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SOCIOECONOMIC EFFECT OF THE ADOPTION OF LEAFY VEGETABLE TECHNOLOGIES ON LEAFY VEGETABLE PRODUCTION IN RIVERS STATE, NIGERIA

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ABSTRACT
This study investigated the socio-economic impact of the adoption of agricultural technologies on leafy vegetable production in Rivers State, Nigeria. Employing a quota sampling technique, 191 leafy vegetable farmers from 18 Local Government Areas were surveyed. Analysis of the socioeconomic characteristics showed that the majority were female respondents (51.6%), with ages between 39-49 years (41.9%), and 76.3% being married. Notably, 46.5% and 51.9% had tertiary and secondary education, respectively. The types of agricultural technologies on leafy vegetable production available to vegetable farmers in the study area were organic manure application and using inorganic fertilizer (NPK), improved planting material seedling on fluted pumpkin, field preparation using check basin method and preservation/storage procedure using sorting out diseased and bruised produce as they ranked 1st position. Organic fertilizer (compost) exhibited higher adoption (mean score = 3.95) than inorganic fertilizer (NPK) (mean score = 3.22) by leafy vegetable farmers. The major socio-economic impacts were enhanced food security (91.4%) and agricultural knowledge acquisition (87.9%). Regression analysis identified age, household size, and educational level as significant predictors of technology adoption. The study concluded that the adoption of agricultural technologies on leafy vegetable production had positive socioeconomic impact on the farmers and vegetable production in the study area as it improved farm income, the acquisition of agricultural knowledge and enhancement of rural livelihood. It was therefore recommended that vegetable farmers should be encouraged to adopt vegetable technologies since it increases their production level.

Keyword: Socioeconomic Impact, Adoption, Agricultural Technologies, Leafy Vegetable

INTRODUCTION
Basic agricultural technology adoption is gradually changing with time, positing advances that regulate leafy vegetable production to ensure food availability, nutrition and security. Technology is the application of knowledge of nature for achievement of goals. It includes the fashioning of instruments, synchronization of activities with nature, use of natural materials and generation of ideas (Adeoke *et al,* 2017). Almost every field of life flow to develop modern ways of doing things to cope with the changing environment we live in, these includes medicine, library, learning, agriculture, amongst others.

Alhassan *et al* (2019) state that improved agricultural technology transfer to farmers in order to step up production activities, food security and growth in agricultural output depends on technological usages, which enhances the productive capacity of the agricultural sector (Osabohien *et al,* 2018).

Modern day agriculture is complex driven, not limited to sowing a seed, rearing animal or fish farming. It takes a whole ecosystem and a host of actors to work together to produce the food we need for a population of more than seven billion people (Farming First, 2016). Technological upgrade in the field of agriculture is increasing geometrically to ensure food sufficiency for the growing population. The agricultural industry which also includes leafy vegetable has experienced a massive technological shift in recent times. These technologies constitute the very keys to the survival of the human race (Heikkila, 2018). Technology itself is aimed at improving a given situation or changing the status quo to a more desirable level. Nigeria ranked seventh in top fifteen countries using modern agricultural technologies with agricultural outputs in 2015 with 573,999 GDP Millions of USD and 106 agricultural outputs in USD Billions (Rehman *et al,* 2017).

Leafy vegetables are herbaceous plants loaded with nutritional and medicinal properties. Leafy vegetable farms are found everywhere in the world. There are numerous challenges experienced by leafy vegetable farmers not considering the importance of vegetables ranging from its nutritious values, medicinal properties, income generation and its consumption by man and his livestock. Some of the challenges experienced by leafy vegetable farmers includes; scarcity of land, lack of capital, lack of farm input, lack of agricultural training, lack of agricultural extension workers, lack of agricultural aid, poor preservation quality, insect attacks and low market prices (Azad *et al*, 2014). Leafy vegetable farms are very common in Rivers State because they are easily grown especially in rainy season. The array of vegetables which serve as a staple food for many Nigerian families, arising from the dietary needs, medicinal uses and for the farm animals includes; fluted pumpkin, African spinach, water-leaf, bitter-leaf, garden egg-leaf, scent leaf, wild spinach, black pepper, bush buck, African rose wood, Curry leaf, African eggplant leaf, etc. Tanimonure *et al* (2021) concluded that the inclusion of diverse underutilized indigenous vegetables into cropping systems in rural areas and vegetable home gardening practices in the rural and urban areas of developing countries could alleviate the challenge of nutrition insecurity.

