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Are Tomato Farmers Willing to Adopt the Hydroponics Farming System in Oyo State, Nigeria?

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ABSTRACT

The rising demand for tomatoes and tomato-based foods in Nigeria owing to its numerous health benefits calls for a comprehensive and economically viable farming system to replace or complement traditional farming systems for tomato production. This study therefore assessed the level of awareness of tomato farmers and their readiness to adopt the hydroponics farming system. The sociodemographic determinants of their readiness to adopt hydroponic farming were also identified. Measures of central tendency and the logistic regression model were employed in the analysis of data. Knowledge of hydroponic farming was low among the farmers. Key positive determinants of awareness include distance to market, having government support and access to social media. More than three-fifths of the farmers were willing to adopt the hydroponics farming system. Such farmers had tertiary education, access to extension agents and relatively small farm sizes. High initial capital for adoption was the most critical limitation to the readiness of adoption of the system. Enhanced tomato output from this system may be a cause for its advocacy. Awareness and adoption of hydroponic farming can be increased if extension services are intensified. This will ensure food security and sustainable economic development.

Key words: hydroponics farming system, tomatoes, awareness, willingness to adopt

INTRODUCTION

Tomato (*Lycopersicon esculentum*), a member of the Solanaceae family botanically known as berry, is a main fruit vegetable, regarded as an important cash and trade crop in many parts of the world particularly over the last century (Ajagbe et al., 2014). However, some cultivars are grown annually in some regions of the world (Babarinsa and Ige, 2014; Abdullah et al., 2010). The delicate and compression-sensitive fruit is highly nutrient-dense and as such its numerous health benefits cannot be overemphasized (Achoja and Okoh, 2014).

Production and consumption of tomatoes around the world have increased tremendously over the past 25 years. This is mainly because of the health benefits derived from tomatoes and tomato-based foods, as well as the fact that the crop generates income for farmers and is a potential for growth and employment creation owing to its numerous uses (Anang, 2015; Adenuga et al., 2013). In addition, the tomato industry has a huge potential for increasing foreign export earnings of many African countries (Ayandiji and Adeniyi, 2011). Globally, tomato production is estimated at 162 million tonnes. In Africa, the total tomato production for 2020 was 22,228,893 tonnes with Egypt being the foremost producer in the continent with 6.731.220 tonnes, followed by Nigeria with 3,693,722 tonnes and Gabon with 410 tonnes being the African country with the least production in 2020 (Ebimieowei and Ebideseghabofa, 2013; FAOSTAT, 2020).

However, with 66% of the world's population expected to live in cities by 2050 (UNDESA, 2014), efforts to streamline production techniques have intensified recently in order to fulfil the food demands of a rapidly expanding population. The ability of conventional production practices to meet this demand for sustainable food security has thus been called into question. Soil-based crop production faces severe limitations including diminishing land area and soil fertility, soil degradation, the prevalence of pests and disease, and climatic changes due to global warming among others (Putra and Yuliando, 2015; Perrin et al., 2014). Thus, the need for a comprehensive and economically viable farming system to replace or complement traditional farming

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methods for the provision of adequate and good food for the fast-growing population. The hydroponics system is a modern agricultural system that mineral-rich water rather than soil is employed for nurturing the plant (Kläring, 2001). In other words, the relatively modern farming system does not require fertile land to be effective and only requires a small amount of water and expanse of land when compared with the other traditional systems.

In horticultural practice in recent times, there has been a proliferation of farming systems in which conventional substrates are not used. These include the aeroponic systems, the nutrient film technique (NFT), and the static hydroponic system (Pudelski, 1998; Komosa et al., 2014. In the hydroponics system, plants are grown without soil. The system on the other hand uses mineral nutrient solutions (mineral, synthetic and organic substrates) to feed the plants in water infused with nutrients (Komosa, 2002; Kleiber, 2012). The systems range from simple to complex setups (Alshrouf, 2017).

