Sullivan, 2003).

Sustainability in agriculture puts together resilience and persistence, and deals with economic, social and environmental effects (Petty, 2008). Agriculture has changed, especially since the end of World War II. On top of this, food and fiber productivity has increased as a result of new agricultural technologies and related actions, which privileged to take advantage of high production gains. Currently, sustainable agriculture is a point of discussion in most parts of the world. For the most part, agriculturalists concur that sustainable agriculture is of essential to the sustainability of the ecosystem and the increasing human population (Abubakar and Attanda, 2013). Hence, sustainability centers on environmental issues and it impacts on the society (Kambewa, 2007). As a result, sustainable agriculture is more of a management viewpoint than a way of operation (MacRae, et al., 1993).

Though, the notion of sustainable agriculture is still novel, it is gathering momentum within conventional agriculture, in view of the fact that, it deals with many environmental, social and economic prospects for farmers, pastoralists, consumers and policymakers (Abubakar and Attanda, 2003).

### **Principles of sustainable agriculture**

Integrating environmental processes into food production practices, lessening the use of non-renewable inputs, making successful use of the understanding and expertise of farmers, and putting together constructive capacities of people to resolve farming and environmental challenges, are the key principles for sustainability (Pretty, 2008).

As sustainable farming fulfills environmental, economic, and social purposes at the same time, it is nature based. Moreover, economic sustainability relies on gainful enterprises, with prudent financial, marketing, and risk management. Social sustainability comes from participatory decision making in order to improve community's quality of life as an objective (Sullivan, 2003).

On the other hand, farmers craft sustainable agriculture based on the following point of views: farmers anticipate change; they are familiar with and recognize limits and resources; put up strong, equally favorable dealings; empower their employees; not contented with common business practices; business functions are management-intensive; take appropriate risks, and have a passion for farming (Dover and Talbot, 1987).

### **Benefits of Sustainable agriculture**

Sustainable agriculture adds to ecological preservation (putting things back to the environment), avoids contamination (waste so produced remains inside the farm's ecosystem), cutback costs (helps in reducing the overall cost involved in the process of farming), improves biodiversity (farms produce different kinds of animals and plants), it is favorable to animals (animals are cared for, treated humanely and with respect to be productive), cost-effective and beneficial to farmers/ pastoralists (receive a fair wage for their effort), shun societal impartiality (workers are offered competitive salaries and benefits; safe work environment, food satisfaction and proper living conditions), and beneficial to the ecology (decreases the use of non-renewable environmental resources) (Kapoor, 2010).

### **The goals of Sustainable agriculture**

In order to guarantee sustainable agriculture and productivity it is important that pioneering technologies like, modern irrigation systems, better crop varieties, superior soil quality and safeguarding the surroundings are insured (Dover and Talbot, 1987).

According to Sustainable Agriculture Research and Education (SARE) programme, profitable farm income, environmental protection, for instance, improving soil fertility, reducing non-renewable resources use (fuel and synthetic fertilizers and pesticides), curtailing adverse condition on wellbeing and on flora and fauna, water quality and other ecological resource, and supporting farm families and society are the main goals of sustainable development (USDA, 2017).

### **The Approach to sustainable agriculture**

Sustainable agriculture are meant to provide lasting resolution to problems faced by farmers, that is, it is a system approach with the general aim of stable wellbeing of the earth and its inhabitants. Sustainability is practical and its marker is attaining economic, social and environmental stability when all the three are treated as a single unit (Sullivan 2003). Sustainable schemes are those that best use ecological possessions and services and not destructing existing beneficial environmental resources (Scher and MacNeely, 2008; Kesavan and Swaminathan, 2008).

### **Sustainable agriculture techniques or practices**

The most common sustainable agricultural methods in use by farmers in order to realize important targets are: crop alternation, the use of cover

crops, soil fortification, use of natural pest predators, and IPM (Integrated Pest Management) (UCSUSA, 2017).

Social, economic, and environmental sustainability are closely linked. Poor farmers/pastoralists realize that ecological ruin will harm their livelihood in the long run. Thus, it calls for a strong social, economic and environmental policy for attaining sustainable agriculture (ibid.).

It is also important to note that implementation of sustainable farming practices, like, crop alternation, pest and better mechanical/biological weed control; soil and water management practices; and planned use of animal and green fertilizer; and use of other accepted or man-made inputs needs the expertise of farmers/pastoralists and the support of other relevant stakeholders (O'Connell, 1992).

Innovative technologies using modern irrigation systems, improved crop varieties, improved soil fertility and conserving the environment are supposed to guarantee sustainable agriculture. However, modern commercial agricultural systems, are commonly viewed as unsustainable and are typified by intensive tillage and cropping practices, high rates of mechanization and chemical input use, and have consequences on soil erosion, deteriorating soil fertility and forcing the acquisition of purchased inputs and as affecting food production, water quality and other likely resources, regardless of their short term payback (Dover and Talbot, 1987).

### **The future of sustainable agriculture**

Some 795 million people are struggling with hunger, and over two billion are a micronutrient deficient or over nourished. Furthermore, to make agriculture and food systems sustainable and eradicate hunger and poverty,



challenges like population pressure, climate change, natural disasters, pests and diseases, and other major changes happening in the global food systems need to be addressed (FAO, 2017).