There is the need to improve leafy vegetable farming due to the increased demand by the teeming population giving its importance. Incorporating fluted pumpkin leaf powder in cassava pasta led to some improvements in the techno-functional and sensorial attributes (Oluranti *et al*, 2021). There is need to educate people about the importance of indigenous leafy vegetables (ILV`s) and the nutritional benefits attached to them (Sinethemba *et al,* 2022). This can only be achieved by the application of modern agricultural technology. Leafy vegetable technology which can be put to use by vegetable farmers includes; fertilizer application, harvesting\post harvesting, grading, irrigation, organic farming, packaging, pest control, planter, preservation, processing, seed preparation, selection of improved planting materials, soil conservation and vegetable propagation, storage.

So many modern technologies have been introduced in leafy vegetables in a bid to enhance productivity and food security. Some of these technologies are faced with acceptability, cost of the technology, transformability, compatibility, complexity, amongst others. However, the adoption of agricultural technologies has influenced leafy vegetable production in so many areas in Nigeria especially in Rivers State. It has increased the availability of leafy vegetables in our markets, not just availability but has become so common that there are no more seasons for production of vegetables. Based on the intricacies surrounding agriculture, this study investigated the socio-economic impact of the adoption of agricultural technologies on leafy vegetable production in Rivers States, Nigeria. It is imperative not only to develop new agricultural technologies but rather, ascertain if these technologies have a positive influence on leafy vegetable farmers.

Objective of the Study

The specific objectives of this study were to:

i. describe the socio-economic characteristics of leafy vegetable farmers in the study area;
ii. identify the types of leafy vegetable technologies on production available to vegetable farmers; and
iii. examine the leafy vegetable technologies adopted by vegetable farmers;
iv. ascertain the socio-economic effect of farmers for adopting leafy vegetable technologies on leafy vegetable production in the study area.

The hypotheses that was tested to guide the objectives were:

Ho1: The socio-economic characteristic of the respondents has no effects on their adoption of leafy vegetable technologies on leafy vegetable production in the study area.

Ho2: There is no significant difference in the socio-economic impact on farmers for adopting agricultural technologies on leafy vegetable production in the study area.

METHODOLOGY

The study was conducted in Rivers State; Rivers State is one amongst the 36 States of Nigeria. The Nigerian census data released in 2006, asserts that the state has a population of 5,198,716. Rivers State is the sixth-most populous state in Nigeria. Its capital, Port Harcourt is the center of Nigeria's oil industry. The State is bounded on the north by Abia and Imo States on the south by the Atlantic Ocean, to the east by Akwa Ibom State and to the west by Bayelsa and Delta States. Rivers State has a total land area of 11,077 km^2 (4,277 mi^2), making it the 26th largest state in Nigeria (Government of Rivers State of Nigeria, 2009). Rivers State currently consists of 23 Local Government Areas, all of which handle local administration, under an elected Chairman. Major cash crops produced are oil palm products, rubber, coconut, raffia palm and jute. Other crops grown for food include African spinach, bitter leaf, eggplant leaf, fluted pumpkin, garden parsley, wild spinach, scent leaf, water leaf, wild lettuce, cabbage melon, pineapples, mango, pepper, banana and plantain. The fishing industry is an important sector in Rivers State.