The many advantages of the system include use of water rather than soil as the medium of growth; increased and consistent yields; no environmental pollution; efficiency of nutrient uptake by the plants and water use efficiency. In fact, consistent production year round is possible with coordinated supervision of growth environment (Brechner and Both, 2014). The system is a successful and rapidly expanding industry in the world (Carruthers, 2012). Its impact on productivity and growth through the development of infrastructure cannot be overemphasized (Imran, 2011). It is thus a technology with enormous potential for achieving self-sufficiency in the production of tomatoes in the developing world and Nigeria in particular.

While numerous studies have been carried out on various farming systems for tomato production among farmers in Nigeria (Ugonna et al., 2015, Katanga et al., 2018; Degiri et al., 2019), studies that assess the farmers' knowledge and readiness to accept hydroponic farming as a method for tomato production are still very scanty. Hence this study will add to literature on the potential of sustainable farming systems for tomato production by examining numerous factors that influence awareness as well as the willingness of tomato farmers to adopt the hydroponics farming system in the study area. The study aims to assess the level of understanding of the hydroponic systems among tomato farmers; examine the factors influencing the level of awareness; identify the determinants of the readiness to accept the hydroponic farming system; and examine limitations to the acceptance of hydroponics farming by the farmers.

MATERIAL AND METHODS

The study was conducted in Akinyele Local Government Area (LGA) of Oyo state Nigeria. The estimated population of the area was 297,600 over a land area of 432.2 km^2 as at 2016 (City Population, 2020). Of this population, 90% is primarily engaged in agriculture. The average temperature of the area is 29^{o}C, humidity is 63% and the major seasons are the dry and rainy seasons. A multistage sampling technique was employed in this study to select respondents. In the first stage, Akinyele Local Government was purposively selected because of the concentration of tomato farmers in the area. In the second stage, five wards were randomly selected from twelve wards in the Local Government Area. The random selection of thirty farmers each from the five wards was the last stage. In all, a total of 150 tomato farmers constituted the sample size.

Descriptive statistics such as tables, percentages, weighted mean, and frequency were used to describe the socioeconomic characteristics of tomato farmers and the constraints to adopting hydroponic farming. However, the logit regression model was used to examine the factors affecting the awareness of hydroponic farming and to identify the factors affecting the willingness of tomato farmers to adopt the system. To examine the socioeconomic characteristics of the farmers and the limitations to the acceptance and use of hydroponics farming, frequencies and percentages were used. The logit model following Udimal et al. (2017) and Ntshangase et al. (2018) was used to identify the determinants of awareness and the readiness to accept and use hydroponic farming as a production method (see Adepoju and Olaseni (2020) for details of the model). The model requires a binary dependent variable, independence of the observations, and little or no multicollinearity among the independent variables. The model for this study is specified as follows:

$$P_i = \frac{e^{X_i\beta}}{1+e^{X_i\beta}} \quad (1)$$

$$Y_I = \beta_0 + \beta_i X_i + \varepsilon_i \quad (2)$$

$$Y = \alpha + \Sigma\beta_1 X_1 + \Sigma\beta_2 X_2 + \ldots + \Sigma\beta_n X_n + \varepsilon_i \quad (3)$$

where Y_i = 1 if aware; 0= if otherwise and Y_i = 1 if willing to adopt; 0= if otherwise, β_0 is constant, β_i are parameters/coefficients of the explanatory variables, α is the intercept, β is the slope, β_i... β_n are coefficients of the independent variables ε_i is random/disturbance term, X_1....X_n are the independent variables.

RESULTS AND DISCUSSION

Table 1 presents the socioeconomic characteristics of the farmers. More than four-fifths of the farmers were male and married with about three-tenths between the ages of 36 and 45 years. The mean age of the farmers stood at 46.7±11.3 years. Majority of the farmers were educated and as expected were primarily engaged in farming. More than half of the farmers