In order to attain sustainability, protecting and improving the ecology is fundamental, and issues like climate change, energy, water scarcity and biodiversity, and soil degradation need to be dealt with. The social dimension covers labor rights and the health of communities. Food quality, safety and animal welfare are also imperative social aspects. The economic aspect demands that sustainable agriculture is fruitful, competent and viable. The benefits should also be seen in farm profitability, in thriving local economies, and all the way through the whole value chain. Furthermore, the idea of agricultural sustainability does not mean ruling out any new technologies or practices. If it improves yield to farmers and does not cause undue harm to the farm setting, it is considered as having some level of sustainability benefits. However, agricultural schemes accentuating these philosophies also tend to be diverse within setting and economies (Dobbs and Pretty, 2004; MEA, 2005). Sustainable agriculture generates food and other goods to farmers and markets, but also put in a range of valued public goods, such as clean water, wildlife habitats, carbon sequestration, flood protection, groundwater recharge, landscape amenity value and leisure/tourism. Thus, sustainability can be seen as both relative and case dependent and implies a balance between a range of agricultural and environmental goods and services (Pretty, 2008).

Recent practical studies had indicated that properly executed agricultural sustainability interventions and ventures arise from shifts in the factors of agricultural production (e.g. from use of artificial fertilizers to nitrogen-fixing legumes; from pesticides emphasis to natural enemies; from plowing

to zero-tillage). Intensification is considered to be better than extensive agricultural engagement in order to make better use of existing resources (e.g. land, water, and biodiversity) and technologies (Buttel, 2003; Tegtmeier and Duffy, 2004). Thus, the issue centers on the type of intensification, meaning utilizing natural, social and human capital assets, combined with the use of best available technologies and inputs (best genotypes and best ecological management) that minimize or eliminate harm to the environment, which is termed as sustainable intensification (Pretty, 2008).

### **Sustainable Agriculture and Food Security**

Many of the food insecure households, including subsistence farming groups, are net purchasers of food. Thus, other income generation means appear desirable in shaping food access for poor farmers and pastoralists. Furthermore, at household level, deficit of resources and earnings, susceptibility to natural hazards, and helplessness and prohibition has been the central causes of poverty and food insecurity (Degefa, 2005).

However, achieving food security and preservation of environmental equilibrium are challenges for professionals in the sector along with the vulnerability of agriculture to climate change. Moreover, sustainable agriculture can be seen as an environmental approach, where soil and water, living things and the surroundings live in accord with food chains (Abubakar and Attanda, 2013).

New farming methods with negative ecological effects are considered as potential causes of the emergence of sustainable agriculture and the curiosity to sustain agriculture and food scheme in conformity with environment started in the 1950s–1960s, though, the thoughts about

sustainability dates back to the oldest writings from China, Greece and Rome (Conway, 1997; Li, 2001; Pretty, 2002). At present, the interest is to come up with agricultural technologies and practices capable of ensuring sustainability, which: (i) do not have negative impact on environment, (ii) are easy to get to and valuable to farmers and pastoralists, and (iii) directs to food production increase and buoyant possessions on ecological goods and services (Pretty, 2008).

World total food production grew by 145% since 1960s. In Africa, Latin America and in Asia, a growth of 140%, 200% and 280% is recorded, respectively.. Furthermore, between 1980s–1990s a fivefold increase was witnessed in China. Though, started from a higher base, production doubled in the USA and increased by 68% in Western Europe in about the same period (FAO, 2005). While, world population grew from three billion to more than six billion, with a change in consumption pattern which puts additional burden on the Earth ((Kitzes, et al., 2008; Pretty, 2007). Although, there are reports which indicate that per capita agricultural production has exceeded population growth (Hazell and Wood, 2008); and for each person, compared with 1960, there is 25% more food; this cumulative data doesn't show regional differences. Nevertheless, in Asia and Latin America, a 76% and 28% increase per capita food production was reported in 2008, respectively. But Africa's per person food production increase was 10% lower in 2008 than in 1960, though the population has increased in 2008 whilst China's per capita food production grew by three fold over the same period. Furthermore, these increase in agricultural production raised millions out of poverty in many parts of the world. Yet, these cumulative progresses in productivity did not diminish the occurrence of hunger for each household. It is alarming that, near the beginning of the

twenty-first century, there are more than 800 million hungry people in the world. Where, one third are in East and Southeast Asia, and the other third in South Asia, one fourth in sub-Saharan Africa and 5% each in Latin America/ Caribbean and in North Africa/Near East. However, there has been progress when compared to the 1970s where 960 million people were underfed, which consisted of one-third of the people in developing countries (Pretty, 2007).

### **Conclusion**

Sustainable agriculture is that form of agriculture which endeavors to bring into being sufficient food to meet the needs of current demand without draining soil productiveness and the ecology for the coming generation, and sustainable farming is expected to be a low input agriculture and capable of maintaining production and cost-effectiveness.

Thus, sustainable agriculture is one that supports profitable production, protects environmental quality, uses natural resources efficiently, provides consumers with affordable and high-quality products, decreases dependency on non-renewable resources, enhances the quality of life of farmers/pastoralists and other communities, and that which will last for generations to come.

Furthermore, sustainable agriculture makes use of nature's goods and services and properly utilizes technologies and practices locally adapted to the place. Agricultural systems with high level of social and human resources are more able to innovate in the face of uncertainty (Olsson and Folke, 2001; Pretty and Ward, 2001).

This suggests that there are many pathways towards agricultural sustainability, and no solitary and more likely widely applicable arrangement of technologies, inputs and ecological management is recommended to a particular locality. .

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