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VEGETABLE FARMERS' PERCEPTION OF HYDROPONICS FARMING TECHNOLOGIES IN OGUN STATE, NIGERIA

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Abstract

This study examined vegetable farmers' perception towards hydroponic technologies in Ogun State, Nigeria. The study employed the use of a two-stage sampling technique to employ 320 vegetable farmers as respondents. Primary data was gathered through organized interviews and a structured questionnaire. Descriptive and inferential statistics were used to analyze data collected. Findings showed that only 31.3% were involved primarily in farming, livelihood diversification was 49.4% in favour of trading/business. Also, 35% of the respondents belonged to cooperatives and 90% had a favorable perception of hydroponics. The study examined the constraints to the practice of hydroponics where increase in the tariff of power supply ranked first position. Results of Chi-square test of relationship between socioeconomic characteristics of respondents and their perceptions of hydroponics farming technology showed that only level of education and membership of cooperatives indicated significant relationship. The study recommends that empowerment programmes and knowledge acquisition programmes on hydroponic technology farming should be targeted at vegetable farmers who are members of farmers' cooperatives and this is to ensure successful knowledge impact and positive effects of the programme.

Key words**:** *hydroponic, vegetable farming, perception, constraints, co-operative, education*

INTRODUCTION

Agriculture is an important sector of the economy and a way of life for many Nigerians, contributing almost 25% of the country's GDP and employing 70% of the labour force [11]. Despite its economic importance, Nigeria's agricultural sector suffers several difficulties that have an impact on its output [18]. Poor land tenure systems, insufficient irrigation for agriculture, climate change, and land degradation are a few of these challenges. Other factors include inadequate funding, significant post-harvest losses, minimal access to markets, low technology, high production costs, and poor input distribution [18].

Hydroponics was derived from the Greek words hydro, meaning water, and ponos, meaning work. Hydroponic farming is a division of soilless farming that involves the development of plants without the use of soil, and the plants receive all the vital nutrients from a nutrient-rich water-based solution [5]. There are varieties of hydroponic approaches in which plants can either be cultivated in a non-soil medium or directly in the solution. Hydroponic has many advantages over orthodox farming and they include; a shorter growth interval for many plants, no pesticides or herbicides, improved use of space, and increased productivity, amongst others. Conventional farming practices mainly involve such soil-bound methods and can cause a variety of antagonistic effects on the environment. Conventional farming is the practice of growing crops in the ground, outside, often with irrigation and the active application of nutrients such as fertilizers and herbicides. The deleterious impacts of conventional agriculture is not only related to the growth conditions of the crops but in particular to the effect on natural ecosystems, including high and inefficient water demand, vast land requirements, fertilizer use, soil degradation and loss of biodiversity [3].

According to [12], vegetables are common crops grown and eaten in Nigeria. The fresh parts of the plants are either eaten raw, cooked or processed in some other ways. Vegetables provide fundamental vitamins, minerals and antioxidants that provide many important health benefits to the body. [7] opined that

vegetables yield per unit land areas is high when related to other arable crops, making it a good source of income generation. However, the use of chemicals in vegetable production has been well-known as a major source of health complications and a cause of several health and environmental loss to the entire population. To achieve viable food production levels in Nigeria, farmers need to alleviate the effects of climate change, insecurity, flooding, farmer-herders' clashes, inflation, and rising food prices through inventive farming technologies. To achieve this, hydroponics technology is one of such innovations for producing food all the year round. Furthermore, to meet the food requirements of the growing population, there is a need to embrace out-of-box techniques to achieve the United Nations' sustainable development (SDGs) goal 2; Zero hunger which "seeks sustainable solutions to end hunger in all its forms by 2030 and to achieve food security". Farmers' opinion is influenced and moulded, among other things by their distinct characteristics, experiences, information they receive, cultural and geographical locations in which they live.

Food security has become a major global concern as a result of the recent lack of access to sufficient and healthy foods for many people worldwide. If immediate action is not taken, almost 25 million people in Nigeria could go hungry [19]. It is more important than ever to supply food in quantities and grades that support food production. Hydroponic farming presents a viable means of accomplishing this. However, there hasn't been much study done on the value of hydroponic farming methods in improving food security, especially in poor nations like Nigeria where food insecurity is most prevalent.