Table 1: Socioeconomic characteristics of the respondents

Socio-economic characteristics	Frequency	Percentage	Mean	Standard deviation
Gender				
Male	134	89.3		
Female	16	10.7		
Age (years)				
< 35	29	19.3	46.7	11.3
36-45	48	32.0		
46-55	31	20.7		
> 55	42	28.0		
Marital status				
Single	15	10.0		
Married	123	82.0		
Divorced	6	4.0		
Widowed	6	4.0		
Educational status				
No formal education	26	17.3		
Primary	49	32.7		
Secondary	72	48.0		
Tertiary	3	2.0		
Primary occupation				
Farming	135	90.0		
Trading	6	4.0		
Artisan	8	5.3		
Civil servant	1	0.7		
Access to credit				
Yes	77	48.7		
No	73	51.3		
Source of credit				
Cooperatives	21	58.4		
Money lenders	45	27.3		
Friends/Relatives	11	14.3		
Cooperative membership				
Yes	87	58.0		
No	63	42.0		
Access to extension agents				
Yes	85	56.7		
No	65	43.3		
Tomato farm size (hectares)				
<5	72	48.0	7.4	5.1
6-10	56	37.3		
11-15	11	7.3		
>15	11	7.4		
Monthly earnings (naira)				
< 20000	4	2.7	72486.7	66722.2
20001-30000	11	7.3		
>30001	135	90.0		
Years of farming experience				
< 10	51	34.0	17.4	10.3
11-20	57	38.0		
21-30	23	15.3		
> 30	19	12.7		
Awareness of the hydroponics system				
Yes	10	6.7		
No	140	93.3		
Willingness to adopt the hydroponics farming system				
Yes	102	68.0		
No	48	32.0		

had access to credit and more than two-fifths were members of a farmers cooperative society. The average tomato farm size for cultivation was 7.4±5.1 hectares. The average monthly income was ₦72,486.70 ± ₦66,722.20 and about two-fifths of the farmers had less than 20 years of farming experience. The average years of farming experience amounted to 17.4±10.3 years.

Tomato farmers' understanding and readiness to accept the farming system were obtained by finding the frequencies and percentages of their responses. Farmers' awareness was very low as only one out of ten farmers had ever heard of hydroponic farming. On the other hand, about one-tenth of those who were aware had poor knowledge of the process and principles of operations of the hydroponics system. Interestingly, the farmers' willingness to adopt hydroponic farming was high as more than three-fifths of the farmers were willing to adopt, while less than two-fifths showed no interest in adopting the farming system.

The factors influencing the awareness of tomato farmers of the hydroponics farming system is shown in Table 2. Following Greene (2012), the log-likelihood ratio of −19.39 showed the overall fit of the model; the Chi-square value was 17.82, while the variance inflation factors (VIF) were used to examine multicollinearity between the independent variables. Gender, distance to market, government support, farm size, and social media had significant effects on the awareness of hydroponics farming. Specifically, being a male farmer decreased the probability of awareness of hydroponic farming by 0.1079 units. This finding negates the findings of Kahimba et al. (2014) and Ntshangase (2018), which reported that male farmers were more aware and were more likely to adopt agricultural technology than female farmers. However, Adesina et al. (2001) cautioned that the influence of gender on technology awareness and subsequent adoption should not be generalized as it may be dependent on the type of technology and its attributes.

Distance to market affected farmers' awareness positively i.e., a kilometer increase in the farm distance to the market increased the likelihood of awareness of hydroponic farming by 0.0029 units. In contrast to these findings, Zegeye et al. (2021) observed that farmers who resided distant from their farm plots and local markets were less likely to be aware of and adopt agricultural innovations. This is primarily due to the lack of publicly available information about better technologies necessary for farmers to make educated judgements regarding their adoption.

Government support had a positive effect on farmers' awareness. In other words, farmers obtaining one form of support or the other from the government were more likely to be aware of hydroponics. This finding is consistent with the findings of Liverpool-Tasie (2014) and Carter et al. (2014) who in separate but related studies found evidence that government support (subsidies) increased awareness and specifically generated a higher willingness to pay for technology after the subsidy.

Furthermore, access to social media also had a positive effect on farmers' awareness of hydroponic farming as the use of social media increased the likelihood of awareness of hydroponic farming by 0.0844 units. This finding aligns with those by Kabbiri et al. (2018) and Diaz et al. (2021), who in related studies on the use of information and communication technology in the agricultural sector reported significant and positive effects. Nevertheless, the social media technology must be user-friendly.