The research design for this study was descriptive survey. The population of the study comprised of all male and female registered leafy vegetable farmers in Rivers State Ministry of Agriculture, Nigeria. There are 635 registered leafy vegetable farmers in Rivers State. (Rivers State Ministry of Agriculture; farmers' registration data, 2009-2022). The multistage sampling procedure was employed. First was the purposive selection of 3 LGAs that are synonymous with core vegetable farming from each agricultural zone. The second stage involved selection of 9 core vegetable farming communities from each of the selected LGAs and the third stage was the selection of vegetable farmers using the simple random sampling. A total of 191 vegetables farmers were used for the survey. The primary data source was gathered using interview schedule data instrument. The analysis was carried out with the use of descriptive and inferential statistics. such as frequencies, percentage, mean scores, standard deviation and t-test. A 5 point likert-scale rating that gave a mean of 3.0 as the decision rule and a 4 point rating scale that gave a decision rule of 2.50. Multiple regression analysis was used in determining the relationship between socioeconomic characteristics of leafy vegetable farmers and the adoption of agricultural technologies for leafy vegetable production. The four functional forms of regression model viz: linear, semi-log, double log and exponential was tested. The multiple regression model was presented as thus;

Y= a+b1X1+b1b2X2 + …..+ bnXn ……………………………………… 3.1

Where: Y-is the dependent variable; X-is the independent variable; a-is the intercept (the value of Y when X is zero), a constant; b-is the slope of the line or the coefficient.

The three functional forms of the multiple regression model are as follows:

Linear

X= bo +b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + …..bnXn + ei….. 3.2

Exponential-Log function

LnY= bo +b1X1+ b2X2 + b3X3 + b4X4 + b5X5 + …..bnXn + ei….. 3.4

Double log function

LnY= Lnbo +b1 Ln X1+ b2 Ln X2 + b3 Ln X3 + b4 Ln X4 + b5 Ln X5 +...bn Ln Xn + ei…3.5

Socio-economic characteristics of leafy vegetable farmers,

Where:Y= Impact of socialization

X_1 = Gender (Male=1, Female=2); X_2 = Age range in years (17-27 =1, 28- 38 =2, 39-49 = 3, 50-60 =4); X_3 = Marital status (single=1, married=2, divorced=3, separated=4, widowed=5).

X_4 = Local Government Areas (Khana, Tai, Etche, Ikwerre, Etinan, Itu, Uruan,Obot, etc..

X_5 = Educational level (No education =1 Primary =2, Secondary =3, Tertiary=4).

X_6 = Household size (1-3=1, 4-6=2, 7-9=3, 10-12=4).

X_7 = Farming status (full time =1, part time =2,)

X_8 = Monthly income (1-20,000=1, 21,000-40,000=2, 41,000-60,000=3, 61,000-80,000=4).

X_9 = Contact with extension agents (Annually = 1, Bi-annually = 2, Monthly = 3, Fortnightly =4); Ei = error term

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Respondents

The socio-economic characteristics of the respondents is shown in table 1

Table 1: Response on socio-economic characteristics of the respondents

Variables	Freq.(n=(191)	(%)	Mean
Sex			
Male	92	48.2	
Female	99	51.8	
Age (Years)			
17 – 27	19	9.9	
28 – 38	55	28.8	
39 – 49	80	41.9	41 yrs
50 - 60	30	15.7	
> 60	7	3.7	
Marital Status			
Single	22	11.5	
Married	145	75.9	
Separated/divorced	7	3.7	
Widowed/widower	17	8.9	
Level of Education			
Primary education	3	1.6	
Secondary education	99	51.8	
Tertiary education	89	46.6	
Household Size (persons)			
1-3	19	9.9	
4-6	6	3.1	
7-9	62	32.5	9 persons
10-12	87	45.5	
> 12	17	8.9	
Farming Status			
Full-time	63	33.0	
Part-time	128	67.0	
Monthly Net income (₦)			
< 21,000	2	1.0	
21.000-40,000	23	12.0	
41,000-60,000	34	17.8	
61,000-80,000	39	20.4	₦76,474
81,000-100,000	49	25.7	
> 100,000	44	23.0	
Contact with Extension Agents			
None (0)	6	3.1	
Fortnightly (24)	16	8.4	
Monthly (12)	23	12.0	
Bi-Annually (6)	83	33.0	5/year
Annually (1)	63	43.5	

Source: Field Survey (2021)

