ASSESSMENT OF YOUTHS INVOLVEMENT IN SOILLESS FARMING IN OGUN STATE, NIGERIA.

BY

Wisdom Chike ANONYUO

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CERTIFICATION

This is to certify that Wisdom Chike ANONYUO, with matriculation number AGR1700010 carried out this research work in partial fulfillment for the award of the degree of Bachelor of Agricultural Economics and Extension Services, Faculty of Agriculture, University of Benin, Benin City, Nigeria.

_____	_____
MR GODWIN UWANA	DR. (MRS) M.J KONYENIKON
Project Supervisor	Head of Department
DATE: _____	DATE: _____

DEDICATION

This project is dedicated firstly to God Almighty for His grace and mercy. I also wish to dedicate this project work to my parents Mr. and Mrs. Donald Anonyuo, for their show of love, their support, for always showing up for me and for not giving up on me throughout the course of my study.

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ABSTRACT

In Nigeria, agricultural practices remain largely unattractive to people, especially the youths for various reasons which include; low returns on time and input investments, limited access to land, low investments in infrastructure necessary for efficient value chain. Hence, the need to boost agricultural productivity has become a major topic of discourse among development institutions. This study accessed the involvement of youths in soilless farming in Ogun State, Nigeria. The specific objectives are to examine the socioeconomic characteristics of youths involved in soilless farming, to examine the factors that influence youths' involvement in soilless farming, to ascertain the youths' attitude towards soilless agriculture technology, to examine the benefits of soilless farming to the youths involved, investigate the challenges hindering the full engagement of youths in soilless farming.

A two-stage sampling procedure was used to select a total of 102 respondents for the study and primary data was collected with the use of questionnaire and results were analyzed using Pearson Product Moment Correlation (PPMC).

The mean age of respondents was the ages of the respondents showed that the majority of the respondents were between the ages of 23 – 27 years, 59% were males, 41% were females. 84% were single, while 15% were married.

Also, 72% had tertiary education. 62% of the respondents earned #50,000 naira or less per month, while 27% of the respondents earned between #50,000 to #100,000 naira. Furthermore, 93% of the respondents noted that they would recommend soilless farming to other young people. Finance 50% and environmental factors 30.4% were major factors hindering respondents full engagement.

In addition, the result revealed that respondents' attitudes towards soilless farming have a positive relationship towards the socioeconomic characteristics (age

(r=0.882), sex (r=0.820), marital status (r=0.560), education (r=0.790), course studied (r=0.849), farm name (r=0.783), position at work (r=0.869), duration of involvement (r=0.854) and income (r=0.849)).

In conclusion, youth involvement in soilless agriculture is low and can be improved upon through trainings, publicity and government investment in public orientation and the benefits of practicing soilless farming.

CHAPTER ONE

1.0 Introduction

1.1 Background to the study

The agricultural sector significantly contributes to the attainment of national food self-sufficiency by accounting for over 90% of total food consumption requirements and it also aids in the maintenance of a healthy populace as stated by the Alliance for a Green Revolution in Africa (AGRA) in 2017. The food industry is very important for developing economies, reducing poverty, and making sure people have enough food in many poor countries. It helps people make money, gives people jobs, and gives food to people. However, despite the nation's great potentials in agricultural production, it is alarming to note that most of the African countries still depend on food importation. Importations of food are expected to increase from thirty five billion United States dollars to above one hundred and ten billion dollars by 2025 (FAO, 2017).

The agricultural sector plays a pivotal role in driving economic growth and development, alleviating poverty, and ensuring food security in many developing nations across the world. This is primarily because it contributes to income generation, generates employment opportunities, and provides sustenance for the population. Nevertheless, the fulfilment of these potential benefits of the agricultural sector hinges on the increased productivity of farmers (Awotide *et al*, 2016). In

recent years, a host of challenges, such as climate change and the diminishing per capita land available for agricultural production due to a growing population, have significantly hampered agricultural productivity (Roos *et al*, 2017).

For example, in the African context, a multitude of factors are responsible for the low productivity of agriculture. These factors encompass a lack of awareness about improved agricultural practices, limited utilization of fertilizers, insufficient irrigation, suboptimal use of improved seeds, conflicts, weak institutional support, abscence of incentives, the prevalence of diseases and pests, and ineffective policies (Awotide *et al,* 2016; Roos *et al*, 2017).

Based on the findings of Osabohien *et al* (2019), in West Africa, the majority of farming households are primarily engaged in subsistence farming traditional, rudimentary tools such as hoes and cutlasses. These tools only yield a limited agricultural output intended for family consumption. This situation is concerning, particularly when considering the projected global population of approximately 9-11 billion by 2050 (Roos *et al*, 2017).

In the case of Nigeria, agricultural practices have failed to attract a significant number of individuals, especially the young people. There are various reasons for this, including the unattractive returns in terms of time and input investments, limited access to land, inadequate investment in the essential infrastructure required for an efficient agricultural value chain. Consequently, there is a pressing need to enhance

agricultural productivity, which has become a central topic of discussion among development institutions. The solution proposed involves the adoption of improved agricultural technology, which offers a means to transition from the current state of low productivity characterized by subsistence farming to a more commercial agricultural model. This shift has the potential to increase the market share of agricultural output, thereby promoting market competition and reducing production, processing and marketing costs. Ultimately, this will lead to a decrease in the actual cost food price while encouraging greater involvement of young people in agriculture (Awotide *et al*, 2016).

Although history shows that soilless agriculture has existed for a long time, it was not a widely used technique for cultivating crops at the time. In order to achieve increased production and higher revenues, it implies soil-based agriculture that runs under controlled conditions (EL-Kazzaz, 2017). Technically speaking, it is possible because the photosynthetic process does not take into account soil. It makes it possible to keep an eye on the fertilizers and pesticides that are applied to crops on a regular basis (Kumari *et al*., 2021).

It dated far back as the early 60s, when Sir Francis Bacon, who was regarded as the Father of soilless agriculture, published a book titled Sylva Sylvarum, after which several scientists also worked on it, before it finally became acceptable. The hanging gardens of Babylon and the floating gardens of Aztecs of Mexico are also examples of Hydroponics culture. Initially only three crop species were grown when

hydroponics was applied commercially: tomato, lettuce and herbs, however, recently, wide range of crops are successfully grown hydroponically, e.g. pepper, strawberry, cucumber, potatoes, roses, (Macwan *et al*, 2020).

In accordance with the type of substrates and containers, the plant's nutrient system, and drainage, soilless agriculture can be divided into three categories, namely hydroponics, aeroponics, and aquaponics, according to Kumari *et al*. (2021).

Simply put, hydroponics—also referred to as hydroculture—is the process of growing plants without soil. In addition to being fed a solution with the ideal ratio of primary, secondary, and micronutrients, plants are grown in an inert media, such as pebbles, coco coir fiber, etc. Hydroponically grown fruits, vegetables, herbs, and flowers are all possible. Because there are so many nutrients accessible, the plants grow much larger and develop a deep root system more quickly (EL-Kazzaz, 2017).

On the other hand, the most sophisticated kind of soilless agriculture is aeroponics. The roots in this system hang in the air under the reservoir cover and are misted with nutrient solution found in the reservoir by a stressful pump to cover the entire area around the root with nutrient solution mist (EL-Kazzaz, 2017). In this system, sealed root chambers are used as reservoirs for nutrient solution, and the plants above the reservoir cover (polystyrene or other material) will be supported or hung through holes in the expanded cover. Inside of a protected structure, it has been proven to be mostly ideal for growing leafy vegetables like spinach, lettuce, etc. (Kumari *et al*, 2021).

Aquaponics, also referred to as aqua agriculture, is an aquaculture method that combines hydroponics, in which plants are grown in water in a symbiotic environment, with aquaculture, in which aquatic animals such as snails, fish, crayfish, and prawns are cultivated in tanks. In the system, water from an aquaculture system is transferred to a hydroponics system, where toxic by-products are first converted into nitrites and then into nitrates by nitrifying bacteria that reside on the surface of the grow bed media, which are then used as nutrients by the plants. The water is then cleaned and returned to the aquaculture system (EL-Kazzaz, 2017).

Vegetables, garden plants, and other types of plants have all been grown using soilless farming techniques over time. According to Hussain *et al*. (2014), practically any plant may be grown using the method. Cereals, fruits, fruit vegetables, leafy greens, condiments, flower/ornamental crops, medicinal crops, and fodder crops are a few of these crops. There are a number of benefits to using soilless farming techniques in agriculture. It has been found to offer solutions to the issues that traditional soil farming encounters. Hydroponics, which is a water-efficient method of production, allows for the recycling and reuse of water, so that no water is wasted, according to Okemwa (2015). Furthermore, Khan *et al*. (2018) acknowledged that crops can be shielded from severe weather. Electricity can be produced using solar or wind energy to operate the hydroponics system. According to Solanki *et al*. (2017), crops grow two times more quickly in hydroponic systems than they do in standard ones. Contrarily, aeroponics allows for maximum space utilization because twice as

many plants can be accommodated per unit floor surface. Additionally, it guarantees the exportation of soil-free plants grown from cuttings (Aatif *et al*., 2014).

Many industrialized and emerging nations, including Thailand, Latin America, Kenya, and some areas of Nigeria, employ soilless agriculture, which has been identified as one of the methods.

1.2 Statement of research problem

The drawbacks of conventional agriculture are beginning to exceed their advantages. The practice of soil farming has negative effects due to the increased use of pesticides and herbicides, the presence of disease-causing organisms, the depletion of nutrients as a result of erosion, flooding, and continuous cultivation, soil compaction, soil deterioration, and many other factors (Ike *et al*., 2019). According to Ajibade and Oyeniyi (2018), the continuous drop in the labour force caused by rural-to-urban migration has an effect on maximum productivity and yield, which leads to a situation where demand outweighs supply of agricultural products.

In addition, the country's population is expected to grow to between 9 and 11 billion people by 2050 (Roos *et al*., 2017), creating a demand for additional food that can only be satisfied by growing food production. New farming framework techniques must be developed and advanced now to avoid a future food problem (Masqood and Farhan, 2022).

However, the government and the food sector are both concerned about the adoption and commercialization of new and existing technologies at the farm and industry levels (Ugochukwu and Phillips, 2018; Chavas and Nauges, 2020). Improved crop varieties, climate smart agricultural technologies, integrated pest management, conservation agriculture, integrated fertilizer management, soilless agriculture, etc. are some of the technologies that have recently been created (Sennuga *et al*., 2020).

However, due to issues such expensive technology costs, a lack of technical expertise, a lack of manufacturing inputs and resources, high maintenance costs, etc., the adoption of these technologies is still low (Geza *et al*., 2021; Ikehi *et al*., 2022). According to studies (Mwangi and Kariuki, 2015; Geza *et al*, 2021; Ikehi *et al*, 2022) stakeholder investment, provision of finance facilities, proper information, institutional support, and training farmers with adequate technological skills, among other things, will aid in technology adoption.

In Nigeria, soilless agriculture is a relatively new agricultural technology. Mr. Adebowale Onafowora, the CEO of the BIC Farms concept, pioneered it in the nation in 2013 (Tijani, 2022).

The advantages of this sustainable agricultural practice, according to Ajibade and Oyeniyi (2018), include higher productivity, a need for little labor, not being season-bound, low management costs, the absence of weed competition, the absence of soil-borne pests and diseases, water and land conservation, and adaptability to areas

affected by drought, flooding, and other soil-based limitations. They further stated that it is a practical strategy for eliminating hunger from the globe by the year 2030. Additionally, the issue of declining arable land resulting in conflicts between farmers and herders can be addressed using soilless agriculture (Ugwumba, 2018; Pradhan and Deo, 2019).

Given these benefits, it is urgent to take into account this system as a key agricultural strategy rather than just an auxiliary or alternative farming technique in Ogun State (Sownya *et al*., 2022).

Numerous trainings have been held and are still being held to provide farmers, particularly young people, with the technical know-how necessary to help them practice the technology. The majority of research on the subject has solely addressed smallholder farmers' desire to use the technology and their demographics (Ajibade and Oyeniyi, 2018; Kumari *et al*, 2021; Adepoju and Olaseni, 2022).

This study aimed at studying the involvement of youths in soilless farming in Ogun State, Nigeria by finding answers to the following research questions;

i. What are the socioeconomic characteristics of youths involved in Soilless farming in Ogun State?
ii. What factors influence youth involvement in Soilless farming in Ogun State?
iii. What are the attitudes of youths towards Soilless Farming in Ogun State?
iv. What are the benefits of Soilless farming to youths in Ogun State?

v. What are the challenges hindering youths from engaging fully in Soilless farming in Ogun State?

1.3 Objectives

The main objective of this study is to assess the involvement of soilless agriculture technology among youths in Ogun State, Nigeria. The specific objectives are as follows;

i. To describe the Socioeconomic characteristics of youths involved in soilless farming in Ogun State;
ii. To examine the factors that influences youths involvement in soilless farming in Ogun State;
iii. To ascertain the youths' attitude towards soilless farming in the study area;
iv. To examine the benefits of soilless farming to the youths in Ogun State;
v. To investigate the challenges hindering youths from engaging fully in Soilless farming in Ogun State.