Conversely and contrary to a priori expectations, an additional increase in farm size decreased the likelihood of farmers' awareness of hydroponic farming by 0.0185 units. This indicates a negative effect of farm size on awareness of the hydroponics system. This finding corroborates the findings of Adeola (2010) and Lugandu (2013), who both revealed that land sizes significantly influenced technology adoption negatively. However, other studies (Knowler and Bradshaw, 2007; Mazvimavi and Twomlow, 2009; Nyambose

Table 2: Factors influencing tomato farmers' awareness of hydroponics farming system

Variables	Coefficients	Marginal effect	Z-value
Gender	−2.1700*	−0.1079	−1.62
Distance to market	0.0772*	0.0029	1.66
Government support	4.5906***	0.2977	2.57
Farm size	−0.5002**	−0.0185	−2.07
Social media	2.0400**	0.0844	2.39
Household size	−0.4603	−0.0170	−1.31
Age	−0.0295	−0.0011	−0.46
Cooperative society	1.1922	0.0410	0.86

*, **, *** indicate significant at 10%, 5% and 1% significant levels, respectively. McFadden Pseudo R2 = 0.4723, Chi squared = 17.82, Log likelihood function = −19.39

Table 3: Factors influencing tomato farmers' willingness to adopt hydroponics farming system

Variables	Coefficients	Marginal effect	Z-value
Age	0.0814	0.0241	0.87
Age square	−0.0010	−0.0003	−1.07
Monthly income	0.6971*	0.2061	1.85
Farm size	−0.0623*	−0.0184	−1.82
Extension	0.9622*	0.2896	1.68
Cooperative Membership	−0.5442	−0.1481	−0.99
Distance to market	−0.0302	−0.0089	−1.39
Level of education			
Primary	−0.1894	−0.0652	−0.56
Secondary	0.3472	0.1083	−0.56
Tertiary	1.2457**	0.2895	1.83

*,**, *** indicate significance at 10%, 5% and 1% level, respectively. McFadden Pseudo R2 = 0.1628, Chi squared = 30.61, Log likelihood function = −78.72

and Jumbe; 2013) showed that land holdings influenced technology awareness and adoption positively.

The determinants of tomato farmers' willingness to adopt the hydroponics farming system is presented in Table 3. A Chi-square value of 30.61 and a log-likelihood value of –78.72 showed the goodness of fit of the model. Significant factors positively influencing the readiness of farmers comprised the tertiary educational status of the farmers, access to extension services, and the monthly income of the farmer. However, farm size under tomato cultivation had negative effect.

Having tertiary education increased the probability of farmers' willingness to adopt hydroponic farming system by 0.2895 units. This finding agrees with those of Jumbe and Nyambose (2016) and Ntshangase et al. (2018) who all reported a positive effect of education on farming technology adoption. Also, the willingness to adopt hydroponic farming increased by 0.2061 as monthly income increased by one naira. This finding agrees with the findings of Ntshangase et al. (2018) in which higher incomes were associated with higher levels of adoption rates by farmers. Specifically, Pereira and Sain (1999) reported that farmers who were advantaged in terms of resources were more likely to adopt a technology first, especially if the use of the technology depends on investment in required production equipment. On the other hand, Nyanga (2012) reported that the likelihood of a high-income farmer adopting a new technology is low because the current level of production is satisfactory and generating income as expected. As such, farmers may see no need to adopt new technology.

The positive effect of access to extension services on farmers' willingness to adopt the hydroponics farming system increased by 0.2896 units. This is expected as access to extension services gives the farmer the opportunity to be reliably informed about new technologies. This finding is supported by the findings of Arslan et al. (2014), Jumbe and Nyambose (2016) and Ntshangase et al. (2018) which emphasized the importance of reliable channels for getting information across to farmers, so that farmers are empowered to process and make use of such information. This is worthy of note as farmers who were frequently visited and had access to extension workers had a higher likelihood of adopting technologies or farming practices

On the other hand, the effect of farm size was negative implying that an increase in farm size decreased the likelihood of adoption of hydroponic farming by 0.0184 units. This may be connected to the high initial capital required to start a hydroponics farm. This finding however negates the findings of Udimal et al. (2017), where farm sizes influenced farmers' adoption of technologies positively – as farmers with large farm sizes were more likely to adopt new technologies. This is expected as such farmers can afford to try out new technologies using a portion of their land not under cultivation. This could eventually lead to adoption based on the outcome of the trial. However, for farmers with smaller farms, who must cultivate their crops every season to subsist, this might not be feasible.