Table 1 presents the socioeconomic characteristics of leafy vegetable farmers in Rivers State, The result reveals a notable gender disparity with 51.8% of respondents being female, while 48.2% were male indicating a more involvement of women in leafy vegetable production within these State. This result aligns with similar findings by Effiong *et al*., (2021) in Yakurr Local Government Area, Cross River State, where 75.4% of leafy vegetable farmers were females. Analysis of respondents' age distribution reveals an average age of 41 years, with the majority (41.9%) falling within the 39 to 49 years bracket which suggests that farmers, particularly those aged 39 to 49, are likely to be more receptive to improvement programmes, making them more amenable to adopting advanced technologies for vegetable production. This age-related responsiveness is a positive indicator for the success of technology adoption in the study area. This confirms the work of Emodi and Elenwa (2018) got and average age of 41.3 years among urban homestead vegetable farming in Anambra State. Regarding marital status, 75.9% of respondents were married, a factor with potential implications for labour supply dynamics, as family members may contribute to farm labour, thereby reducing labour costs. This finding resonates with Obinaju and Asa (2015) economic analysis of vegetable farming, where a majority (72.2%) of respondents were reported as married. Education emerges as a crucial variable, with 46.6% of respondents having tertiary education, and the majority (51.8%) possessing secondary education. This suggests that respondents have the educational background necessary for adopting leafy vegetable production technology. Educational attainment is recognized as a key influencer in the adoption of farming technologies, making this finding significant for technology adoption initiatives agreeing with the observation of Elenwa and Okorie (2019) on the use of organic materials in vegetable production in Ngor Okpala Local Government Area of Imo State. Analysis of household size indicates a mean of 9 persons, with 45.5% of respondents having household sizes ranging from 10 to 12 persons. A larger household size provides a distinct advantage in terms of available family labour for vegetable production, potentially reducing labour costs. This demographic feature is a positive factor for successful arable crop production including vegetable cultivation in the study areas (Elenwa and Emodi, 2019). The majority (67.0%) of respondents identified as part-time farmers, engaging in other jobs as their primary sources of income, while 33.0% were full-time farmers with additional income sources. The monthly income analysis revealed a mean of N76,474. These findings align with a comparative study on fluted pumpkin production in the Niger Delta reported gross margins and net profits (Effiong et al, 2021). Noteworthy is the frequency of contact with extension agents, with 43.5% of respondents having contact once a year.

Effects of socioeconomic characteristics on the adoption of leafy vegetable technologies in leafy vegetable production

Ho_1: The socio-economic characteristic of the respondents has no effects on their adoption of leafy vegetable technologies on leafy vegetable production in the study area. The table below shows the effects of socioeconomic characteristics on the adoption of leafy vegetable technologies on leafy vegetable production.

Table 2 Summary of Multiple Regression Analysis showing the effect of Socioeconomic Characteristics on the Adoption of leafy vegetable Technologies in Leafy Vegetable Production

	Linear			Semi-Log			Double -Log		
Variables	Coef	t-cal	sig. t	Coef	t-cal	sig. t	Coef	t-cal	sig. t
(Constant)	0.119	0.815	0.415	.045	1.419	0.157	0.038	1.131	0.259
Age	0.094	1.875	0.062	.018	1.665	0.097	0.021	0.677	0.497
Marital Status	-0.059	-1.334	0.183	- .015	- 1.517	0.130	0-.031	- 0.594	0.553
Household Size	0.161	3.788	0.000*	.045	4.834	0.000*	0.851	9.168	0.000 *
Monthly Net Income	0.044	1.091	0.276	.014	1.559	0.120	0.237	5.090	0.000 *
Educational Level	0.862	13.924	0.000*	.102	7.502	0.000*	0.015	0.283	0.777
R	0.874			0.77 0			0.781		
R^2	0.764			0.59 3			0.609		
F-cal	237.5			106. 5			143.1		
Pv	0.000			0.00 0			0.000		

Dependent Variable; Adoption. Source: SPSS 25.0 output based on field survey (2023)