1.4 Hypothesis of the study

Ho1: There is no significant relationship between the socioeconomic characteristics of respondents and their attitude towards soilless farming.

1.5 Justification of the study

According to Ajibade and Oyeniyi (2018), soilless agriculture is a sustainable agricultural method that has the potential to increase agricultural productivity and subsequently Nigeria's socioeconomic growth. The goal of this research is to better

understand young participation behaviours and the drivers behind soilless farming among them.

The findings of this study will assist Nigerian agricultural research and training institutions, private farms, etc. in identifying obstacles preventing youth from fully participating in soilless agriculture and the best ways to overcome them to promote active participation. Government, private, and non-governmental development organizations, policy makers, and investors will receive information from the research about the obstacles that prevent youths from fully participating, enabling them to collaborate and offer support to youths in order to encourage and increase involvement.

In order to raise awareness and improve understanding among young people, the research will also give training centers for soilless agricultural information on the channels that may be used more effectively to disseminate information about soilless agriculture. Youth involvement in soilless agriculture would eventually pave the way for it to gain more traction and acceptance in Nigeria, leading to increased food production, youth employment, and a decrease in the problem of food insecurity.

Finally, this study aims to shed light on the potentials of hydroponic farming, stressing the likelihood that farmers in both rural and urban areas of the study region will adopt it as a solution to food insecurity and a low standard of living. The use of hydroponics is well-established in biological research and instruction, in addition to being a technique with commercial applications (Pandey, Vanita, and Singh, 2009).

CHAPTER TWO

LITERATURE REVIEW

2.0 The concept of youth

The idea of youth is socially manufactured rather than physiologically established, thus it can change over time, depending on how a society is doing economically, and even on who you ask. Around the world, it differs in many societies and cultures.The European Youth Policy claims that there is no one age group that accurately describes "young people" in Europe. Some national youth policies have stringent lower and upper age restrictions, whilst others operate with a "children and youth policy," blurring the lines between children and youth. The European Commission White Paper on Youth (Denstad, 2009) specifies that young people between the ages of 15 and 25 are the target audience for youth policy in many European nations.

Youth, as defined by the United Nations (UN), is anyone between the ages of 15 and 24. The age range can be significantly greater for policy reasons. Youth in Africa are defined specifically as people between the ages of 18 and 21, depending on the country. However, a young person's legal status changes greatly depending on the situation. Legal minimum ages frequently change depending on the gender as well as the age limit's intended use, such as marriage, military service, alcohol access, voting rights, criminal responsibility, consent to medical treatment, consent to sexual

activity, etc.

In the majority of Nigerian civilizations, youth is understood as the movement from childhood to maturity, which includes a number of formal rites of passage. These rituals are important simply because by taking part, a person assumes a new position and status that is made legitimate by actual community participation and acknowledgement. According to the African Youth Charter from 2006, "youth" is defined as anyone between the ages of 15 and 35. Additionally, the 2009 National Youth Policy of Nigeria defined youth as being between the ages of 18 and 35. However, the 2019 National Youth Policy, which was released, sets a 29-year-old upper age limit for the chronological definition of youth based on the demographic data that is currently available.

2.1 Youth Involvement in Agriculture

For many rural Africans, agriculture is their main source of income and is a key driver of economic development (Dercon and Gollin, 2014). Its contribution to the security of food and nutrition, the creation of jobs, and the elimination of social inequality and poverty in Africa cannot be emphasized. The industry also offers business prospects, which are ideal for creating jobs, especially for young people. Additionally, the expanding urban markets in Africa offer a chance for higher demand for prepared and processed meals, which would afterwards draw a lot of private sector investment for small, medium, and big farmers and other players in the food system. According to AGRA (2020), maximizing agribusiness in Africa might

lead to the opening of markets worth more than $100 billion United State Dollar per year by 2025.

Since there haven't been enough employment possibilities to keep up with the youth population growth for some time, unemployment in Nigeria has continued to rise. Youth made up more than half of Nigeria's population in 2013, which was expected to be 167 million people, with an estimated 11.1 million of them being unemployed, according to the National Population Commission. By 2018, there were 20.9 million young people without jobs, and employment rates had climbed by 23.1% (National Bureau of Statistics, 2018). Over time, several governments had established various strategies to confront this threat. The government's initial response was the development of initiatives like Operation Feed the Nation (OFN), Directorate of Food, Road and Rural Infrastructure (DIFFRI), and others that assisted in giving people with an interest in agriculture quick and direct employment.

Nevertheless, a number of these programs encountered a variety of difficulties, including poor administration and implementation, financial difficulties, underwhelming replies from prospective trainees, inconsistent policies, and a lack of trained resource employees managing the training programs (Akande, 2014). Additionally, the government's incapacity to include youngsters in the mainstream has been one of the key failures of agricultural development programs that have been enacted throughout the years.

Youth involvement, according to Checkoway (2011), is the active involvement of young people in adult organizations that is based not only on their token presence or passive presence, but also on quality, such as when people have a genuine impact on the process, influence a particular decision, or produce a positive outcome. Participation, engagement, community youth development, inclusiveness, and volunteerism are other synonyms connected to involvement. The assumption behind youth involvement is that young people are capable citizens as opposed to merely passive consumers and beneficiaries of services. It entails allowing youth to participate in institutions and decision-making processes that have an impact on their lives.

The challenges that come with opportunities in the agricultural sector, particularly those that are so important to young people, must be adequately addressed if active youth involvement in it is to be achieved (Chinsinga and Chasukwa (2012); Awotide *et al* (2016); Roos *et al* 2017). These challenges include lack of access to finance, extension services, production inputs and resources, poor and/or limited infrastructure markets, and training. According to Sumberg *et al*. (2017), the socioeconomic environment of young people primarily characterizes farming as a "poor man's" career, marked by long hours of work with low economic returns and social standing; this indicates the need for a shift in young people's perceptions of agriculture. According to Geza and colleagues (2021; Ikehi and colleagues 2022)

changing young perception will necessitate the supply of financial facilities, proper information, institutional support, equipping youth with adequate technology skills, design of youth friendly policies, etc.

Youth participation in programs focused on issues that concern them, such as reproductive health, education, social protection, the environment, etc., should also be encouraged. Young people must therefore be involved in agriculture through entrepreneurial endeavors, policy development, participation in value-chain activities, and lobbying within the institutions and systems related to the food system.

2.2. Youth and Agricultural technologies

The adoption of new technologies is increasing in the agricultural sectors, and in some regions of the world, this acceptance has transformed modern agricultural technology, increasing production of quality and quantity agricultural products while decreasing labor and loss (Kwaye *et al*., 2021). According to Tang *et al*. (2021), technology will play a significant role in the agriculture industry in the future decades. Farmers will have more access to information, become knowledgeable and productive through smart farming with automated operations, and this will all be made possible by technology.

Especially in the areas of smart farming, drone application, decision-making, sustainability, and food productivity, technology is essential to today's world of agricultural production (Pathak *et al*., 2019; Abdullahi *et al*., 2015; Berhanu *et al*.,

2021).

According to Porter and Heppelmann (2015), technology is the use of equipment and scientific knowledge to increase agricultural productivity while reducing the need for hard labor. These tools reduce the environmental impact of farming, lighten workloads, and improve resource integration.

Additionally, precision agriculture has made it possible to assess the soil moisture accurately and to immediately plant seedlings on farmlands. Additionally, technology applications like sensors, such as humidity sensors, CO2 concentration sensors, etc., limit the consumption of surplus resources like water and nutrients while having a significant impact on fluctuations in labor force, fertilizer, fallow time, etc. Another is a GPS device, which enables farmers to stroll through farmland while tracking it to measure the entire area (Pathak *et al*., 2019; Kwaye *et al*., 2021). According to Dagunga *et al*. (2020), the adoption of technology in the agricultural sector is a significant step toward achieving food security.

The relationship between technology and youth farming was found to be statistically significant in a study conducted by Kwaye *et al*. (2021) to determine factors that influence youth in Ghana to enter the farming industry. This finding suggests that technology was a key factor influencing youth involvement in farming.

2.2 Soilless Agriculture- Concept and definition

Any technique for producing plants that does not use soil as the rooting medium and instead provides nutrients to the roots through irrigation water is known as soilless agriculture. Following the proper concentration of nutrients being dissolved in irrigation water, the crop is then given access to the nutrient solution. It functions in a controlled environment to achieve increased earnings and productivity (EL-Kazzaz, 2017).

Growing a variety of horticultural crops in various pots, containers, pipes, and trays with different growing mediums or substrates contained inside grow bags, such as vermiculite, rock wool, and coconut fiber or coco pit, is known as soilless agriculture. Technically speaking, it is possible because the photosynthetic process does not take into account soil. The usage of fertilizers and pesticides on farms may be monitored thanks to technology (Kumari *et al*., 2021). Soilless agriculture is a modern method of producing plants that relies on giving them the necessary nutrients and water (Azizoglu *et al*. 2021).

Another term for soilless agriculture is soilless farming or soilless culture. In East Africa, there is a growing trend toward smart agriculture, which includes growing crops with or without a media or using a flowing nutrient solution. Instead of using soil, the medium could be an organic or inorganic solid material. To give sustenance for the plant, it could either take the form of a single or combined

substance. Vermiculite, sawdust, perlite, rice hulls, coco-peat, and other materials are some examples of the media. Utilizing the technology in a controlled environment ultimately allows for cultivation in locations with unfavorable agricultural conditions, such as constrained space, subpar soils, etc. The method promotes plant growth while regulating the amounts of water, dissolved oxygen, and mineral salts like nitrogen, potassium, phosphorus, calcium, sulphur, and iron. At their root zone, they also require water, light, and carbon dioxide (Gumisiriza *et al*., 2022).

2.3 History of Soilless Agriculture

It has been possible to grow crops without needing soil since the early 1960s. The 1627 book Sylva Sylvarum by Sir Francis Bacon, the Father of Scientific Method, which he named "Water Culture," was the first publication on cultivating terrestrial plants without soil. In 1666, Irish scientist Robert Boyle wrote about the earliest attempts to cultivate plants with their roots submerged in water. John Woodward published the results of research on the soilless culture of spearmint in 1699, concluding that less pure water sources are preferable than distilled water for growing plants. In the years between 1859 and 1875, two German botanists named Julius von Sachs and Wilhelm knop improved the mineral solutions used for soilless growing of plants. Professor William Frederick Gericke of the University of California at Berkeley made the initial suggestion for a commercial water culture in

1929. He later invented the term "hydroponics" to refer to the practice of growing plants with roots in a liquid medium. Additionally, he published a book on soilless gardening in 1940. The Hoagland solution, created in 1938 by Dennis R. Hoagland and Daniel I. Arnon, two plant nutritionists from the University of California, has been used in hydroponics ever since. Vegetables have been grown hydroponically since 1930 on Wake Island, a rocky atoll in the Pacific Ocean that serves as a Pan American Airlines fuelling station (Macwan *et al*., 2020).

2.4 Types of soilless agriculture

There are two basic types of soilless culture: closed soilless culture and open soilless culture, according to Kazzaz (2017), Pradhan and Deo (2019).

Closed soilless culture: The dissolved supplements are processed again in sealed soilless buildings, where the supplement concentrations are also monitored and balanced. In hydroponic systems, adjusting the supplement is a test, and the dissolved supplements must be examined and dichotomized at least once each week. Results must balance the dissolved supplements. The dissolved supplements may escape the balance if not properly controlled. Both fundamental and sophisticated soilless culture frameworks are integrated in closed soilless structures.

Open soilless culture: For each irrigation cycle, a new dissolved supplement is intricated in open soilless structures. The dripping structure is typically used to convey the dissolved nutrients to the plants. In order to keep fertilizer balanced in the root zone, an acceptable keep run-off must be maintained. Every soilless culture only uses substrates, and open soilless cultures can utilise dribble frameworks. However, if a reservoir is needed to recirculate the nutritional solution, a drip system is used as a closed system.

It is from the soilless culture categorization that the three major divisions came from, which includes: aquaponics, aeroponics, and hydroponics systems of soilless agriculture.

2.4.1 Aquaponics

It is a soilless farming system where plants and fish are raised in an associated relationship as the water is recycled through the system and plants uptake nutrients acquired from recycled fish waste water (Gumisiriza *et al,* 2022). It is also known as "Aqua agriculture", a system of aquaculture in which aquatic animals such as snails, fishes, crayfish, prawns are grown in tanks in combination with hydroponics in which plants are grown in water in a symbiotic environment. In the system, water from an aquaculture system is being passed to hydroponics system, where the toxic by-products are broken down by nitrifying bacteria that live on the surface of the grow bed media initially into nitrites and subsequently into nitrates,

which are utilized by the plants as nutrients, and the water is then cleansed and passed back into the aquaculture system (Kazzaz, 2017).