It is against this background that this study intends to provide answers to the following research questions.

1. What are the socio-economic characteristics of the respondents?
2. What is the awareness level of vegetable farmers on hydroponic farming technology?
2. What is the perception of vegetable farmers to hydroponic farming technologies in the study area?
3. What are the constraints to the practice of hydroponic farming in the study area?

MATERIALS AND METHODS

Study Area

On February 3rd, 1976, the Western States were combined to form Ogun State. Lagos State borders Ogun State on the south; Oyo and Osun States border it on the north; Ondo State borders it on the east; and the Republic of Benin borders it on the west. The state is located between longitudes 3.0°0' and 5.0°0 East and latitudes 6.2°0 and 7.8° 0 North of the Greenwich Meridian.

Population, Sampling procedure and sampling size

The population of the study consisted of 1,076 vegetable farmers belonging to vegetable farmer's group registered in Ogun state, Nigeria. For this study, a two -stage sampling technique was adopted. The first stage was the purposive selection of two (2) Local Governments, Odeda and Ewekoro due to large number of vegetable and hydroponic farming activities. The second stage involved the random selection of (32%) respondents from each of the Local Governments Areas.

Table 1. Summary of sampling procedure and sampling size

Stage 1: Purposive selection of Two Local Governments Areas (LGAs)	Stage 2: proportionate Random sampling	
	Total Number of vegetable farmers	**32% of farmers**
Odeda	675	204
Ewekoro	383	116
Total	**1,058**	**320**

Source: Soilless Agriculture database in Ogun state.

Instruments for data collection

The data used for the study was primary data which was acquired via structured questionnaire. Experts from the Department of Agricultural Extension and Rural Development made modifications to the questionnaire's design to assure its validity and establish content validity. Various technologies on hydroponics technologies were outlined and respondents were asked to tick if they are aware or not aware. A score of 1 and 0 were assigned respectively. Perception statements on vegetable farmers towards

hydroponic farming technologies were listed for respondents to tick. These statements were placed on a 5-point Likert type scale. The scales were strongly agree, agree, undecided, disagree and strongly disagree while scores of 5,4,3,2 and 1 were assigned respectively for positively worded statement but the reverse was the case for negatively worded statements. A list of constraints was outlined and respondents were asked to tick if the constraints are Very Severe, Severe, Not Severe and Not a constraint. A score of 3, 2, 1 and 0 were assigned to constraints respectively.

Data Analysis

The results obtained from the field were analyzed using SPSS Version 21. Descriptive and inferential statistical tools were used to analyze the data collected. Frequency counts, percentages, means and standard deviations and chi-square were descriptive tools that were used to present the findings from all objectives of the study. Inferential statistics such as Pearson Product Moment Correlation were used to test the hypothesis.

RESULTS AND DISCUSSIONS

The average age of the respondents was 36.1 years, according to the statistics presented in Table 1. Contrary to the findings of [7], who found that young men and women in a study of farm youth participation in farming disapproved of the aspirations of working as farmers, this indicates that vegetable farming is dominated by youths in the research area. In order to carry out vegetable farming tasks effectively, these young people must be nimble and economically engaged. Gender equity in the ratio of male to female teenagers cultivating vegetables in the research area is implied by the respondents' sex, which was 56.3% male and 43.8% female. The results are in line with the finding of [10],who reported that male farmers had more awareness and were more likely to adopt agricultural technology than female farmers and that women appear to be less adaptive because of financial or resource constraints. Most (78.8%) of the youths were mainly singles which may indicates that they had relatively minimal responsibilities and time to dedicated to hydroponics farming. The result corroborates with the results of [6], who looked at actual evidence supporting the claim that the majority of research participants were single. They followed Islam (46.3%), Christianity (52.5%), and Traditional (1.3%) religions, according to the research. These outcomes concur with those of [17], which found that religious and cultural customs play a significant role in determining technical efficiency. A small percentage of respondents (10.6%) did not have any formal education, but the majority (80.4%) did. The outcomes are consistent with the discoveries of [16] who observed in a research that the farmers in the study area were uneducated. This indicates that the respondents were literate. Literacy can positively influence the adoption of innovation such as hydroponic technology. The average farming experience was 3.4 years. This shows that the farmers in the study area were relatively new to farming and this is in accordance with the findings of [16], who discovered that farming experience was a determinant of adoption of agricultural technology. The main labour types used by farmers were family labour (50.0%) as well as hired labour (30.6%). This result supports the findings of [20], who suggested that a combination of family and hired sources contributed most of the labour supplied for crop production. Also, only 31.3% were mainly engaged in farming occupation while others diversified into trading/business (49.4%), artisan (10.0%) and civil service (9.4%) as their means of livelihood. This negates the findings of [15], where they discovered that the primary source of income for the respondents was agriculture. Few (35.0%) of the respondents were members of cooperatives and this result syncs with the findings of [2], who found that there were indications that joining agricultural cooperatives had a positive impact on the wellbeing of smallholder farmers. The results also showed that the farmers benefitted from loan (5.6%), and trainings (25.6%) in the cooperatives, these findings support the results of [1], who found that farmers who used cooperative societies report benefited in the form of loans and other resources.