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e_i$$

$$\mathrm{AD} = 0.119 + 0.094\mathrm{Ag} - 0.059\mathrm{MS} + 0.161\mathrm{HS} + 0.004\mathrm{MI} + 0.862\mathrm{Ed}$$

t- values in bracket (0.815) (1.875) (-1.334) (3.788) (1.091) (13.862)

The information in Table 2 on the effects of socioeconomic characteristics of the respondents on the adoption of leafy vegetable technologies on leafy vegetable production shows that out of the three functional forms (linear, semi-log, and double log model), the linear model had the highest level of coefficient of determination (R^2) consequently, the model was selected. The multiple correlation coefficient R is 0.874, indicating strong correlation between socioeconomic characteristics and adoption. The Coefficient of Determination (R^2) = 0.764; this shows that 76.4% of the variation in adoption is explained. The remaining 23.7% is explained by other variables not included in the model. The F-calculated of 237.5 had a corresponding significant/probability value of 0.000; the researcher, therefore, concludes that the model was useful. The coefficient of age is 0.094, the t-value is 1.875, and the p-value is 0.062. The p-value is above the significance level of 0.05, suggesting that age is not statistically significant in predicting the adoption of agricultural technologies. However, there is a positive correlation between age and adoption of agricultural technologies. The implication of this positive correlation is that older farmers adopted more leafy vegetable technologies. The coefficient of marital status is -0.059, the t-value is -1.334, and the p-value is 0.183. The p-value is above 0.05, indicating that marital status is not statistically significant. The marital status of the respondents therefore dos not significantly influence its decision to adopt leafy vegetable technology in leafy vegetable production. The coefficient of household size is 0.161, the t-value is 3.788, and the p-value is 0.000. The low p-value suggests that household size is a statistically significant predictor of the adoption of technologies. Also, a positive association exists between household size and adoption of leafy vegetable technologies, suggesting that farmers with more members in the household will likely adopt more technologies in order to increase production and provide for the large household size (Elenwa & Okorie, 2019). The coefficient of monthly net income is 0.044, indicating from the positive sign that as income increases, the tendency to increase the adoption of technology in leafy vegetable production will increase. However, the t-value is 1.091, and the p-value is 0.276 > 0.05 level of significance; suggesting that the monthly net income is not statistically significant in influencing the adoption of leafy vegetable technology in leafy vegetable production. The coefficient of educational level is 0.862, the t-value is 13.924, and the p-value is 0.000. The very low p-value indicates that educational level is highly statistically significant in predicting the adoption of agricultural technologies (Ajuwa *et al*, 2024); there is a positive correlation between educational level and adoption of agricultural technologies suggesting that the higher the educational level, the higher the adoption of agricultural technologies. The regression analysis suggests that age, household Size and educational level are statistically significant predictors of the adoption of leafy vegetable technologies in leafy vegetable production; marital status, and monthly net income may not be significant predictors based on the given p-values. The overall model is statistically significant as indicated by the low p-value for the F-statistic.

Types of Leafy Vegetable Technologies Production Available To Vegetable Farmers in Rivers State

Table 3 shows the types of Leafy Vegetable technologies production available to vegetable farmers in the study area

Table 3: Types of leafy vegetable technologies on leafy vegetable production available to vegetable farmers in the study area

S/n	Leafy vegetables technologies	Freq. (n=191)	%	Rank
A	Fertilizer/organic manure application	175	91.6	1st
1	Inorganic fertilizer (NPK)	175	91.6	1st
2	Organic fertilizer (compost)	132	69.1	4th
B	Improved planting material (seed, stem/seedling)	175	91.6	1st
1	Fluted pumpkin	175	91.6	1st
2	Water-leaf	132	69.1	4th
3	Bitter leaf	150	78.5	3rd
4	Scent leaf	132	69.1	4th
C	Planting distance	136	71.2	2nd