In order to simultaneously produce plant and animal goods, hydroponics and aquaculture are combined in aquaponics. In the Aquaponics system, waste excreted by aquatic creatures is converted into nutrients by bacteria, which are then removed by plants, improving the water quality for the aquatic species. The research studies conducted in the early 1970s by aquaculture researchers, who experimented with producing fish in land-based tanks with continually recycled water (e.g., recirculating aquaculture systems), have had a significant impact on the system. The fact that aquaponic systems improved water quality and offered a second source of income in the form of edible plants helped them stand out from other methods of recirculating aquaculture. Because the system resembles natural systems, generates effective water, and has less of an impact on the environment than some types of aquaculture, it is promoted as a sort of sustainable agriculture. It is a sustainable food production system that makes use of biometric natural systems to help reduce inputs and waste as well as circular economy concepts. It is also a resourceful mechanism that melds flawlessly with the expansion of intensive agriculture in a sustainable way (Tyson *et al*., 2011; Joly *et al*., 2015). There are several sizes and purposes for aquaponic systems. It could be for recreational or personal use, for community and economic development, as a science education tool, or as a way to increase food production in urban areas

where opportunities are limited. Due to environmental contamination and space constraints, conventional agricultural output is restricted (Love *et al*., 2014). Any successful aquaponic system, according to Yep *et al*. 2019, must take into account the effects of the system's design, the pairing of plant and fish species, microbial populations, system water pH control, aeration and filtration technologies, acceptable nutrient ranges, nitrogen levels, quantity and type of feed, pest management, and effective marketing.

The system's administrators are most worried about these elements. Aquaponics, taken more broadly, is a more sophisticated system that integrates many fields, including aquaculture, microbiology, ecology, horticulture, agriculture, chemistry, and engineering.

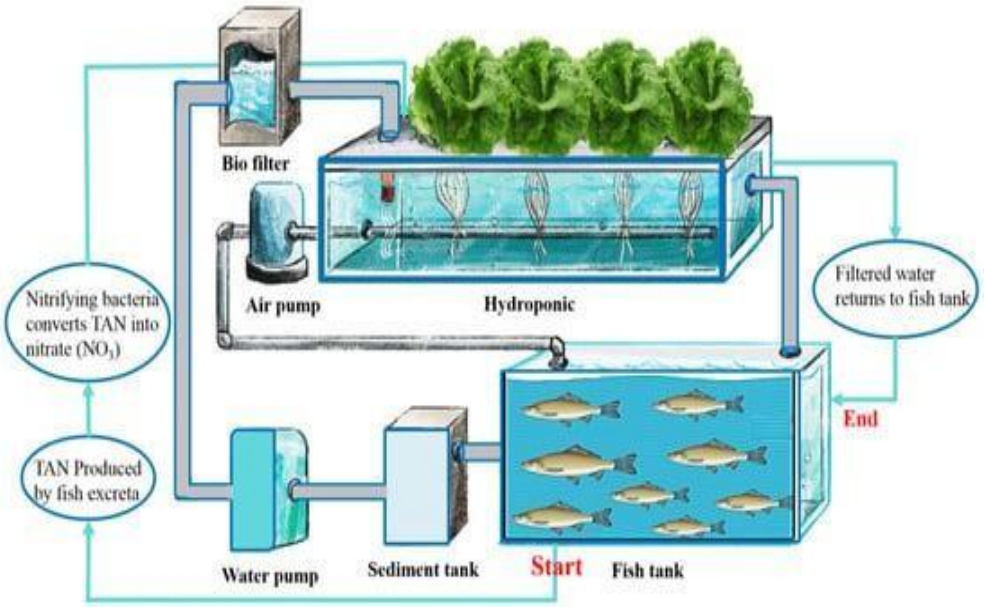

Figure 1: System diagram of Aquaponics

SOURCE: mdpi.com

Figure 2: A single-loop Aquaponics system

SOURCE: New Mexico State University (pubs.nmsu.edu)

2.4.2 Aeroponics

On the other hand, this method uses tools like foggers to provide nutrients to plant roots in the form of a mist. It is the most advanced kind. The roots in this system hang in the air under the reservoir cover and are misted with nutrient solution found in the reservoir by a stressful pump to cover the area around the root with nutrient solution mist. In this system, sealed root chambers are used as reservoirs for nutrient solution, and the plants above the reservoir cover (polystyrene or other material) will be supported or hung through holes in the expanded cover. Under protected structures, it is mostly shown to be suitable for producing green vegetables like spinach, lettuce, etc. (Kazzaz, 2017; Kumari *et al*, 2021; Gumisiriza *et al*, 2022).

Without using soil or other agglomerated media, aeroponics is the practice of growing plants in an environment of air or mist. The Latin words "aero" (air) and "ponic," which indicate labor (work), are the roots of the English word "aeroponic." It is an optional tool for soilless culture in situations with regulated growth, such greenhouses. This technique involves delivering a nutritional solution through a misting device while enclosing the root system in a dark space. It has been extensively used to grow aesthetic plants like chrysanthemums and poinsettias as well as horticultural crops including tomato, lettuce, and cucumber. Due to a rise in demand for higher quality, more effective methods of producing seeds, the system has also been used for seed production. Aeroponics reduces

contact between the plant and the support structure, allowing for the plant's unrestricted growth. Since a mist is easier to manage than a liquid in a zero gravity setting, the technology is frequently employed for NASA space research activities. The drip irrigation, environmental management, non-damaging plant support, and seed germination methods utilized by traditional agriculturalists for decades have all been improved by aeroponics. Excellent aeration and the capacity to regulate humidity, pH, temperature, and water conductivity under a greenhouse are the key benefits of aeroponics (Reyes *et al*., 2011; Gopinath *et al*., 2017).

Aeroponics is one of the quickest ways to propagate potato seeds for potato output, according to Buckseth *et al*. (2016). Large quantities of minitubers can be produced using this method in a single generation, which eliminates the need for additional field developments and saves money and time.

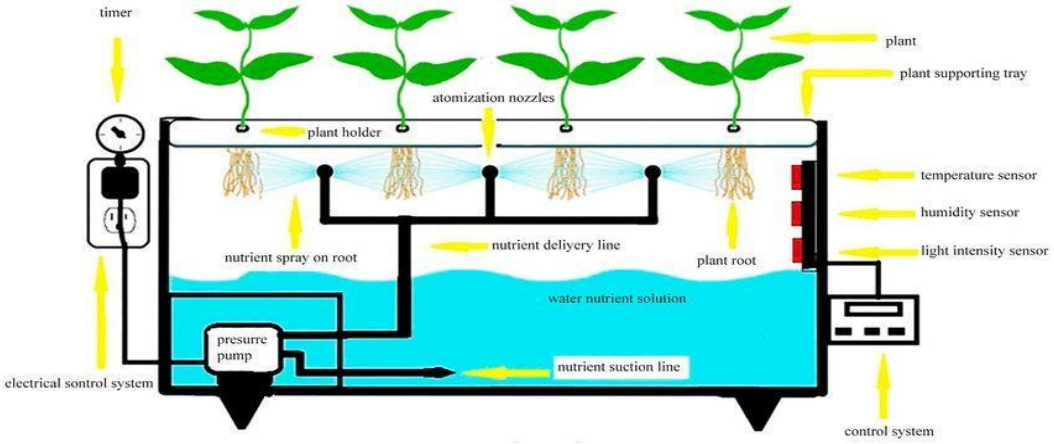

Figure 3: Plant growing using a computer controlled technique

SOURCE: researchgate.net

Figure 4: A vertical aeroponics system

SOURCE: Brian Barth: How does aeroponics work? (Modernfarmer.com)

2.4.3 Hydroponics

This farming method involves nutrient-rich mineral water used to produce crops on a medium. The technology utilizes less water than traditional soil farming, and it has been successfully used to grow a variety of vegetables, including lettuce, spinach, cucumbers, and tomatoes, among other crops, because they require little in the way of nutrients and have a quick growth cycle. The potential for hydroponics to produce higher yields in a smaller amount of space and to support food security by growing food vertically have been revealed by recent trends in agriculture (Gumiziria *et al*., 2022). As a result, hydroponics should be taken into consideration as a better farming option for East Africa, which is grappling with the problems previously mentioned. The term "hydroculture" is another name for it, and it refers to the practice of growing plants without soil. In addition to being fed a solution with the ideal ratio of primary, secondary, and micronutrients, plants are grown in an inert media, such as pebbles, coco coir fiber, etc. Hydroponically grown fruits, vegetables, herbs, and flowers are all possible. Because there are so many nutrients accessible, the plants grow much larger and develop a deep root system more quickly (Kazzaz, 2017).

Cucumber, lettuce, tomato, herbs, and a variety of flowers have all been successfully grown using hydroponics. It is better than the traditional cultivating system because it promotes quick development, high yield, simplicity of handling, effective water use, and reduced fertilizer use. In hydroponics, the aqueous

solution's nutrient concentration is managed and tracked in order to spot nutrient toxicity or deficiency signs in the plant system. In order to conduct experimental studies on native and exotic crops for commercial or medicinal purposes as well as on traditional crops like vegetables and ornamental plants, hydroponics has proven to be very helpful (Adrover *et al*., 2013; Arumugam *et al*., 2021).

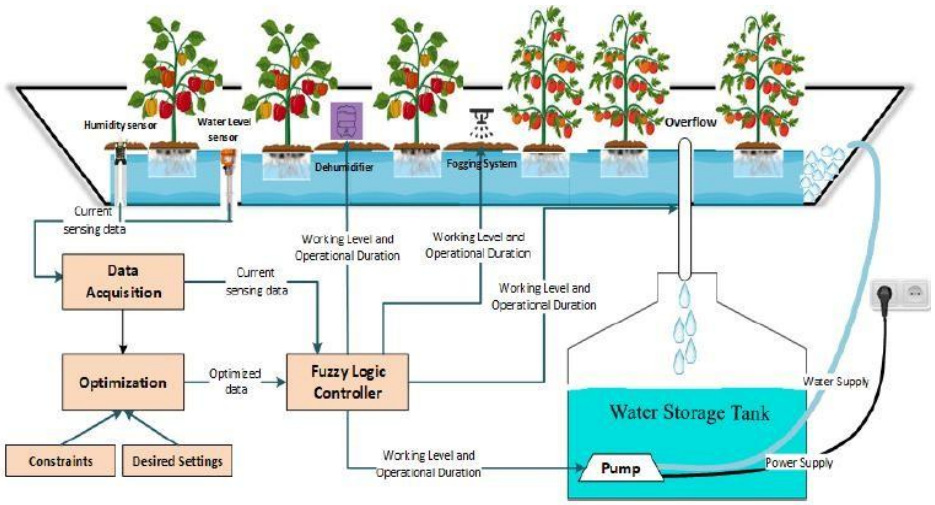

Figure 5: Hydroponics system with proposed optimization and controlled scheme

SOURCE: Researchgate.net

Figure 6: A high tunnel complete hydroponics greenhouse

SOURCE: bicfarmsconcepts.com

2.4.4 Types of Hydroponics

1. Wick or passive system:

It is a significantly less expensive technology in which the nutrient solution is not recycled but instead is absorbed by the plant system through the capillary action of the roots and fibers that carry water to plants. The technique is especially helpful in areas where access to energy is a major issue because it does not require electricity to transfer nutrient solutions. Even though this method is straightforward, teachers can effectively use it to teach students the fundamentals of hydroponics in the classroom. It is mostly utilized for small-scale production, and the long-term growing of crops is not advised.

2. **Nutrient film technique (NFT)**:

Nutrient Film Technique is a sealed system of hydroponic system where the nutrient solution is recycled and recirculated to provide a highly oxygenated nutrient solution to the roots of plants through a channel of PVC pipe arrangements. It was developed by Allan cooper in the 1960s. In the system, plant acquires the essential nutrients and oxygen from the thin film of nutrient solution through their roots. The roots are suspended in a nutrient solution that is typically pumped from a holding tank to a sloping pipe, where the runoff solutions are collected and the cycle is repeated on a regular basis. Initially, plants are cultivated in opaque containers on opaque growth material. This NFT system has just been

upgraded with numerous growing and supporting media.

3. Deep water culture (DWC) or Deep flow technique (DFT):

Deep Flow Technique is another name for Deep Water Culture. Plants are grown on floating or hanging supports, such as rafts, panels, or boards, in a container with a about 10–20 cm-deep nutritional solution. A pump and an aeration equipment make up the system used to cultivate plant roots. The plants' roots are continuously made to immerse in the nutrition solution with the right amount of aeration. To maximize growth, the oxygen content, conductivity, and pH must be regulated.

4. **Drip hydroponic system**:

Two containers—one on top and the other at the bottom—make up the drip hydroponics system. Plants are positioned on the top container in this arrangement, and nutritional solutions are positioned in the lower container. Oxygenated nutrient solutions are delivered up to drips close to the root zone using a pumping device. The used nutrient solution will be returned to the nutrient tank after filtering. Placing aquarium stones in the fertilizer solution will oxygenate the water. This drip hydroponics system can be used to grow plants with deep roots.