Table 2. Socio-economic characteristics of respondents

Variables	Frequency	Percentage %	Mean (SD)
Age (years)			
≤ 25	150	46.9	
26 – 35	162	50.6	36.1(5.09)
36 and above	8	2.5	
Sex			
Male	180	56.3	
Female	140	43.8	
Marital status			
Single	252	78.8	
Married	64	20.0	
Widowed/widower	4	1.2	
Religion			
Islam	148	46.3	
Christianity	168	52.5	
Traditional	4	1.2	
Educational status			
No formal education	34	10.7	
Primary education	100	31.3	
Secondary education	158	49.4	
Tertiary education	28	8.8	
Farming experience(years)			
1 – 5	280	87.5	
6 – 10	34	10.6	3.4(2.46) (years)
11 and above	6	1.9	
Main labour use			
Family members	160	50.0	
Hired labour	22	6.9	
Family and hired	98	30.6	
Communal	40	12.5	
Secondary occupation			
None	100	31.3	
Civil servant	30	9.4	
Artisan	32	10.0	
Trading/business	158	49.4	
Membership of cooperative associations			
Yes	112	35.0	
Benefits of cooperative			
Loans	18	5.6	
Subsidized inputs	10	3.1	
Training	82	25.6	

Source: Field Survey, 2023.

Vegetable farmers' level of awareness of hydroponics technologies

Results in Table 3 showed that the majority of the respondents in the study area (87.5%) were still using traditional methods (use of soil) for farming. However, all (100.0%) were aware of hydroponics farming technology (soilless agriculture). In contrast, [14] found that a large number of people were not aware of the existence of hydroponic farming. The farmers were familiar with Deep Water Culture (79.4%) and local hydroponics technology (45.0%), but only a small percentage (28.8%) was familiar with the nutrient film approach. This suggests that farmers in the research region have a thorough understanding of local hydroponics technologies and deep water culture.

Table 3. Vegetable farmers' level of awareness of hydroponics technologies

Statement	Frequency	Percentage
Are you currently using traditional methods (use of soil) for farming		
Yes	280	87.5
What is your awareness of hydroponics farming practices		
Aware	320	100.0
Which of these hydroponics systems are you aware of		
NFT (Nutrient Film Technique)	92	28.8
DWC (Deep Water Culture)	254	79.4
The Kraktky Method (Local Hydroponics Technologies)	144	45.0

Source: Field Survey, 2023.

Perception of hydroponics technologies

The ranking of farmers' responses to the perception statements is shown in Table 4. The least favorable perception of hydroponic farming technologies is that pests and diseases can spread easily with a mean score of $\bar{x}$=2.88, ranked twenty-first. You would be willing to use hydroponic farming technology if you had access to quality water, with a mean score of $\bar{x}$=4.20, ranked fourth; your farming experience influences your perception of hydroponic farming, with a mean score of $\bar{x}$=4.21 ranked third position [9]. Vegetable production through hydroponics is environmentally friendly, with a mean score of $\bar{x}$=4.21 ranked second.