1	Fluted pumpkin (90X90 cm)	136	71.2	2nd
2	Water-leaf (25X30 cm)	150	78.5	3rd
3	Bitter leaf (1X1.5 meter)	150	78.5	3rd
4	Scent leaf (33X33cm)	132	69.1	4th
D	Field preparation	175	91.6	1st
1	Sunken bed	34	17.8	5th
2	Check basin	175	91.6	1st
E	Pest/weed control	26	13.6	6th
1	Application of pesticides	23	12.0	7th
2	Application of herbicides	132	69.1	4th
F	Harvesting	136	71.2	2nd
1	Done in the morning/evening	132	69.1	4th
G	Preservation/Storage procedure	175	91.6	1st
1	Sorting out diseased and bruised produce	175	91.6	1st
2	Use of well-ventilated containers such as smooth basket	136	71.2	2nd
3	Storage in ambient temperature (Bunching – up method)	132	69.1	4th

Source: Field Survey (2023). **Multiple Responses**

Table 3 shows the types of technologies on leafy vegetable production available to vegetable farmers in the study area. Notably, the predominant technologies on leafy vegetable was organic manure application and using inorganic fertilizer (NPK), improved planting material seedling on fluted pumpkin, field preparation using check basin method and preservation/storage procedure using sorting out diseased and bruised produce as they ranked 1st position. This was closely followed by planting distance for Fluted pumpkin (90X90 cm), harvesting and use of well-ventilated containers such as smooth basket as they ranked second position. Improved planting material seedling on fluted pumpkin Bitter leaf , planting distance for Water-leaf (25X30 cm), and planting distance for Bitter leaf (1X1.5 cm) ranked third position. Harvesting done in the morning/evening, preservation/storage procedure through storage in ambient temperature, pest/weed control through the application of herbicides, planting space of Scent leaf (33X33cm) and improved planting material (seed, stem/seedling) of scent leaf ranked fourth position. Preparation by Sunken bed ranked fifth, pest/weed control ranked sixth and pest/weed control by application of pesticides ranked seventh respectively. These findings align with Aboh and Effiong (2019) study on the contribution of using improved seedlings in vegetable production to food security in Uruan Local

Government Area of Akwa-Ibom State, where improved water leaf (Talinum triangular) and improved fluted pumpkin (Telferia occidentalis) seedlings took precedence.

Level of Adoption of Leafy Vegetable Technologies by Vegetable farmers in Rivers State

Table 4 below provides a comprehensive insight into the level of adoption of Leafy Vegetable technologies by vegetable farmers in the study area.

Table 4: Level of adoption of Leafy Vegetable technologies

S/N	Leafy Vegetable Technologies	Rivers State (n=191)		
		TS	MS	RE
A	**Fertilizer/organic manure application**			
1	Inorganic fertilizer (NPK)	642	3.36	A
2	Organic fertilizer (compost)	722	3.78	A
B	**Improved planting material (stem/seedling)**			
1	Fluted pumpkin	689	3.61	A
2	Water-leaf	621	3.25	A
3	Bitter leaf	685	3.59	A
4	Scent leaf	587	3.07	A
C	**Planting distance**			
1	Fluted pumpkin (90X90 cm)	632	3.31	A
2	Water-leaf (25X30 cm)	587	3.07	A
3	Bitter leaf (1X1.5 meter)	602	3.15	A
4	Scent leaf (33X33cm)	588	3.08	A
D	**Field preparation**			
1	Check basin	662	3.47	A
2	Sunken bed	484	2.53	A
E	**Pest/weed control**			
1	Application of pesticides	645	3.38	A
2	Application of herbicides	379	1.98	D
F	**Harvesting**			
1	Done in the morning/evening	755	3.95	A
G	**Preservation/Storage procedure**			
1	Sorting out diseased and bruised produce	827	4.33	A
2	Use of well-ventilated containers such as smooth basket	635	3.32	A
3	Storage in ambient temperature (Bunching – up method)	631	3.3	A
	Grand mean		**3.30**	**A**

Source: Field Survey Data 2022

Note: A = Agreed, D = Disagreed, TS = Total Score, MS = Mean Score, n = sample size, Re =Remark