5. Ebb and flow system:

The drip hydroponics system, in which there are two containers—one at the top with plants, the other at the bottom with nutrient solution—is very similar to the hydroponics Ebb and Flow system. Instead of pouring nutrients through drippers, this hydroponic method floods them directly to the plant roots. The amount of nutrient solution is controlled by and sent to the bottom container through an overflow pipe that is installed in the top container. Plants with huge root balls are cultivated in this technique similarly to the drip hydroponics system.

2.5 Advantages of soilless agriculture

Soilless agriculture offers a range of advantages. It has been found to give a solution to the issues associated with traditional soil farming, presenting chances for effective nutrient regulation, higher density planting, and increasing output per acre while also improving the quality of the produce. It works well in areas of the world where there is a lack of arable land or fertile land for farming (Pradhan and Deo, 2019). Hydroponics, which is a water-efficient method of cultivation, allows for the recycling and reuse of water, so that no water is wasted. Furthermore, Khan *et al*. (2018) acknowledged that crops can be shielded from severe weather. Electricity can be produced using solar or wind energy to operate the hydroponics system. Similarly, hydroponics has no risk of soil-borne diseases, weed infestations, insect or pest attack, according to Sardare and Admane (2013).

Additionally, it yields a big quantity of the healthiest and most nourishing crop. According to Solanki *et al*. (2017), crops grow two times more quickly in hydroponic systems than they do in traditional methods. Many of the advantages hydroponics has over traditional crop production methods, such as reduced land area needs, lower water usage, accelerated plant growth rates, and year-round production, are also advantages that aquaponics has over them. Additional benefits include multi-crop production and operating efficiency using shared equipment (Pattillo, 2017). Contrarily, aeroponics allows for maximum space utilization because twice as many plants can be accommodated per unit floor surface. Additionally, it guarantees the exportation of soil-free plants grown from cuttings (Hussain *et al*., 2014).

2.6 Soilless agriculture in the world

At the Botany Department of Kasetsart University in Thailand, soilless culture was first practiced in 1957. When HRH Princess Mahachakri visited Israel in 1977 and Japan in 1983, where agricultural advancements including commercial hydroponic systems caught her eye, it became more serious. She proposed that soilless culture methods be further researched and developed in Thailand when she got back. As part of the celebration of the King's 60th birthday in 1987, FAO provided funding to encourage research and development of soilless culture for agricultural production in Thailand. The purpose of the research was to investigate

the potential use of soilless substrates for crop production, as well as to identify which of the challenging hydroponics techniques could be easily adopted by farmers in areas with challenging soil conditions (such as sandy, saline, or acid-sulfate soils, which accounted for about 30% of arable land). Under the auspices of the technological cooperation program between the Royal Project Foundation and the Republic of China, research on dynamic root floating hydroponics—a technique for growing vegetables in the Highlands all year round—was carried out in 1997. Since Thailand's economic crisis in 1997, which resulted in the private sector acquiring the technology from developed nations and enabling it to produce up to 16 crops of leafy vegetables with consistently superior quality, high yields, and rapid growth all year long, soilless culture has spread throughout the nation. According to Watanapreechanon and Sukprasert (2012), 188 hydroponic producers were registered in Thailand in 2010 to produce vegetables for sale, and numerous smaller hydroponic systems were utilized to grow vegetables for domestic consumption.

Health problems in Latin American peri-urban and rural communities have been attributed to a diet lacking in nutrients and a lack of vegetable consumption. Lack of funding for vegetable purchases, a lack of tradition and culture around the growing and consumption of vegetables, and an increase in urban population were identified as the causes of the shortage. Orsini *et al*. (2019) suggested using

community hydroponic gardens as a way to combat poverty, enhance nutrition, and foster a sense of community to address this problem. In order to manage intercropping patterns for leafy vegetable gardens used for both commercial and residential purposes, women farming groups were set up. These groups worked with a technical assistance center that offered guidance, inputs, and maintained business relationships. Two soilless systems, the Garrafas and Caixa systems, with coconut fiber as the substrate, were used to plant the crops. Over the course of the project's two years, it was discovered that daily diets may be supplemented with a wide variety of fresh vegetables. Additionally, because they could sell extra goods to the market, beneficiaries had a more reliable source of financial income. With no need for herbicides, no soil diseases, flexible planting schedules that increase the number of cropping cycles per year, low physical demands, and suitability for women and the elderly, it was determined that soilless practices in vegetable production will be of great benefit to underprivileged rural environments. To develop the first aeroponics system for seed yam production, the International Institute of Tropical Agriculture (IITA) hired a consultant from Kenya in January 2013. A 36 x 8 m screenhouse that was already there was converted to create the 14 box aeroponics system for seed yam production. Two-node vines directly planted were cut from another seedling and transplanted in August 2012. One node vines of first produced seedlings were put in containers 6-19 December for pre-rooting and transplanted to the newly built aeroponics system 26-28 February

2013. On the aeroponics system, it was found that both the pre-rooted and directly planted vines were growing normally, developing new roots and shoots. Within 10 days of planting, more than 50% of the vines produced roots, and three weeks later, 85–100% of the direct vine cuttings produced roots. Both the pre-rooted plantlets and the vine cuttings developed healthy minitubers after 4 months in aeroponics, which were harvested in June 2013. The use of an aeroponics system to propagate micro-tubers, bulbils, and mini-tubers was thus determined to be possible (Balogun *et al*., 2014). However, it is necessary to construct a suitable greenhouse and to adhere to cleaning standards.In Nigeria, a coupled single-loop aquaponics system was assessed by Benjamin *et al* in 2021. They look at fish growth performance in comparison to conventional urban farming production, as well as plant growth performance in micro-scale aquaponics. Some of the fruits and vegetables grown in the aquaponics system include tomatoes (Solanum lycopersicum), African eggplant (Solanum macrocarpon), Scotch Bonnet peppers (Capsicum chinence), and Lagos spinach (Celosia Argentea). Tilapia (Oreochromis nilotirus and Guineensis) and Africa catfish (C. gariepinus) were also raised. The height of the crops in the aquaponics system and those in the control field were found to differ significantly. Additionally, the specific development rates of Tilapia and Africa Catfish were examined and contrasted with those in conventional aquaculture. It was shown that Tilapia and Africa Catfish in aquaponics outperformed them in nearly all growth phases. According

to the research, aquaponics can be used in West Africa to supply fresh vegetables and fish protein while also preserving the environment. Additionally, it has demonstrated excellent potential for year-round food production and performance levels that are on par with soil-based systems.

CHAPTER THREE

3.0 Methodology

3.1 Area and Scope of Study

The Ogun River, which crosses the state from north to south, inspired the name of Ogun State, a region in south-western Nigeria that was formed from the previous Western State in February 1976. Ogun State, which has Abeokuta as its capital and main city, is bordered to the south by Lagos State and the Atlantic Ocean, to the north by Oyo and Osun State, to the east by Ondo State, and to the west by the Republic of Benin. The Gateway State is the moniker for Ogun State. 3,751,140 people call the state home as of 2006, an increase of roughly 7.1 million people since 2016. There are roughly 16,406,226 square kilometers of land covered by it. Similar to other southern regions of the country, it experiences a two-peak rainfall pattern. The normal rainforest vegetation is present. The state experiences tropical weather, with temperatures ranging from 25 to 35 degrees Celsius and a mean annual rainfall of almost 1,500 millimeters.

The Yorubas, who comprise the Egbas, Ijebus, Remos, Aworis, and Yewas, are the majority ethnic group in the state. The other subgroups include the Ketus, Ohoris, Anagos, Eguns, Ilajes, and Ikales. The main source of income for residents is agriculture, with the most widely grown crops including maize, yams, plantains, beans, rubber, palm trees, sugar cane, kola nuts, citrus, cassava, and vegetables. Mineral deposits and a large amount of fertile soil ideal for agriculture are among its

natural resources. Mineral resources like limestone, chalk, phosphates, and clay are abundant throughout the state. There are 20 local government areas in Ogun State. Abeokuta North, Abeokuta South, Ogun Waterside, Ijebu Ode, Ijebu North, Ijebu North East, Odugbolu, Ikenne, Sagamu, Obafemi Owode, Odeda, Ado/Ota, Yewa North, Yewa South, Imeko Afon, IPokia, Ewekoro, Ifo, and Remo North are among them. Abeokuta, Ikenne, Ijebu Ode, and Ilaro are the four agricultural zones that make up the remainder of the state. The state's industrial potential is considerable. It is a prospective industrial zone for the country because of its natural riches, labor force, and geographic proximity to Lagos. The State has quite a number of Soilless Farms but when it comes to training, development and knowledge transfer, BIC Farms Concepts and Soilless Farm Lab have proven to be very instrumental in the process and this has earned them partnerships with IITA, IFAD, Horti Nigeria and MasterCard Foundation.

BIC Farms Concepts is saddled with the responsibility of solving Africa's Agribusiness problems by creating affordable and sustainable business models for her clients in the agriculture/agro-allied and aquaculture sector, inclusive of hydroponics, livestock and agricultural services. Established in 2006, BIC Farms Concepts has two setups, one in Asero Estate, Abeokuta South and the hub at Onijaganjagan, Abeokuta, Ogun State which is very close to the popular Neuro-Psychiatric Hospital in Aro. 13 greenhouses of various sizes make up the hub, one of which is designated as the nursery unit for growing seedlings. in a weekly basis, the

farm conducts trainings in soilless farming and agribusiness. Participants learn how to grow leafy vegetables and fruit-based foods such tomatoes, peppers, lettuce, kale, cucumber, etc. without the use of soil.

Eupepsia Place Limited (ePlace Ltd) was founded with the mission of enabling life via agriculture through "comfort, knowledge, & opportunity". Comfort (food, housing, and connection), knowledge transfer (from development, strategy, and deployment), and connection to opportunities (market, money, and research) are the three main objectives. Utilizing technology, artificial intelligence, robotics, and market involvement, they work to achieve the five core SDGs while gathering information to best direct future solutions. ePlace limited's subsidiary is Soilless FarmLab. With a commitment to delivering comfort, knowledge, and opportunity to ensure shared prosperity, Soilless FarmLab delves into research and development of agricultural technology, deployment of these technologies, as well as information transfer for the growth of the community.

Soilless Farm Lab, a trademarked name for Eupepsia Place, was founded in Abeokuta in 2019 and offers a full range of farming services, including training, farm and business consultancy, farm management, and product delivery. The Soilless Farm Lab, which is based in Magbon, Ogun State, Nigeria, has trained more than 13700 participants through a variety of training programs, including the monthly "work and learn" program, the Young Agripreneur Apprenticeship Programme (YAAP) in collaboration with IITA, IFAD, and BIC Farms Concepts, and the

ongoing EYiA Project (Enterprise for Youths in Agriculture), in which Mastercard Foundation is a full partner and implementing organization.

3.2 Sampling Technique and Sample size

Youths working on the chosen soilless farms in the study area made up the population for this study. For this investigation, a two-stage sampling process was adopted. BIC Farms Concept and Soilless Farm Lab are two well-known centers for soilless agricultural training in Ogun State. The first step entails choosing two soilless farms specifically from among those already in operation in the state. BIC Farms Concept and Soilless Farm Lab were chosen for their significant contributions to training, human capital development, and responsive production as well as consumption. At the second stage, a straightforward random sample of respondents who have received soilless farming training and are now engaged in it was taken from five groups of soilless farmers who had received such training from Bic farms and the Soilless lab. 250 respondents in all were sampled, and 102 completed the questionnaire.

3.3 Data Collection

Primary data was used in this study. Primary data was collected using quantitative method via an electronic survey channel (Google Form), through the use of an open-ended well-designed questionnaires.

3.4 Measurement of variables

Socio-economic characteristics of the participants: Age, sex, marital status, educational status, employment status, farming experience, and level of income are the socioeconomic characteristics of the respondents that were analyzed. The respondents' socioeconomic characteristics such as age according to Ndahgu (2011), is a significant component in the study of youths' involvement and non-involvement in soilless farming since it represents the physical ability to complete a task as well as the psychological propensity to adopt behavioural change.

Factors influencing youth involvement: This was evaluated using a likert scale of 1 – 5 (where 5 is Most Influential, 4 is Influential, 3 is Moderately Influential, 2 is Slightly Influential, 1 is Least Influential) to capture the participants' opinions and experiences. This included variables such as access to training and knowledge, availability of resources, government support, perceived benefits and perceived barriers.

Youths' attitude towards Soilless Farming: This variable was examined using ranking to assess their opinions, perceptions, and beliefs regarding various aspects of soilless farming based on their duration of engagement, experience and knowledge about soilless farming. Concerns such as cost of implementation being high, there is no nutrient deficiency in crops grown through soilless farming, the disconnection from traditional farming methods as favourable, and the production materials used in

soilless farming has no negative impact on the environment and no lack of natural flavour in produce obtained from soilless farming

Benefits of Soilless Farming to the Youths: The benefits of soilless farming to the youths was measured through a quantitative approach. Specific benefits such as increased awareness and understanding of environmental sustainability, personal fulfilment, skill development, productive entrepreneurial opportunities, problem solving, critical thinking and informed decision making skills.