Constraints to acceptance and use of hydroponics farming system by the tomato farmers when evaluated showed six key constraints as presented in Table 4. Frequencies and percentages of the responses for each constraint were employed to examine the severity of the constraints. The most severe constraint faced by the farmers was the high cost of capital required for adoption, and this agrees with the findings of Mugambi (2020), that access to capital is one of the major determinants of uptake of hydroponics farming. Farmers experienced high costs of operations especially – in the process of purchasing mineral solutions and water, labour etc. The second most severe constraint was the lack of government support, which was noted by Omotilewa et al. (2019) that to accelerate the diffusion and adoption of agricultural technologies and enhance their use, many governments need to subsidize inputs. Furthermore, the third and fourth constraints in order of severity were high technical know-how requirements and the complexity of the hydroponics system respectively. One of such is maintaining the nutrient balance in the system (Mugambi, 2020). This finding is supported by the findings of Khan et al. (2018) who reported that maintaining nutrient balance can be achieved partly through an automated system, which may be too technical for farmers to operate. Lack of information on hydroponics ranked as one of the least severe constraints. In the study area, 'tasking farming operations' was the least severe of the six identified constraints to the adoption of hydroponic farming. Although technically complex, the hydroponic farming system's operations were not too onerous to discourage farmers from using it, in their opinion.

Table 4: Constraints to the willingness to adopt the hydroponics farming system

Constraints	Very severe	Severe	Not severe	Not a constraint	Total
High initial capital	136(90.7)	12(8.0)	2(1.3)	0(0.0)	150(100.0)
Lack of government support	112(75.2)	10(6.7)	16(10.7)	11(7.4)	150(100.0)
The system requires high technical knowhow	107(71.3)	39(26.0)	3(2.0)	1(0.7)	150(100.0)
The system is highly complex	98(65.3)	38(25.3)	13(8.7)	1(0.7)	150(100.0)
Lack of information on hydroponics	75(50.0)	61(40.7)	10(6.7)	4(2.6)	150(100.0)
Farm activities are tasking	42(28.0)	48(32.0)	46(30.7)	14(9.3)	150(100.0)

Numbers in parentheses are percentages

CONCLUSION

Most tomato farmers in the study area were uninformed of the hydroponics system, however, a large proportion of those who were aware were prepared to adopt it. This study concluded that farmers' awareness of the hydroponics system was significantly determined by government support, farm size, and access to social media among other factors. The study also concluded that the high cost of capital, lack of government assistance and high technical know-how were the main identified constraints to the adoption of the hydroponics farming system. Thus, agricultural information regarding the hydroponics system must be efficiently disseminated to tomato farmers via extension services and social media in order to boost their knowledge, awareness, and adoption of the technology. In addition, government and stakeholder support should focus on providing tomato producers with the necessary inputs, capital, and technical know-how, among other things. This is to stimulate awareness and implementation of hydroponics technology for improved productivity. Tomato farmers' propensity to adopt hydroponic farming is influenced by their education level, income, availability to extension agents, and the size of their tomato-growing farms. Thus, the importance of human capital development, access to agricultural information, the volume of production, and revenue from production on the readiness to adopt innovative technologies cannot be overemphasised. Thus, these factors should be the focus of development interventions for increased awareness and use of hydroponics technology to assure higher agricultural output and sustained economic development.