Finally, you would be willing to use hydroponics farming technology if proper training was available, with a mean score of $\bar{x}$=4.24 ranked first.

Table 4. Perception of hydroponics technologies

Perception Statements	Mean±SD	Rank
You would be willing to use hydroponics farming technology if proper training was accessible.	4.24±0.75	1st
Production of vegetables through hydroponics is environmentally friendly	4.21±0.71	2nd
Your farming experience influences your perception of hydroponics farming	4.21±0.76	3rd
You would be willing to use hydroponics farming technology if you had access to quality water.	4.20±0.84	4th
I am willing to introduce hydroponics technologies to my friends and family	4.19±0.75	5th
Hydroponic farming technology is easy to use	4.13±0.77	6th
Vegetables grown in hydroponics nutrients solution have faster plant growth and improved yield	4.11±0.87	7th
The level of market demand for hydroponics farming products influences your perception of hydroponics farming	4.11±0.79	7th
The type of crop you grow affects your perception of hydroponics technology	4.08±0.80	9th
Diseases and pests can be easily controlled in Hydroponics farming	4.04±0.88	10th
Nearness to the market influences your perception of hydroponics farming	4.01±0.87	11th
Hydroponic technologies can be set up anywhere	3.93±0.87	12th
Hydroponically-grown vegetables taste better	3.93±0.87	12th
Hydroponics requires proper monitoring of the nutrient solution	3.89±0.89	14th
Kratky method is the best option for hydroponics where there is no electricity	3.73±0.96	15th
Your income level influences your perception of hydroponics technology	3.59±0.98	16th
Your farm size influences your perception of hydroponics technology	3.54±1.00	17th
Your education level influences your perception of hydroponics technology	3.51±1.13	18th
Hydroponic farming is meant for well-educated farmers	3.21±1.13	19th
You experienced the impact of climate change on your crop production	2.95±1.29	20th
Pest and disease can spread easily in hydroponics farming technologies	2.88±1.21	21st

Source: Field Survey, 2023.

Farmers' perception categories on hydroponic technologies

The perception scores of each respondent about hydroponic technologies were categorized. According to results in Table, 90.0% of the respondents had positive perceptions of hydroponic technology, compared to 5.0% who had negative perceptions and another 5.0% who had neutral perceptions. This suggests that farmers had a favorable opinion of hydroponic technologies, which is consistent with the research findings of [13], which discovered that younger farmers had a favorable opinion of hydroponic farming. Farmers in the research area may embrace hydroponic technologies more readily as a result of this.

Table 5. Farmers' perception categories on hydroponic technologies

Categories	Obtained score range	Frequency	%	Mean score
Unfavourable perception	21 – 62	16	5.0	
Neutral	63	16	5.0	80.69±8.63
Favourable perception	64 – 105	288	90.0	
	Total	320	100.0	

Possible range score: 21 – 105 points
Source: Field Survey, 2023.

Constraints to the Practice of Hydroponics Farming

Table 6 showed that increase in the tariff of power supply hydroponic farming technologies may require more electricity than traditional farming methods, according to a mean of $\bar{x}$=2.06 ranked second, inadequate power supply, at $\bar{x}$=2.02 ranked third, and access to credit, at $\bar{x}$=1.97 ranked fourth. These results are consistent with those of [8], which found that access to credit is a significant factor in hydroponic farming, and that there is limited access to training and guidance on hydroponic farming technology ($\bar{x}$=0.71) ranked fifteenth position as the least constraint regarding the practice of hydroponic farming, suggesting that the respondents' lack of access to hydroponics farming training may be a barrier to their use of the technique. This suggests that the primary barriers to the practice of hydroponic farming in the study area were an increase in the power supply tariff, higher electricity requirements, and an inadequate power supply. These findings are consistent

with those of [21], who noted that hydroponic technologies require higher electricity.