Challenges hindering the full engagement: This variable was examined using open-ended and closed-ended questions that allowed youths to identify the difficulties or challenges they face in their involvement in soilless farming. This could include factors such as lack of capital or financing options, a lack of technical expertise or training, or social stigma or lack of acceptance, policy barriers, limited government support and incentives.

3.5 Analytical Technique

Data was analyzed and subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS). Descriptive analysis and inferential analysis were carried out on the collected data. Descriptive analysis was used to present results in Frequency, mean, percentages, graphs and charts, while the inferential analysis was used to test for the hypothesis using Pearson Product Moment Correlation.

1. Objective 1: To examine the socioeconomic characteristics of youths involved in Soilless Farming in Ogun State. This was analyzed using frequency counts and percentage.
2. Objective 2: To examine the factors that influence youths' involvement in soilless farming in Ogun State. This was analyzed using ranking and Likert scale.
3. Objective 3: To ascertain the youths' attitude towards soilless agriculture technology in the study area. This was analyzed with mean score, ranking and Likert scale.
4. Objective 4: To examine the benefits of Soilless Farming to the youths involved in Ogun State. This would be analyzed using mean score and percentages.
5. Objective 5: To investigate the challenges hindering youths from engaging fully in Soilless Farming. This would be analyzed using mean and ranking.

Hypothesis: There is no relationship between the socioeconomic characteristics of the respondents and their attitude towards soilless farming.

The Pearson correlation coefficient will be used to analyze the study's hypothesis, which is expressed as follows;

$$r = \frac{N\sum xy - \left(\sum x\right)\left(\sum y\right)}{\sqrt{\left[N\sum x^2 - (\sum x)^2\right]\left[N\sum y^2 - (\sum y)^2\right]}}$$

Where,

N = number of pairs of scores

∑xy = sum of product of paired scores of socioeconomic characteristics of youths involved in soilless farming and their attitude towards soilless farming

∑x = sum of socioeconomic activities scores

∑y = sum of attitudes towards soilless farming scores

$\sum x^2$ = sum of socioeconomic characteristics squared scores

$\sum y^2$ = sum of attitude towards soilless farming squared

CHAPTER FOUR

Result and Discussion

4.0 Introduction

This chapter detail the descriptive and inferential statistical presentation of data collected from the field. The total respondents used for the study was 102. The result shows the socio- economic characteristics of youths involved in soilless farming, attitudes towards soilless farming, duration of involvement, benefits soilless farming affords youths involved, the challenges hindering youth full involvement and the inferential statistical analysis carried out to test the relationship between variables in the hypothesis of the study.

4.1 Socio-Economic Characteristics of Respondents

4.1.1 Age

From the result in Table 1, the ages of the respondents showed that the majority of the respondents were between the ages of 23 – 27 years with fifty-six percent (56%), while twenty-five percent (25%) were between the ages of 28 – 32 years. This implies that majority of the respondents are in the early youthful age, and are characterized to be adventurous, active and energetic which will positively

influence their productivity especially in the agricultural sector. This corroborate the findings of Adegbola, (2018), that age influences youth involvement in urban agriculture.

4.1.2 Sex

The results from Table 1 shows that based on gender, fifty-nine (59%) of the respondents were males, while forty-one (41%) were females. This implies that male youth are likely to be involved in agricultural practices than female. The finding aligns with Mthi *et al* (2021), in a study aimed at assessing youth involvement in agricultural activities in Eastern Cape Province of South Africa, with the observation that male participation in agriculture was higher than that of female. The less participation by female might be attributed to involvement in non-farm activities like hairdressing, fashion designing or the rigorous work of agricultural activities.

4.1.3 Marital status

Data on marital status of respondents revealed that the majority of the respondents were singles with eighty-four percent (84%), while fifteen percent (15%) were married. The high percentage of single youth could be due to the fact that majority of them are too young to take up marriage responsibilities. The implication of this is the likelihood of participation in agriculture in a bid to make ends meet. This

contradicts Ayanwuyi *et al* (2021), who observed a higher percentage of married youth involvement in agricultural activities.

4.1.4 Level of Education

In Table 1, based on their level of education, seventy-two percent (72%) of the respondents were HND/BSc holders and forty-one percent (41%) of the total respondents studied agricultural related courses and fifty-nine (59%) of them studied non-agricultural related courses. The finding is consistent with Mulema *et al* (2021) that higher percentage of youth in Vietnam had secondary and tertiary education. This could strongly impact involvement in agricultural activities, as majority of the respondents would have access to information on modern agricultural production technologies from a wide range of sources.

4.1.5 Monthly income

From table 1, sixty-two percent (62%) of the respondents earned fifty thousand (₦50,000) naira or less per month, while twenty-seven percent (27%) of them earned between fifty thousand (₦50,000) to hundred thousand (₦100,000) naira per month. This finding aligns with Maisule *et al* (2023) who noticed a higher percentage of youth earns below #30000 naira on a monthly basis.

This indicates that low earnings could affect youth involvement in agricultural technology driven activities like soilless agriculture.

Table 1: Socioeconomic Characteristics of Youths Involved in Soilless Farming

		Frequency (N = 102)	Percentage (%)
Age	18-20	15	15
	23-27	57	56
	28-32	26	25
	32 & above	4	4
Sex	Male	60	59
	Female	42	41
Marital Status	Single	86	84
	Married	15	15
	Widow/Widower	0	0
	Divorced	1	1
Education	SSCE	13	13
	OND/NCE	11	11
	HND/BSC	73	72
	MSC	4	4
	PHD	1	1
Course studied	Agriculture	42	41
	Non-agriculture	60	59
Name of farm	Soilless Farm Lab	10	10
	BIC	10	10
	Non-Soilless Farm	73	72

	None Farms	9	9
Position	Admin	50	49
	Non-admin	37	36
	Others	15	15
Duration of involvement	Less than 1 year	47	46
	1 - 2 years	38	37
	2 - 3 years	11	11
	3 years & above	6	6
Income	No Income	9	9
	Below 50,000	63	62
	50,001 - 100,000	28	27
	Above 100,000	2	2

Source: **Computed from Field Survey (2023)**

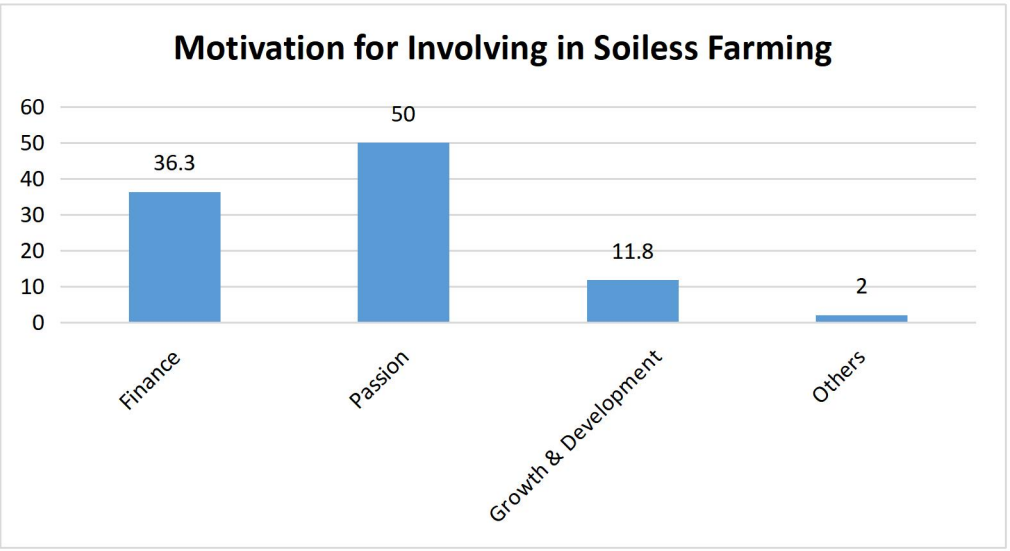

Figure 7: Bar chart showing the motivation for involving in soilless farming in Ogun State.

The figure above shows a bar chart showing the motivation for involving in soilless farming in Ogun State. Fifty percent (50%) were motivated by passion, thirty-six point three percent (36.3%) were motivated by finance and perceived profitability of soilless farming and eleven point eight percent (11.8%) were motivated by growth and development. The results shows that the major motivation factor for youth involvement in soilless farming is passion with fifty percent (50%) while another thirty six point eight percent (36.8%) were motivated by the profitability attached to soilless farming. The implication of this is that the respondents are passion driven and attracted to a new kind of agriculture different from the conventional convention agriculture.

4.2 Factors that Influence Youth Involvement in Soilless Farming

Table 2 above shows the factors influencing the youth involvement in soilless farming by the respondents. The results show that the highest factor that influence youth involvement in soilless farming is personal interest (Mean=4.08), this is followed by the access they have to training and technical knowledge (Mean=3.89). The fact that they perceive that soilless farming is profitable (Mean=3.77) is another factor that influence their involvement in soilless farming, others include the environmental sustainability (Mean=3.75), access to suitable land and space (Mean=3.47), and availability of financial resources (Mean=3.29).

The implication of the result is that the interest of youths in soilless farming is paramount to their participation. When the interest is backed up with the training and technical development, more youths are likely to engage in soilless farming.

The above outcome is in tandem with most literatures by FAO and IITA in the last 10 years that assessed the factors influencing youth's involvement in soilless farming in the world and especially in sub-Sahara Africa, often associated with the level of economic and technological development of the country considered.

Table 2: Factors that Influence Youth Involvement in Soilless Farming

Factors	Mean	Std. Deviation
Access to training and technical knowledge	3.89*	1.052
Availability of financial resources	3.29*	1.199
Access to suitable land or space	3.47*	1.325
Supportive government policies	2.67	1.253
Market demand for soilless produce	3.50*	1.158
Perceived profitability of soilless farming	3.77*	1.004
Personal interest in soilless farming	4.08*	1.021
Environmental sustainability of soilless farming	3.75*	1.173
Family support	3.11*	1.258
Peer influence	2.93	1.253

Source: Computed from field data (2023) Mean ≥ 3.0 = High Influence

4.3 Attitude towards soilless farming technology

Table 3 shows the various concerns of the respondents towards soilless farming technology. The result shows that the highest concerns toward soilless farming technology is based on the cost of implementation being high (Mean=3.95), followed by the knowledge that there is no nutrient deficiency in crops grown through soilless farming was (Mean=3.27). Also, the fact that many view the disconnection from traditional farming methods as favourable (Mean=2.82) and the production materials

used in soilless farming have no negative impact on the environment was (Mean=2.95) are other factors which influence their involvement in soilless farming, other attitude of respondents based on no lack of natural flavour in produce obtained from soilless farming (Mean=2.77).

The implication of the result is that the concerns of youths towards soilless farming is plays a vital role in their involvement. When concerns that have to do with the cost of implementation being too high is resolved by support from government and financial institutions as well as awareness on the fact that production materials used in soilless farming have no negative impact on the environment, many youth are likely to get involved in soilless farming.

Based on the assessment of the youths' attitude towards soilless agriculture technology in Ogun State, it reveals that most of the youths were more sensitive and positive minded towards soilless farming which is a function of their level of their interest, awareness, income, level of education and experience in soilless farming.

Table 3: Attitude towards soilless farming technology

Variables	Mean	Std. Deviation
The cost of implementation of soilless farming is high	3.95*	1.111
There is no nutrient deficiency in crops grown through soilless farming	3.27*	1.380
There is no lack of natural flavour in produce obtained from soilless farming	2.77	1.274
The disconnection from traditional farming methods is favourable	2.82	1.375
The production materials used in soilless farming have no negative impact on the environment	2.95	1.374

Source: Computed from field survey (2023) **Mean > 3.0 = Positive Attitude**

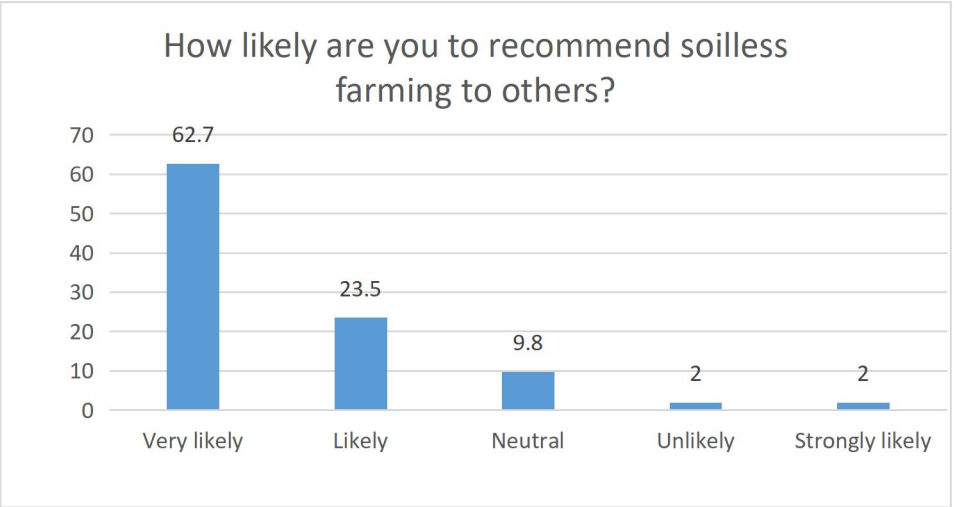

Figure 8: Bar chart showing the likelihood of respondents to recommend soilless farming to others in Ogun State.