REFERENCES

1. Abdullah, F. S., Salik, N. K., Ambreen, S., & Justina, J. T. (2010). Effect of packing materials on storage of tomato. *Mycopath Journal, 8*(2), 85-89.
2. Achoja, F. O., & Okoh, R. N. (2014). Post-harvest properties of tomato and effect on its marketing efficiency. *Turkish Journal of Agricultural and Natural Sciences, 1*(1), 52-58.
3. Adeola, R. G. (2010). Influence of socio-economic factors on the adoption of soil conservation measures in Ibadan/Ibarapa agricultural zone of Oyo State. *Report and Opinion, 2*(7), 42-47.
4. 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, 13*(1), 3-13.
5. Adesina, A. A., Mbila, D., Nkamleu, G. B., & Endamana, D. (2001). Econometric analysis of the determinants of adoption of alley farming by farmers in the forest zone of southwest Cameroon. *Agriculture, Ecosystems and Environment, 80*(3), 255-265.
6. Adenuga, A. H., Muhammad-Lawal, A., & Rotimi, O. A. (2013). Economics and technical efficiency of dry season tomato production in selected areas in Kwara State, Nigeria. *Agris on-line Papers in Economics and Informatics, 5*(1), 11-19.
7. Ajagbe, B. O., Oyediran, W. O., Omoare, A. M., & Sofowora, O. O. (2014). Assessment of post-harvest practices among tomato (Solanum Lycopersicum) farmers/processors in Abeokuta north local government area of Ogun State, Nigeria. *International Journal of Education and Research, 2*(3), 1-12.
8. AlShrouf, A. (2017). Hydroponics, aeroponic and aquaponics as compared with conventional farming. *American Scientific Research Journal for Engineering, Technology, and Sciences, 27*(1), 247-255.
9. Anang, T.B. (2015). A probit analysis of the determinants of fertilizer adoption by cocoa farmers in Ghana. *Asian Journal of Agricultural Extension Economics and Sociology, 8*(1), 1-8.
10. Arslan, A., Mccarthy, N., Lipper, L., Asfaw, S., & Cattaneo, A. (2014). Agriculture, ecosystems and environment adoption and intensity of adoption of conservation farming practices in Zambia. *Agriculture Ecosystem and Environment, 187*, 72-86.
11. Ayandiji, A. O., & Adeniyi, O. D. (2011). Determinants of post harvest losses among tomato farmers in Imeko-Afon Local Government Area of Ogun State, Nigeria. *Global Journal of Science Frontier Research, 11*(5), 22-28.
12. Babarinsa, F. A., & Ige, M. T. (2014). Strength parameters of packaged roma tomatoes at peak point under compressive loading. *International Proceedings of Chemical, Biological and Environmental Engineering (IPCBEE), 65*, 31-35. 5th International Conference on Food Engineering and Biotechnology, Penang, Malaysia, 12-14 March 2014.
13. Brechner, M., & Both, A. J. (2014). Cornell controlled environment agriculture. Hydroponic lettuce handbook. Retrieved from http://www.cornellcea.com/attachments/Cornell CEA Lettuce Handbook.pdf.
14. Carter, M. R., Laajaj, R & Yang, D. (2014). Subsidies and the persistence of technology adoption: Field experimental evidence from Mozambique. National Bureau of Economic Research Working Paper 20465.
15. Carruthers, S. (2002). Hydroponics as an agricultural production system. Practical hydroponics and greenhouses. The commercial growers' magazine issue 63. Retrieved from www.hydroponics.com.au
16. City Population (2020). Akinyele Local Government Area, Nigeria - Population Statistics, Charts, Map and Location (city-population.de)
17. De Herrera, A. P., & Sain, G. (1999). Adoption of Maize Conservation Tillage in Azuero, Panama. Economics Working Papers 7696, CIMMYT: International Maize and Wheat Improvement Center, CIMMYT, Mexico. DOI: 10.22004/ag.econ.7696.
18. Degiri, M. M., Samaila, A. E., & Oaya, C. S. (2019). Effect of weeding frequency and plant spacing on infestation and and damage of the major insect pests of tomato. *African Journal of Agriculture Technology and Environment, 8*(1), 124-132.
19. Diaz, A. C., Sasaki, N., Tsusaka, T. W., & Szabo, S. (2021). Factors affecting farmers' willingness to adopt a mobile app in the

marketing of bamboo products. *Resources, Conservation & Recycling Advances, 11*, 1-7. Retrieved from: https://doi:10.1016/j.rcradv.2021.200056