Table 6. Constraints to the practice of hydroponics farming

Constraints	Mean±SD	Rank
Increase in the tariff of power supply	2.06±0.87	1st
Hydroponic farming technologies may have higher electricity requirements compared to traditional farming methods	2.06±0.86	2nd
Inadequate power supply	2.02±0.89	3rd
Access to credit	1.97±1.02	4th
High input costs	1.97±0.86	5th
High cost of investment	1.96±0.90	6th
Consumers are unwilling to pay a premium price for hydroponically-grown produce	1.94±0.80	7th
Government policies do not favor hydroponics farming practice	1.94±0.90	8th
The availability and quality of water for hydroponics farming technology are major challenges	1.87±0.95	9th
Access to market	1.79±1.10	10th
Technical know-how	1.74±0.98	11th
Scarcity of nutrient solution	1.58±0.88	12th
Literacy level	1.33±0.86	13th
High cost of training	1.00±1.03	14th
Access to training and guidance on hydroponics farming technology is limited	0.71±0.89	15th

Source: Field Survey, 2023.

Chi-square test of the relationship between socioeconomic characteristics of respondents and their perception of hydroponics farming

The results of the Chi-square test are shown in Table 7 and show how respondents' perceptions about hydroponic farming relate to their socioeconomic factors. Results revealed that level of education (24.291, $p<0.05$) exhibited a significant relationship. This is in agreement with the results of [4], who discovered that education boosts farm productivity when modern technology is embraced. Furthermore, cooperative members demonstrated a strong connection (23.022, $p<0.01$), which is in line with the findings of [22], which demonstrated that cooperative membership had a beneficial effect on the extensity of technology adoption. This suggests that further years of education and membership in farmers' cooperative groups will enable farmers to get a positive impression of hydroponics technologies and a solid comprehension of them.

Table 7. Chi-square test of the relationship between socioeconomic characteristics of respondents and their perceptions of hydroponics farming

Perception	Chi-square ($\chi 2$)	Df	Sig. (p-value)
Sex	3.414	2	0.181
Religion	1.314	4	0.859
Level of education	24.291*	15	0.019
Labour type	8.018	6	0.237
Membership of cooperative	23.022**	9	0.006
Age group	4.288	6	0.638
Farming experience group	4.976	4	0.547

**,* Significant at 0.01 and 0.05 level respectively
Source: Field Survey, 2023.

CONCLUSIONS

This study examined the vegetable farmers' perception of hydroponics technologies in Ogun State, Nigeria. Based on major findings, the study concluded that vegetable farmers in Ogun State had positive perception of hydroponic technology farming. The high rate perceptions of the farmers were their willingness to use hydroponics farming technologies if proper trainings were accessible and their knowledge that production of vegetables through hydroponics is environmentally friendly. Socioeconomic factors that supported farmers' favourable perception about hydroponic farming were additional years of schooling as well as additional years of joining farmers' cooperative group. Vegetable farmers in the research region were well-versed in native hydroponics technologies and deep water culture. The primary barriers to the implementation of hydroponic farming in the research area were an increase in power supply tariffs, an increase in the amount of electricity needed, and an inadequate power supply. The study recommends that empowerment programmes and knowledge acquisition programmes on hydroponic technology farming should be targeted at vegetable farmers who are members of farmers' group/cooperative and is to ensure successful knowledge impact and positive effects of the programme.

REFERENCES

[1]Agbo, A.J., Mbah, E.N., Okeke, M.N., 2018, Prospects of Cooperative Society for Sustainable Agriculture among Smallholder Farmers in Benue State. International Journal of Applied Agricultural Sciences, 4(5), 103-109.

[2]Akinola, A.A., Kehinde, A., Tijani, A.A., Ayanwale, A., 2023, Impact of Membership in Agricultural Cooperatives on Yield of Smallholder Tomato Farmers in Nigeria. Environmental and Sustainability Indicators 20(2023), 100313.

[3]Fussy, A., Papenbrock, J., 2022, An Overview of Soil and Soilless Cultivation Techniques—Chances, Challenges and the Neglected Question of Sustainability. Plants, 2 (11): 1153.

[4]Kafando, B., Essohanam, P., Kodjo, T.G., 2022, Education and Agricultural Technology Adoption: Evidence from Rural India. International Journal of Research in Business Management and Economics, 1(1): 53-74.

[5]Kibiti, J. G., 2017, Factors Influencing Adoption of Urban Hydroponic Farming. A Case of Meru Town, Meru County, Kenya. A Research report Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Master of Arts in Project Planning and Management of the University of Nairobi.