Fertilizer and inorganic manure application garnered substantial adoption, evidenced by a mean of 3.36, surpassing the threshold of 3.0 as shown in table 4. Notably, organic fertilizer (compost) exhibited a higher level of adoption with a mean score of 3.78; compared to inorganic fertilizer (NPK). This suggests a pronounced inclination towards the use of organic compost in the studied area. For the first four ranked vegetables, namely fluted pumpkin $\bar{x}$=3.61, water-leaf $\bar{x}$=3.25, bitter-leaf $\bar{x}$=3.59 and scent-leaf $\bar{x}$=3.07 amongst others. Improved planting materials saw widespread adoption, with $\bar{x}$ > 3.0. The detailed breakdown reveals a progressive adoption process, with a considerable number of respondents advancing to the adoption stage. The recommended planting distances for fluted pumpkin, water-leaf, bitter-leaf, and scent-leaf were all embraced by the farmers, as indicated by $\bar{x}$ > 3.0. A closer examination illuminates the stages of awareness, interest, evaluation, trial, and adoption, providing a nuanced understanding of the adoption dynamics, particularly for fluted pumpkin. Agricultural technologies related to field preparation witnessed widespread adoption, with $\bar{x}$ = 3.12 >3.0. In the domain of pest/weed control, the adoption of pesticide application received favorable responses with $\bar{x}$ > 3.0. However, the application of herbicides did not meet the adoption threshold, indicating a divergence in acceptance among leafy vegetable farmers. The study's exploration of fertilizer application encourages a holistic approach, endorsing the combined use of manures and fertilizers to reduce dependence on inorganic fertilizers. This aligns with contemporary agricultural wisdom that seeks to balance productivity with sustainability (Kifayatullah et al., 2020). Harvesting recommendations, including the timing of morning or evening harvests, garnered substantial adoption with $\bar{x}$ = 3.67. Additionally, technologies related to the preservation and storage of leafy vegetables, such as sorting out diseased and bruised produce, using well-ventilated containers, and employing ambient temperature storage (Bunching-up method), were widely embraced with $\bar{x}$ > 3.0.

Perceived Socioeconomic Effects of Adopting Agricultural Technologies in Leafy Vegetable Production in Rivers state

The perceived socio-economic effect on the adoption of agricultural technologies in leafy vegetable production is shown in Table 5.

Table 5: Perceived socio-economic effectof adopting Leafy Vegetable technologies on leafy vegetable production

S/n	Socio-economic effects of agricultural technologies	TS	MS	R
1	Acquisition of agricultural knowledge	608	3.18	A
2	Addressing rural security challenges	513	2.69	A
3	Easy adoption of other agricultural innovations	571	2.99	A
4	Advance technical know-how	513	2.69	A
5	Agricultural skill acquisition	536	2.81	A
6	Better market	437	2.29	D

7	Combating climate change	433	2.27	D
8	Commercial agriculture	406	2.13	D
9	Conservation of natural resources	415	2.17	D
10	Contribution to an agricultural-friendly environment	485	2.54	A
11	Cost reduction	534	2.80	A
12	Creation of agricultural linkages	398	2.08	D
13	Cultural diffusion	401	2.10	D
14	Developing internet-based agriculture	415	2.17	D
15	Development of the agricultural industry	429	2.25	D
16	Development of rural infrastructure	393	2.06	D
17	Dissemination of agricultural information	608	3.18	A
18	Drift from manual power-assisted agricultural activity	429	2.25	D
19	Drift from simple farm tools to modern agricultural technology	608	3.18	A
20	Enhancement of food security	637	3.34	A
21	Enhancing rural livelihood	588	3.08	A
22	Improved farm income	632	3.31	A
23	Improving rural economy	530	2.77	A
24	Increased agricultural production	576	3.02	A
25	Mobilizing agricultural research workers	439	2.30	D
26	Poverty eradication	533	2.79	A
27	Preservation of perishable crops	512	2.68	A
28	Promoting mechanized farming	381	1.99	D
29	Provision and use of improved seedling	590	3.09	A
30	Reduced labour	442	2.31	D
31	Technology transfer	561	2.94	A
32	Time-saving	528	2.76	A
33	Technology integration	558	2.92	A
34	Use and practice of organic farming	526	2.75	A

Source: Field Survey Data 2022

Of the 34 identified socio-economic effects in table 5, respondents affirmed 21 and disagreed on 13, shedding light on the multifaceted outcomes of technological integration in farming practices. Foremost among the socio-economic effects is the enhancement of food security, with an agreement of $\bar{X}$=3.33 from the respondents. This shows the role adoption of leafy vegetable technologies plays in ensuring a stable and sustainable food supply. This agrees with the findings by Dube et al.