20. Ebimieowei, E., & Ebideseghabofa, E. (2013). Postharvest quality of commercial tomato (*Lycopersicon Esculentum Mill.*) fruits brought into Yenagoa Metropolis from Northern Nigeria. *Journal of Biology Agriculture and Healthcare, 3*(11), 49-54.
21. Food and Agriculture Organization Statistical Database. (2020). Retrieved from www.fao.org/faostat/en/#data/QCL
22. Greene, W. H. (2012). Econometric Analysis (7th ed.). Boston, MA: Pearson Education.
23. Imran, M., & Niazi, J. (2011). Infrastructure and Growth. *The Pakistan Development Review, 50*(4), 355-364.
24. Jumbe, C. B. L., & Nyambose, W. (2016). Does conservation agriculture enhance household food security? Evidence from smallholder farmers in Nkhotakota in Malawi. *Sustainable Agriculture Research, 5*(1), 118-128.
25. Kabbiri, R., Dora, M., Kumar, V., Elepu, G., & Gellynck, X. (2018). Mobile phone adoption in agri-food sector: Are farmers in Sub-Saharan Africa connected? *Technological Forecasting and Social Change, 131*, 253-261.
26. Kahimba, F.C., Mutabazi, K.D., Tumbo, S.D., Masuki, K.F., & Mbungu, W.B. (2014). Adoption and scaling-up of conservation agriculture in Tanzania: Case of Arusha and Dodoma Regions. *Natural Resources, 5*, 161-176.
27. Katanga, Y. N., Danwawu, S. S., & Musa, B. (2018). Economic analysis of tomato production in Fagge Local Government Kano State, Nigeria. *Dutse Journal of Economics and Development Studies, 6*(2), 98-104.
28. Khan, F. A., Kurklu, A., Ghafoor, A., Ali, Q., Umair, M., & Shahzaib (2018). A review on hydroponic greenhouse cultivation for sustainable agriculture. *International Journal of Agriculture, Environment and Food Science, 2*(2), 59-66.
29. Kläring, H. P. (2001). Strategies to control water and nutrient supplies to greenhouse crops: A review. *Agronomie, 21*(4), 311-321.
30. Kleiber T., Markiewicz B., & Niewiadomska, A. (2012). Organic substrates for intensive horticultural cultures: Yield and nutrient status of plants, microbiological parameters of substrates. *Polish Journal of Environmental Studies, 21*(5), 1261-1271.
31. Komosa, A., Kleiber, T., & Markiewicz, B. (2014). The effect of nutrient solutions on yield and macronutrient status of greenhouse tomato (Lycopersicon esculentum Mill.) grown in aeroponic and rockwool culture with or without recirculation of nutrient solution. *Acta Scientiarum Polonorum Hortorum Cultus, 13*(2), 163-177.
32. Komosa, A. (2002). Inert media – progress or inertia? *Advances of Agricultural Sciences Problem, 485*, 147-167.
33. Knowler, D., & Bradshaw, B. (2007). Farmers' adoption of conservation agriculture: A review and synthesis of recent research. *Food Policy, 32*(1), 25-48.
34. Liverpool-Tasie, L. S. O. (2014). Fertilizer subsidies and private market participation: The case of Kano State, Nigeria. *Agricultural Economics, 45*(6), 663-678.
35. Lugandu, S. (2013). Factors influencing the adoption of conservation agriculture by smallholder farmers in Karatu and Kongwa Districts of Tanzania. Presented at REPOA's 18th Annual Research Workshop held at the Kunduchi Beach Hotel, Dar es Salaam, Tanzania; April 3-4, 2013.
36. Mazvimavi, K., & Twomlow, S. (2009). Socioeconomic and institutional factors influencing adoption of conservation farming by vulnerable households in Zimbabwe. *Agricultural Systems, 101*, 20-29.
37. 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 (Master's theses). Norwegian University of Life Sciences, Norway. Retrieved from https://hdl.handle.net/11250/2683457
38. Ntshangase, N., Muroyiwa, B. A., & Sibanda, M. (2018). Farmers' perceptions and factors influencing the adoption of no-till conservation agriculture by small-scale farmers in Zashuke, *KwaZulu-Natal Province. Sustainability, 10*(2), 1-16.
39. Nyanga, P. (2012). Factors Influencing adoption and area under conservation agriculture: A mixed methods approach. *Sustainable Agriculture Research, 1*(2), 27-40.
40. Omotilewa, O. J., Ricker-Gilbert, J., & Ainembabazi, J. H. (2019). Subsidies for agricultural technology adoption: Evidence from a randomized experiment with improved grain storage bags in Uganda. *American Journal of Agricultural Economics, 101*(3), 753-772.
41. Perrin A., Basset-Mens C., & Gabrielle, B. (2014). Life cycle assessment of vegetable products: A review focusing on cropping systems diversity and the estimation of field emissions, *International Journal of Life Cycle Assessment, 19*(6), 1247-1263.
42. Pudelski, T. (1998). *Tomatoes under glass and foil*. Warsaw, Poland: PWRiL.
43. Putra, P. A., & Yuliando, H. (2015). Soilless culture system to support water use efficiency and product quality: A review. *Agriculture and Agricultural Science Procedia, 3*, 283-288.
44. Udimal, T. B., Jincai, Z., Mensah, O. S., & Caesar, A. E. (2017). Factors influencing the agricultural technology adoption: the case of improved rice varieties (NERICA) in the Northern Region, Ghana. *Journal of Economics and Sustainable Development, 8*(8), 137-148.
45. Ugonna, C. U., Jolaoso, M. A., & Onwualu, A. P. (2015). Tomato value chain in Nigeria: Issues, challenges and strategies. *Journal of Scientific Research and Report, 7*(7), 501-515.
46. United Nations Department of Economic and Social Affairs, Population Division. (2014). World urbanization prospects: The 2014 revision, methodology working paper no. ESA/P/WP.238. Retrieved from https://population.un.org/wup/publications/Files/WUP2014-Methodology.pdf
47. Zegeye, M. B., Fikire, A. H., & Assefa, A. B. (2021). Impact of agricultural technology adoption on food consumption expenditure: *Evidence from rural Amhara Region, Ethiopia*. Cogent Economics and Finance, 10(1),1-16. https://doi.org/10.1080/23322039.2021.2012988