The bar chart above shows the likelihood of respondents to recommend soilless farming to others in Ogun State. Sixty-two point seven percent (62.7%) were very likely to recommend soilless farming to others, twenty-three point five percent (23.5%) were likely, nine point eight percent (9.8%) were neutral, while two percent (2%) were unlikely and strongly likely to recommend soilless farming respectively. The bar chart shows that a higher percentage of youths already involved in soilless farming were very likely to recommend soilless farming to other youths in the state and this denotes an increase in more youth involvement in soilless farming in the coming years in the state.

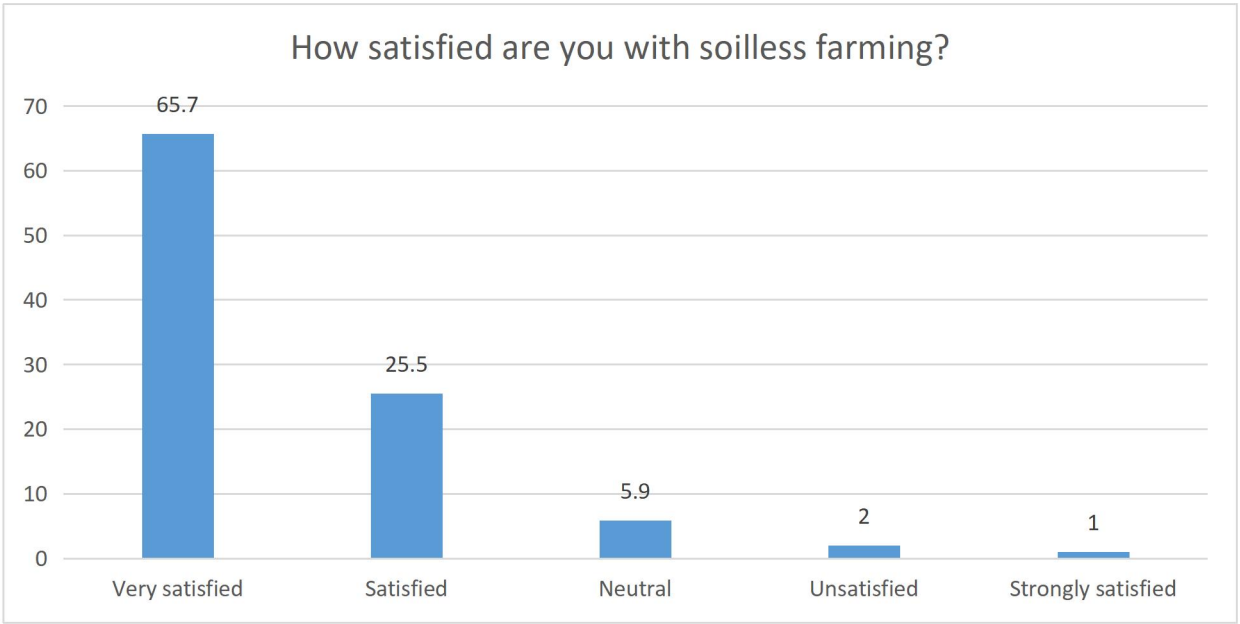

Figure 9: Bar chart showing how satisfied respondents are with soilless farming in Ogun State.

Figure above shows a bar chart showing how satisfied respondents are with soilless farming in Ogun State. Sixty-five point seven percent (65.7%) were very satisfied with soilless farming, twenty-five point five percent (25.5%) were simply satisfied, five point nine percent (5.9%) were neutral, while two percent (2%) were unsatisfied and one percent (1%) were strongly satisfied with soilless farming all together. The implication of this is that satisfaction with soilless farming is paramount to how likely that are to recommend soilless farming to others in the state. The more satisfied they are with soilless farming the more they introduce other youths to get engaged in soilless farming.

4.4 Benefits of Soilless Farming to the Youths involved

Table 3 shows the benefits of soilless farming to the youth noted by the respondents. The results show that the highest benefits of soilless farming to youths involved are opening up to productive entrepreneurial opportunities in soilless farming as a benefit (Mean=3.63) and providing them with valuable learning opportunities about advanced agricultural technologies, hydroponic systems, and innovative growing techniques was (Mean=3.63), followed by increase in their awareness and understanding of environmental sustainability was the highest benefit (Mean = 3.61), an opportunity to engage their community, collaborate and expand their social capital as a benefit (Mean=3.56), while other benefits include personal fulfilment as they witnessed the growth and success of the crops cultivated (Mean= 3.50) and development of problem-solving, critical thinking and informed decision-making skills (Mean=3.45).

Based on the assessment of the benefits of Soilless Farming to the youths in Ogun State, the above most mentioned and strongly agreed with benefits of soilless farming were namely; opening them up to productive entrepreneurial opportunities, allowing them to explore business ventures in the agricultural sector, providing them with valuable learning opportunities about advanced agricultural technologies, hydroponic systems, and innovative growing techniques and increasing their

awareness and understanding of environmental sustainability were notably so as most of the respondents were with the age group who are always willing to learn, take up new challenges and innovative. Also, owing to their level of education most of the found soilless farming more enlightening than just being profitable judging by their affinity for knowledge.

Table 4: Benefits of Soilless Farming to the Youths involved

Benefits	Mean	Std. Deviation
Soilless farming increases my awareness and understanding of environmental sustainability	3.61*	.647
Soilless farming brings me personal fulfilment as I witness the growth and success of the crops cultivated	3.50*	.593
Soilless farming opens me up to productive entrepreneurial opportunities, allowing me to explore business ventures in the agricultural sector	3.63*	.525
Soilless farming provides me opportunities to engage my community, collaborate and expand my social capital	3.56*	.573
Soilless farming helps me develop my problem-solving, critical thinking, and informed decision-making skills	3.45	.623
Soilless farming provides me with valuable learning opportunities about advanced agricultural technologies, hydroponic systems, and innovative growing techniques	3.63	.544
Soilless farming increases my awareness and understanding of environmental sustainability	1.00	.000
Soilless farming brings me personal fulfilment as I witness the growth and success of the crops cultivated	1.14	.468

Source: **Computed from field survey (2023)** **Mean ≥ 3.0 = High Benefits**

4.5 Challenges hindering youths from engaging fully in Soilless Farming in Ogun State.

The result ranked financial factors fifty percent (50%) and environmental factors thirty point four percent (30.4%) as the major factors hindering youths from fully engaging in soilless farming.

The result is in tandem with Trevor and Musole (2018) that several factors limits youth participation in agricultural activities, ranging from financial challenges, lack of interest, lack of access to basic information, priority given to agriculture among others. The implication of this is that youth involvement and full engagement in soilless farming could be low as a result of these constraints.

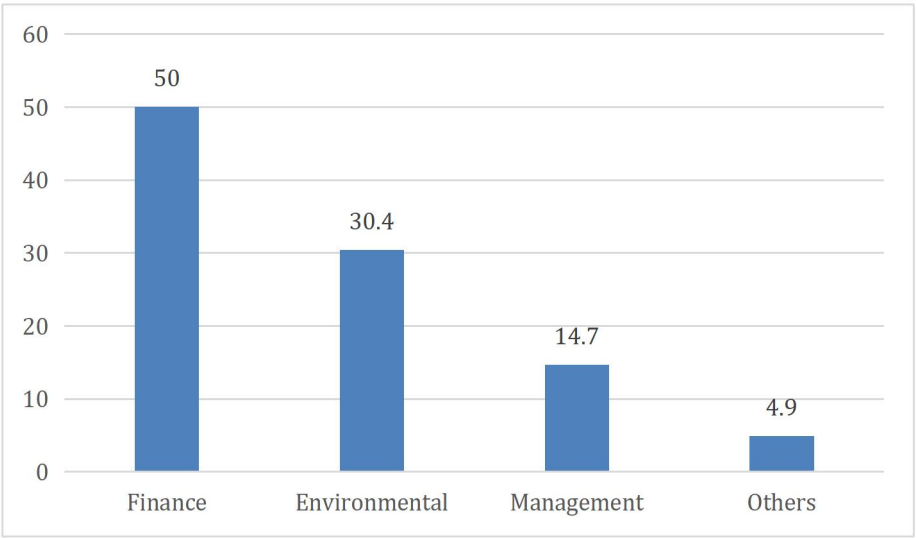

Figure 10: Bar chart showing the challenges hindering respondents from fully engaging in soilless farming in Ogun State.

The figure above shows a bar chart showing the challenges hindering respondents from fully engaging in soilless farming in Ogun State. 50% noted finance to be a challenge hindering the respondents from full engaging in soilless farming, 30.4% noted environmental factors, 14.7% noted management, while 4.9% noted other factors.

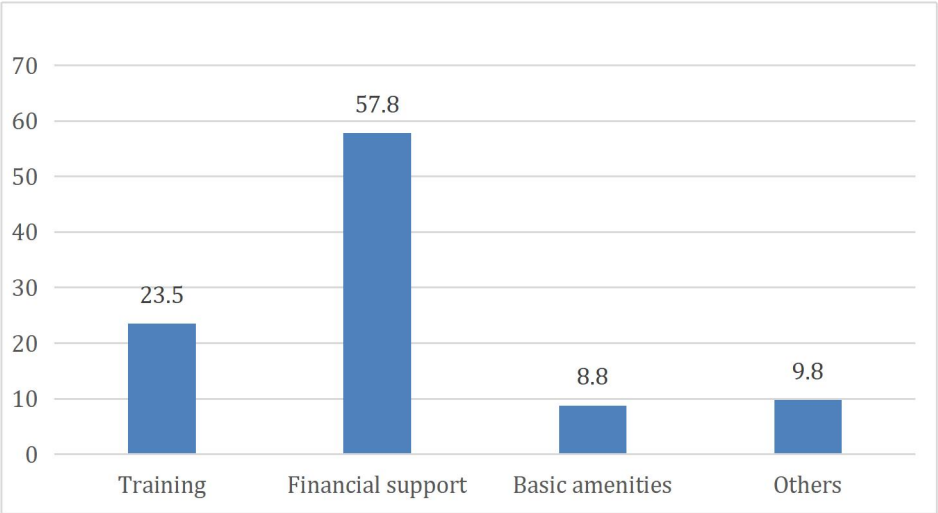

Figure 11: Bar chart showing the recommendations made by respondents on addressing challenges faced in soilless farming in Ogun State.

The figure above shows a bar chart showing the recommendations made by respondents on addressing challenges faced in soilless farming in Ogun State. Fifty-eight percent (57.8%) recommended financial support to address challenges in engaging fully in soilless farming, twenty-three point five percent (23.5%) recommended training, eight point eight percent (8.8%) recommended basic amenities, while nine point eight percent (9.8%) recommended other measures.

4.6 Hypotheses Testing

Table 5: There is no significant relationship between the socioeconomic characteristics of the respondents and their attitude towards soilless.

Variables	Attitude towards soilless farming technology	
	R	Significance (2-tailed)
Age	.882	.000*
Sex	.820	.000*
Marital status	.560	.000*
Education	.790	.000*
Course studied	.849	.000*
Name of farm	.783	.000*
Position	.869	.000*
Duration of involvement	.854	.000*
Income	.842	.000*

Source: Computed from field survey (2023) **Significant at p<0.001**

The table shows that there was a significant difference between the respondent's socio-economic characteristics and their attitude towards soilless farming in Ogun state. The respondents' attitudes towards soilless farming have a positive relationship

towards the socioeconomic characteristics (age (r=0.882), sex (r=0.820), marital status (r=0.560), education (r=0.790), course studied (r=0.849), farm name (r=0.783), position at work (r=0.869), duration of involvement (r=0.854) and income (r=0.849)). This positive relationship denotes that as the socioeconomic characteristics of respondents improve, their attitude towards soilless farming becomes more favourable or positive. In other words, when socioeconomic characteristics such as income, level of education, age, access to resources, position on the farm are higher or more favourable, individuals tend to have a more positive view about soilless farming which can potentially encourage greater acceptance and adoption of soilless farming practices. The null hypothesis, which stated that there is no significant relationship between the socio-economic characteristics of the respondents and their attitude towards soilless farming in Ogun State was therefore rejected and the alternate response that respondents' attitude towards soilless farming influenced by their socio-economic characteristics (age, sex, marital status, education, course studied, farm name, position at work, duration of involvement and income) was therefore accepted.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

This study was carried out to assess the level of involvement of soilless agriculture technology among youths in Ogun State, Nigeria.