(2018), emphasizing the potential of tropical leafy vegetables in improving food security, reinforces the significance of this effects. Additionally, respondents acknowledged several other major socio-economic effects arising from the adoption of agricultural technologies. These include improved farm income ($\bar{X}$=3.30), the acquisition of leafy vegetable knowledge ($\bar{X}$=3.19), enhancement of rural livelihood ($\bar{X}$=3.09), provision and use of improved seedlings ($\bar{X}$=3.08), increased agricultural production ($\bar{X}$=3.02), and facilitation of easy adoption of other agricultural innovations ($\bar{X}$=2.99). Also, they confirmed advanced technical know-how, agricultural skill acquisition, and the dissemination of agricultural information. Conversely, certain socio-economic impacts were not universally accepted by respondents. Developments such as rural infrastructure ($\bar{X}$=2.24), cultural diffusion ($\bar{X}$=2.09), promoting mechanized farming ($\bar{X}$=2.02), mobilizing agricultural research workers ($\bar{X}$=2.31), commercial agriculture ($\bar{X}$=2.12), and developing internet-based agriculture ($\bar{X}$=2.17) did not garner consensus as significant outcomes of adopting agricultural technologies in leafy vegetable production. Similarly, combating climate change ($\bar{X}$=2.28), the shift from manual power-assisted agricultural activities ($\bar{X}$=2.24), and the creation of agricultural linkages ($\bar{X}$=2.08) were not widely acknowledged as notable impacts. This resonates with a broader societal consciousness regarding the nutritional benefits of leafy vegetables, as highlighted by Ejiofor et al. (2018).

Ho_2: There is no significant difference in the socio-economic effects on farmers for adopting leafy vegetable technologies on leafy vegetable production in the study area

Table 6: Summary of t-test analysis result showing the significant difference in the socio-economic effects of adopting leafy vegetable technologies in leafy vegetable production in the study area

Variable	*n*	*Mean* $\bar{x}$	*SD*	*Df*	t_{cal}	*Sig. t*	*Level of significance*	*Dec.*
Rivers	*34*	2.64	0.41	66	1.98	0.045	0.05	Rejected

Source; Field Survey Data 2023, detailed in Appendix 1

Table 6 presents the results of a t-test analysis on the socio-economic effects of adopting leafy vegetable technologies in leafy vegetable production in the study area. The mean socio-economic impact score is 2.64. With the degrees of freedom of 66, the calculated t-value is 1.982. The p-value associated with the t-test is 0.045 at 0.05 level of significance is 0.05. The implication of this finding is that there is a significant difference in the socio-economic effects of adopting leafy vegetable technologies in leafy vegetable production in the study area. The t-test did find a statistically significant difference in the socio-economic impact in the study area, as the p-value (0.045) is less than the chosen level of significance (0.05). Therefore, it is concluded that there is a significant difference in the socio-economic effects of adopting leafy vegetable technologies in leafy vegetable production in the study area.

CONCLUSION AND RECOMMENDATIONS

The results of this study have shown that the adoption of agricultural technologies on leafy vegetable production had positive socioeconomic impact on the farmers and vegetable production in the study area as it has improved farm income, the acquisition of agricultural knowledge, enhancement of rural livelihood, provision and use of improved seedlings, increased vegetable production and facilitated the easy adoption of other agricultural innovations in the study area. Based on the findings, it was recommended that efforts should be made to expose vegetables farmers to new innovations/technologies and practices in vegetable production.

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