Ali so pridelovalci paradižnika pripravljeni sprejeti hidroponski sistem kmetovanja v državi Oyo v Nigeriji?

IZVLEČEK

Naraščajoče povpraševanje po paradižniku in živilih na osnovi paradižnika zaradi številnih koristi za zdravje zahteva celovit in ekonomsko vzdržen sistem kmetovanja, ki bi nadomestil ali dopolnil tradicionalne sisteme kmetovanja za pridelavo paradižnika. V raziskavi je bila ocenjena stopnja ozaveščenosti pridelovalcev paradižnika in njihova pripravljenost za uvedbo hidroponičnega sistema kmetovanja. Ugotavljali so tudi socio-demografske determinante pripravljenosti kmetovalcev za hidroponsko kmetovanje. Pri analizi podatkov so bila uporabljena merila centralne tendence in model logistične regresije. Znanje o hidroponskem kmetovanju je bilo med kmeti slabo. Ključni pozitivni dejavniki ozaveščenosti vključujejo oddaljenost od trga, državno podporo in dostop do družbenih medijev. Več kot tri petine kmetov je bilo pripravljenih sprejeti hidroponski sistem kmetovanja. Ti kmetje so imeli terciarno izobrazbo, dostop do svetovalnih agentov in razmeroma majhne kmetije. Visok začetni kapital za uvedbo je bil najbolj kritična omejitev pripravljenosti za sprejem sistema. Povečan pridelek paradižnika iz tega sistema je lahko razlog za njegovo zagovarjanje. Ozaveščenost in sprejemanje hidroponičnega kmetovanja se lahko povečata, če se okrepijo svetovalne službe. To bo zagotovilo prehransko varnost in trajnostni gospodarski razvoj.

Ključne besede: hidroponski sistem kmetovanja, paradižnik, zavedanje, pripravljenost sprejeti