The objectives of this study were to describe the socioeconomic characteristics of youths involved in soilless farming, examine the factors that influence youths involvement in soilless farming, ascertain the youths' attitude towards soilless farming, examine the benefits of soilless farming to the youths involved and investigate the challenges hindering youths from engaging fully in soilless farming in Ogun State, Nigeria.

The research methodology designed for this study was a descriptive approach which utilises a two-stage sampling procedure and a quantitative method of data collection to collect information about the socioeconomic characteristics, factors influencing youths, attitude, benefits and the challenges hindering youths from engaging fully in Soilless farming in Ogun State, Nigeria via a self-structured Google-form questionnaires. The data collected were analysed using SPSS version 27, presented in tables, charts, frequency, mean, percentages, graphs and charts, while the Inferential analysis will test for the hypothesis using Pearson Product Moment Correlation between studies. It was found that the major socio-economic

characteristics influencing soilless farming in Ogun state are age, level of education and the income earned per month, the most influential factors were personal interest, access to training and technical knowledge, perceived profitability and environmental sustainability of soilless farming, major concerns of youths towards soilless farming were; the cost of implementation being high, there is no nutrient deficiency in crops produced via soilless farming, most mentioned benefits were; exposures to entrepreneurial opportunities, exploration business ventures in the agricultural sector, provision of valuable learning opportunities on hydroponic systems and innovative growing techniques and increasing their awareness and understanding of environmental sustainability and the major challenges investigated were; financial and environmental factors.

5.2 Conclusion

The most influential factors influencing youths involvement in soilless farming in Ogun state were personal interest, access to training and technical knowledge, perceived profitability and environmental sustainability of soilless farming. The above outcome highlights that the interest of youths in soilless farming is paramount to their participation. When interest is backed up with training and technical development, many youths are likely to engage in soilless farming.

Again, the most common benefits of soilless farming to the youths involved were; opening them up to productive entrepreneurial opportunities, allowing them to

explore business ventures in the agricultural sector, providing them with valuable learning opportunities about advanced agricultural technologies, hydroponic systems, and innovative growing techniques and increasing their awareness and understanding of environmental sustainability were notably so as most of the respondents were with the age group who are always willing to learn, take up new challenges and innovative. Also, owing to their level of education most of them found soilless farming more enlightening than just being profitable judging by their affinity for knowledge.

Finally, it was noted that the major challenges; financial and environmental factors. The above challenges points to the fact that the level of economic growth and develop of the country, priorities given to agriculture, innovation and technology were the most forces behind the challenges hindering youths from engaging fully in soilless farming in a country such as Nigeria and particularly in Ogun State.

5.3 Recommendation

With regards to the result of this research work, the following recommendations were made;

- The various higher institutions of learning should improve more on educating and creating enough awareness for the populace (especially the youths due to the high level of interest shown) on the wide range of advantages involves in practicing soilless farming using the most effect

media of communication such as social media, webinars, reality shows etc most accessed by the youths.

- The government should specially look into how to make soilless farming widely practicable and sustainable among the youths in the direction of reducing the high cost of procuring practice materials and getting trained in relations to the cost of production and profit made by subsiding the cost of planting materials and rolling out grants to high performing experts of soilless farming over a significant duration of practice.
- The government too can also invest hugely into the public orientation and awareness of the positives of practicing soilless farming in order to allow the public embrace the concept based on the practicability, acceptance of produce from soilless farming and attracting local and foreign investors in the long run.
- All practicing farmers of soilless farming, especially in the urban areas should be oriented on how to maximize the concept of soilless for a full and functional advantage on both local and international scenes. They can begin by localizing the technology through the use of local items that can be found around them and also through embracing asset based community development (ABCD).

REFERENCES

Abdullahi, H.S., Mahieddine, F. and Sheriff, R.E. (2015) Technology Impact on Agricultural Productivity: A Review of Precision Agriculture Using Unmanned Aerial Vehicles. 7th International Conference on Wireless and Satellite Systems, Bradford, 6-7 July 2015, 388-400.

Adepoju A. O., Olaseni O. C. (2021). Are yam farmers aware and willing to adopt the aeroponics farming system in Oyo State, Nigeria? Agris on-line papers in Economics and Informatics, Volume XIII

Adrover, M., Moyà, G., & Vadell, J. (2013). Use of hydroponics culture to assess nutrient supply by treated wastewater. *Journal of environmental management*, *127*, 162-165.

AGRA. (2017). Africa Agriculture Status Report: The Business of Smallholder Agriculture in SubSaharan Africa (Issue 5). Nairobi, Kenya: Alliance for a Green Revolution in Africa(AGRA). Issue No. 5

AGRA. *Africa Agriculture Status Report. Feeding Africa's Cities: Opportunities, Challenges, and Policies for Linking African Farmers with Growing Urban Food Markets* (2020); Alliance for a Green Revolution in Africa (AGRA): Nairobi, Kenya.

Ajibade L. T., Oyeniyi S. T. (2018). Soilless Farming: A key player in the Realisation of "Zero Hunger of the Sustainable Development Goals in Nigeria; *International Journal of Ecological Science and Environment Engineering*, Vol 5, No 1, 1-7

Arumugam, T., Sandeep, G., & Maheswari, M. U. (2021). Soilless farming of vegetable crops: An overview.

Awotide, B. A., Karimov, A. A., & Diagne, A. (2016). Agricultural technology adoption, commercialization and smallholder rice farmers' welfare in rural Nigeria. *Agricultural and Food Economics*, *4*(1), 1-24.

Ayanwuyi, E., Akinboye, O.A. and Olaniyi, O.A. (2007) Youth Participation in Rural Development Projects in Surulere Local Government Area of Oyo State, Nigeria. Social Sciences, 2, 312-317.

Balogun, M., Maroya, N., & Asiedu, R. (2014). Seed yam production in an

aeroponics system: a novel technology. *YIIFSWA(*Yam Improvement for Income and Food Security in West Africa, International Institute of Tropical Agriculture, Ibadan), *Working Paper SeriesNo. 2*.

Barth, B. (2018). How Does Aeroponics Work?. *Retrieved*, *8*, 14-19.

Benjamin, E. O., Tzemi, D., & Fialho, D. S. (2021). Sustainable Urban Farming in Sub-Saharan Africa: A Review of a Coupled Single-Loop Aquaponics System in Nigeria.

Berhanu, Y., Angassa, A. and Aune, J.B. (2021) A System Analysis to Assess the Effect of Low-Cost Agricultural Technologies on Productivity, Income and GHG Emissions in Mixed Farming Systems in Southern Ethiopia. Agricultural Systems, 187, Article ID: 102988. https://doi.org/10.1016/j.agsy.2020.102988

Bikram Pradhan and Bandita Deo (2019).Soilless Farming, The Next Generation Green Revolution; Current Science, Volume 116, 728-731.

Buckseth, T., Sharma, A. K., Pandey, K. K., Singh, B. P., & Muthuraj, R. (2016). Methods of pre-basic seed potato production with special reference to aeroponics—A review. *Scientia horticulturae*, *204*, 79-87.

Chavas J., Nauges C. (2020). Uncertainty, Learning, and Technology adoption in agriculture. Applied Economic Persepectives and Policy, 42 (1), 42-53.

Checkoway, B. What is youth participation? *Child. Youth Service. Revolution (* **2011)**, *33*, 340– 345

Chinsinga, B.; Chasukwa, M. Youth, agriculture and land grabs in Malawi. *IDS Bull.* **2012**, *43*, 67–77.

Dagunga, G., Amoakowaa, A., Ehiakpor, D.S., Mabe, F.N. and Danso-Abbeam, G. (2020) Interceding Role of Village Saving Groups on the Welfare Impact of Agricultural Technology Adoption in the Upper East Region, Ghana. Scientific African, 8, e00433.

Denstad, F. Y. (2009). Youth policy manual. *How to develop a national youth strategy Councilof Europe*, 11.

Dercon, S.; Gollin, D. Agriculture in African development: Theories and strategies. *Annu. Rev. Resour. Econ.* **2014**, *6*, 471–492

Egboduku, C.O., sennuga, S.O., and Okpala, E.F., (2021). Factors influencing the interest of youths towards career in agriculture: A case study of Bwarri Area Council, Abuja, Nigeria. *International Journal of Advance agricultural Research,* 9(2), 6-14

El-Kazzaz K. A., El-Kazzaz A. A., (2017) Soilless Agriculture a New and Advanced Method for Agriculture Development: an Introduction. *Agri Res & Tech: Open Access Journal*, 3(2):555610.

Enhancing Youth Development and Participation in the context of Sustainable Development. Federal Ministry of Youth and Sports Development 2019 Edition. Nigeria NationalYouth Policy.

Farayola C. O. ;Adebisi I. O.; Akilapa O.; Gbadamosi F. Y.(2020): Does innovation enhance Youth Participation in Agriculture: A review of Digitalization in Developing country. *International Journal of Research in Agriculture and Forestry*. 7(2), 7-14.

Fasakin I. J.; Ogunniyi A. I.; Bello L. O.; Mignouna D. ; Adeoti R.; Bamba Z. and Awotide B. A. (2022). Impact of intensive youth participation in agricultu re on rural household's revenue: Evidence from rice farming households in Nigeria. *Journals of Agriculture*, 12,584.

Food and Agriculture Organization (FAO) (2017). The future of food and agriculture – Trends and challenges. Rome.

Geza W.; Ngidi M.; Ojo T.; Adetoro A. A.; Slotow R.; Mabhaudhi T. (2021). Youth Participation in Agriculture: A scoping review. Sustainability, 13, 9120.

Girei, A. A., Saingbe, N.D., Ohen, S.B., and Gimba, E.A. (2016). Youth involvement in agricultural production in Obi Local Government Area, Nasarawa State, Nigeria. *International Journal of Environment, Agriculture and Biotechnology*, 1(4), 238628.

Gopinath P., Vethamoni P. I., & Gomathi, M. (2017). Aeroponics soilless cultivation system for vegetable crops. Chemical Science Review and Letters, *6*(22), 838-849.

Gumisiriza M.S., Kabirizi J.M.L., Mugerwa M., Ndakidemi P.A., Mbega E.R., (2022). Can Soilless farming feed urban East Africa? An assessment of the

benefits and challenges of hydroponics in Uganda and Tanzania. Environmental challenges, 6, 100413.
https://doi.org/10.1007/978-3-319-25479-1_29

https://www.un.org/esa/socdev/documents/youth/fact-sheets/youth-participation.pdf(2013)United Nations Missions in South Sudan

https://www.youthpolicy.org National Youth Policy 2009-2014

Hussain A., Iqbal K., Aziem S., Mahato P., Negi A. K. (2014). A Review On The Science Of Growing Crops Without Soil (Soilless Culture) – A Novel Alternative For Growing Crops. *International Journal of Agriculture and Crop Sciences.* Available online at www.ijagcs.com IJACS/2014/7-11/833-842 ISSN 2227-670X

Ike, C. R., Orakwe, C. L., & Ezeagu, C. A. (2019). Hydroponic Water Requirement Estimation for Cucumber Using FAO-CROPWAT Model in Awka, Anambra State, Nigeria. *Journal of Engineering and Applied Sciences*, *15*(1), 118-129.

Ikehi M.E., Ejiofor T.E., Ifeanyieze F.O., Nwachukwu C.U, Ali, C.C (2022). Adoption of agricultural innovations by farmers in Enugu State, Nigeria. *International Journal of Agricultural Technology*, 18(1), 123-140, 2022.

Imran Ali Lakhiar, Jianmin Gao, Tabinda Naz Syed, Farman Ali Chandio & Noman Ali Buttar (2018) Modern plant cultivation technologies in agriculture under controlled environment: a review on aeroponics, *Journal of Plant Interactions,* 13:1, 338-352, DOI: 10.1080/17429145.2018.1472308

Info@bicfarmsconcepts.com Greenhouse archives, BIC Farms concepts.

Joly, A., Junge R., and Bardocz T. (2015). Aquaponics business in Europe: some legal obstacles and solutions. *Ecocycles*, *1*(2), 3–5. https://doi.org/10.19040/ecocycles.v1i2.30

Khan F. A., Kurklu A., Ghafoor A. (2015), A review on hydroponic greenhouse cultivation for sustainable agriculture. *International Journal of Agriculture, Environment and Food Science*; 2(2): 59-66.

Khudoyberdiev, A., Ahmad, S., Ullah, I., & Kim, D. (2020). An optimization scheme based on fuzzy logic control for efficient energy consumption in hydroponics environment. *Energies*, *13*(2), 289.

Kumari A., Upadhyaya A., Jeet P., Prakash V., Ahamed A. and Saurabh K. (2021).

Soilless farming: A worthwhile effort towards smart agriculture. Food and Scientific Reports. Food and Scientific Reports.com.