[6]Menalaos, A., Jiaqing, O., Gianluca, E., 2020, Singles' Reasons for Being Single: Empirical Evidence from an Evolutionary Perspective. Front. Psychol., 11

[7]Mukaila, R., Falola, A., Akanbi, S.U.O., Obetta, A. 2022, Effects of Vegetable Production on Income and Livelihood of Rural Households in Nigeria. Mustafa Kemal Üniversitesi Tarim Bilimleri Dergisi, 27(2):213-223.

[8]Mugambi, F. M., 2020, Factors Affecting the Approbation of Hydroponics Farming as a Means to Mitigate and Adapt to Climate Change Amongst Small Scale Farmers: A Case Study Of Meru County Kenya.

[9]Naresh, R., Jadav, S.K., Singh, M., Patel, A., Singh, B., Beese, S., Pandey, S.K., 2024, Role of Hydroponics in Improving Water-Use Efficiency and Food Security. International Journal of Environment and Climate Change, 14(2):608-633.

[10]Neway, M. M., Zegeye, M. B., 2022, Gender Differences in the Adoption of Agricultural Technology in North Shewa Zone, Amhara Regional State, Ethiopia. Cogent Social Sciences, 8:1.

[11]Nwakwo, C.U., Ikehi, M.E., Ejiofor, T.E., Ifeanyieze, F.O., 2024, successive national agricultural policies/programmes, growth of gross domestic product (GDP) and expansion of agribusinesses in Nigeria. Plos one,19(2): e0291999.

[12]Ofuya, T.I., Okunlola, A.I., Mbata, G.N., 2023, A Review of Insect Pest Management in Vegetable Crop Production in Nigeria. Insects, 14(2): 111.

[13]Perera, M. S. S., Fernando, P. J. S., De Silva, P. R. S., Munugoda, K. D., 2022, Farmers' Perceptions and Willingness to Adapt Hydroponic Systems: A study in Welimada, Sri Lanka. International Symposium on Agriculture and Environment, University of Ruhuna, Sri Lanka.

[14]Rajasegar, G., 2023, Hydroponics: Current Trends in Sustainable Crop Production. Bioinformation 19(9):925-938. Environmental and Sustainability Indicators 20: 100313.

[15]Shah, T., Tao, J., Shah, F., Farooq, A., Ishaq, M., Khan, S., 2016, A Comparative Study of the Agricultural Practices of Members and Non-Member Farming Community of Model Farm Services Center in Khyber Pakhtunkhwa Pakistan. Journal of Animal and Plant Sciences, 26: 1787-1796.

[16]Szegedi, K., Győri, Z., Juhász, T., 2024, Factors Affecting Quality of Life and Learning-Life Balance of University Students in Business Higher Education. Humanit Soc Sci Commun, 11, 113

[17]Tanko, M., Ismaila, S., 2021, How Culture and Religion influence the Agriculture Technology Gap in Northern Ghana. World Development Perspectives, 22: 100301.

[18]Udemezue, A.N., Kanu, A.C., 2019, Challenges Of Nigerian Agricultural Sector in the Twenty First Century: The Case of Nomadic Insurgence and Terrorist Sects. Universal Journal of Agricultural Research 7(2):117-124.

[19]United Nations Children's Fund: Report of the Executive Board of the United Nations Children's Fund on the Work of its First Regular Session of 2023.

[20]Wang, J., Hu, X., 2021, Research on Corn Production Efficiency and Influencing Factors of Typical Farms: Based on Data from 12 Corn-Producing Countries from 2012 To 2019. Plos One, 16(7): E0254423

[21]Xu, Z., Elomri, A., Al-Anasari, T., Kerbache, L., El Mekkawi, T., 2022, Decisions on Design and Planning of Solar-assisted Hydroponic Farms under Various Subsidy Schemes. Renewable and Sustainable Energy Reviews, 156: 2022.

[22]Zhang, S., Sun, Z., Valentinov, V., 2020, The Effect of Cooperative Membership on Agricultural Technology Adoption in Sichuan, China. China Economic Review, 62:10.1016.