Kwakye, B. D., Brenya, R., Cudjoe, D. A., Sampene, A. K., & Agyeman, F. O. (2021). Agriculture Technology as a Tool to Influence Youth Farming in Ghana. *Open Journal ofApplied Sciences*, *11*(8), 885-898.

Labor Force Statistics - Volume I: Unemployment and Underemployment Report (2018).

Labor Force Statistics: Unemployment and Underemployment Report Q2 2020 - Abridged LaborForce Survey Under Covid-19. National Bureau of statistics. nigeriastat.gov.ng

Lakhiar, I. A., Gao, J., Syed, T. N., Chandio, F. A., & Buttar, N. A. (2018). Modern plant cultivation technologies in agriculture under controlled environment: A review on aeroponics. *Journal of plant interactions*, *13*(1), 338-352.

Love, D. C., Fry, J. P., Genello, L., Hill, E. S., Frederick, J. A., Li, X., & Semmens, K. (2014). An international survey of aquaponics practitioners. *PloS one*, *9*(7), e102662.

Macwan J., Dhruv Pandya, Dr. Himanshu Pandya, Dr. Archana Mankad (2020). review article review on soilless method of cultivation: hydroponics. *International Journal of Recent Scientific Research,* pp 37122-37127.

Magagula, B., & Tsvakirai, C. Z. (2020). Youth perceptions of agriculture: influence of cognitive processes on participation in agripreneurship. *Development in practice*, *30*(2), 234-243.

Maisule, A. M., Sennuga, S. O., Bamidele, J., Alabuja, F. O., & Osho-Lagunju, B. (2023). Rural Youth Participatio n in Agriculture-Based livelihood Activities in Abuja, Nigeria. *International Journal of Research and Scientific Innovation* (IJRSI) PP, 45-62.

Masqood, A. W., & Farhan , A. W. (2022). A Study on Hydroponic Farming System of Wheat for Sustainable Development of Agriculture. *International Journal of Agricultural Economics*, *7*(1): 1-3.

Mthi, S., Yawa, M., Tokozwayo, S., Ikusika, O.O., Nyangiwe, N., Thubela, T., and Nkohla, M.b. (2021). An Assessment of Youth Involvement in Agricultural Activities in Eastern Cape Province, South Africa. Agricultural sciences, 12(10), 1034-1047.

Mulema, J., Mugambi, I., Kansiime, M., Twu Chan, H., Chimalizeni, M., Xuan Pham, T., Oduor, G., (2021). Barriers and opportunities for the youth engagement in agribusiness: empirical evidence from Zambia and Vietnam, Development in practice, 31:5, 690-706, DOI: 10.1080/09614524.2021.1911949

National Bureau of Statistics. https://www.nigerianstat.gov.ng.

National Population Commission (NPC) [Nigeria] and ICF International. 2014. Nigeria Demographic and Health Survey 2013. Abuja, Nigeria, andRockville, Maryland, USA: NPC and ICF International.

Okemwa E. (2015), Effectiveness of Aquaponic and Hydroponic Gardening to Traditional Gardening. *International Journal of Science Research and Innovative Technology*; 2(12):21-52

Orsini, F., Michelon, N., Scocozza, F., & Gianquinto, G. (2008). Farmers-to-consumers: an example of sustainable soilless horticulture in urban and peri-urban areas. In *International Symposium on the Socio-Economic Impact of Modern Vegetable Production Technology in Tropical Asia 809* (pp. 209-220).

Osabohien, R., Matthew, O., Gershon, O., Ogunbiyi, T., & Nwosu, E. (2019). Agriculture development, employment generation and poverty reduction in West Africa. *The Open Agriculture Journal*, *13*(1).

Osabohien, R., Matthew, O., Ogunbiyi, T., and Nwosu, E., (2019). Agriculture development, employment generation and poverty reduction in West Africa. *The Open Agricultural Journal*, 13(1).

Pathak, A., Uddin, M.A., Jainal Abedin, M., Andersson, K., Mustafa, R. and Hossain, M.S. (2019) IoT Based Smart System to Support Agricultural Parameters: A Case Study. Procedia Computer Science, 155, 648-653.

Pattillo, D. A. (2017). An overview of aquaponic systems: hydroponic components.North Central Regional Aquaculture Center (NCRAC), Technical Bulletin Series.

Porter, M.E. and Heppelmann, J.E. (2015) How Smart, Connected Products Are

Transform Companies. Harvard Business Review.

Pradhan, B., & Deo, B. (2019). Soilless farming–the next generation green revolution. *Current Science*, *116*(5), 728-732.

Reyes, J. L., Montoya, R., Ledesma, C., & Ramirez, R. (2011). Development of an aeroponic system for vegetable production. II International Symposium on Soilless Culture and Hydroponics *947* (pp. 153-156).

Roos E, Bajzel, B., Smith, P., Patel, D., Little D., and Gamet, T., (2017), Greedy or needy? Land use and climate impacts of food in 2050 under different livestock futures, Global Environmental change, 47, 1-12.

Sallenave, R., & Shultz, R. C. (2019). Decoupled aquaponics: A comparison to single-loop aquaponics.

Sardare M. D., Admane S. V. A. (2013), review on plant without soil-Hydroponics.International. Journal of Research in Engineering and Technology; 2(3): 299-304.

Sennuga, S. O., Fadiji, T.O., and Thaddeus, H. (2020). Factors influencing adoption of improved agricultural technologies (IATs) among smallholder farmers in Kaduna sate, Nigeria. *International Journal of agricultural Education and Extension*, 6(2), 382-391.

Solanki S., Gaurav N., Bhawani G., Kumar A. (2015), Challenges and possiblilities in hydroponics: an indian perspective. *International Journal of Advanced Research*; 5(11): 177-182.

Sumberg, J.; Yeboah, T.; Flynn, J.; Anyidoho, N.A. Young people's perspectives on farming in Ghana: A Q study. *Food Secur.* **2017**, *9*, 151–161

Taha, M. F., ElMasry, G., Gouda, M., Zhou, L., Liang, N., Abdalla, A., ... & Qiu, Z. (2022). Recent Advances of Smart Systems and Internet of Things (IoT) for Aquaponics Automation: A Comprehensive Overview. *Chemosensors*, *10*(8), 303.

Tang, K., Wang, M., & Zhou, D. (2021). Abatement potential and cost of agricultural greenhouse gases in Australian dryland farming system. *Environmental Science and Pollution Research*, *28*, 21862- 21873.

Tijani A. (2022), Special Report: Soilless Farming to the Rescue. How to boost Agriculture without hurting forests. Foundation for Investigative Journalism.

Trevor, S. and Musole, K.J. (2018) Rural Youth Participation in Agriculture in Zambia. *Journal of Agricultural Extension*, 22, 52-63. https://doi.org/10.4314/jae.v22i2.

Trevor, S., & Kwenye, J. M. (2018). Rural youth participation in agriculture in Zambia. *Journal of Agricultural Extension*, *22*(2).

Tyson, R. V., Treadwell, D. D., & Simonne, E. H. (2011). Opportunities and Challenges to Sustainability in Aquaponic Systems, *HortTechnology hortte*, *21*(1), 6-13.

Ugochukwu A.I, Phillips P.W.B (2018). Technology adoption by agricultural producers: A review of the literature. From Agriscience to Agribusiness. 361-377.

Ugwumba E. (2018). Understanding the Herder-Farmer Conflict in Nigeria. Conflict Trend;African Centre for Constructive Resolution of Dispute, Issue 3, 40-47.

Wattanapreechanon, E., & Sukprasert, P. (2012). Development of soilless culture for crop production in Thailand. *Kasetsart Journal of Social Sciences*, *33*(3), 475-485.

Yep B., Zheng Y. (2019). Aquaponic trends and challenges– A review. *Journal of CleanerProduction*, *228*, 1586-1599.

APPENDIX
RESEARCH QUESTIONAIRE
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION SERVICES
FACULTY OF AGRICULTURE
UNIVERSITY OF BENIN,
BENIN CITY, EDO STATE, NIGERIA.

Dear Sir/Madam,

I am a final year student of the above-named institution. My name is **Wisdom Chike, ANONYUO** and I am carrying out a research project on the **Assessment of Youths Involvement in Soilless Farming in Ogun State**.

I solicit your cooperation to kindly answer the questions below as correctly as possible so as to ensure reliable data for this study. This research work is purely for academic purpose and all information to be supplied will be treated with absolute confidentiality and used strictly for this study only.

Thanks for your anticipated cooperation.

SECTION A: **Socio Economic Characteristics**

Instruction: Please fill in the blank spaces and tick (√) where necessary against the statement below as it applies to you.

1. Local Government Area: _____
2. Age (in years): _____
3. Sex: male ( ) female ( )

4. Marital status: single ( ) married ( ) widowed ( ) divorced ( )
5. Highest educational level: no formal education ( ) primary ( ) JSSCE ( ) SSCE ( ) OND/NCE ( ) HND/BSc ( ) MSc ( ) PhD ( )
6. Course Studied in the University: _____
7. What is the name of the farm you currently work in or own?
8. Which position do you currently hold on the farm? _____
9. How long have you been involved in Soilless Farming?
10. Monthly income: _____

SECTION B: Factors that Influence Youth Involvement in Soilless Farming

1. **What motivated you to get involved in soilless farming?**

_____

Instructions: Please, rank the following factors based on their influence on your involvement in soilless farming. Do this on a scale of 1 – 5. 5 is Most Influential, 4 is Influential, 3 is Moderately Influential, 2 is Slightly Influential and 1 is Least Influential.

Factors that influence involvement decision	Agreement with statement				
	1(LI)	2	3	4	5 (MI)
Access to training and technical knowledge					
Availability of financial resources					
Access to suitable land or space					
Supportive government policies					
Market demand for soilless produce					
Perceived profitability of soilless farming					
Personal interest in soilless farming					
Environmental sustainability of soilless farming					
Family support					
Peer influence					

Others (if you have none, kindly leave blank)

_____

SECTION C: Attitude towards soilless farming technology

Instructions: Based on your feelings and concerns about soilless farming, rank your agreement with the following statements. Please tick as it pertains to you from 1 to 5. Where 5 means Strongly Agree (SA), 4 means Agree, 3 means Disagree, 2 means Strongly Disagree (SD) and 1 means undefined (UD).

Concerns About Soilless Farming	**Ranking**				
	1(UD)	**2**	**3**	**4**	**5(SA)**
The cost of implementation of soilless farming is high					
There is no nutrient deficiency in crops grown through soilless farming					
There is no lack of natural flavour in produce obtained from soilless farming					
The disconnection from traditional farming methods makes it favourable					
The production materials used in soilless farming has no negative impact on the environment					

Others (specify) _____

How likely are you to recommend soilless farming to others? Very likely ( ) Likely ( ) Neutral ( ) Unlikely ( ) Very unlikely ( )

How satisfied are you with soilless farming? Very satisfied ( ) Slightly satisfied ( ) Neutral ( ) Unsatisfied ( ) Strongly unsatisfied ( )

SECTION D: Benefits of Soilless Farming to the Youths involved

Instructions: The following statements are related to the benefits of soilless farming to youths involved. Please rate your agreement with the following statements and tick correctly. Where 4 means Strongly Agree (SA), 3 means Agree, 2 means Disagree and 1 means Strongly Disagree (SD).

Benefits of Soilless Farming to Youths Involved	**Agreement with statement**			
	1(SD)	**2**	**3**	**4(SA)**
Soilless farming increases my awareness and understanding of environmental sustainability				
Soilless farming brings me personal fulfilment as I witness the growth and success of the crops cultivated				
Soilless farming opens me up to productive entrepreneurial opportunities, allowing me to explore business ventures in the agricultural sector				
Soilless farming provides me opportunities to engage my community, collaborate and expand my social capital				
Soilless farming helps me develop my problem-solving, critical thinking, and informed decision-making skills				
Soilless farming provides me with valuable learning opportunities about advanced agricultural technologies, hydroponic systems, and innovative growing techniques				

Others (if you have none, kindly leave it blank)

_____

How has Soilless Farming impacted your livelihood? (One sentence answer please)

_____

Do you think soilless farming has the potential to create employment opportunities for youths in Ogun State? Yes ( ) No( ) Unsure ( )

1. If yes, why?

   _____

   If no, why?

   _____

SECTION E: Challenges hindering full engagement

Instruction: Please, kindly fill as appropriate.

1. Please, kindly itemize 5 major challenges you face in your involvement in Soilless Farming.

   i) _____
   ii) _____
   iii) _____
   iv) _____
   v) _____

2. How do you think these challenges can be addressed? (Please list them numerically).
3. Would you recommend soilless farming to other young people in Ogun State? Yes( ) No( )
4. If Yes, why? (One sentence answer please).

   _____

5. If No, why? (One sentence answer please).

   _____

PICTURES FROM FIELD WORK

Plate 1: Staking of Bell Pepper plant

Plate 2: Group picture with some of the youth in the Abeokuta Hydroponics hub

Plate 3: Project Activities at BIC Farms Abeokuta

Plate 4: A picture of me at the front of the Green House Abeokuta