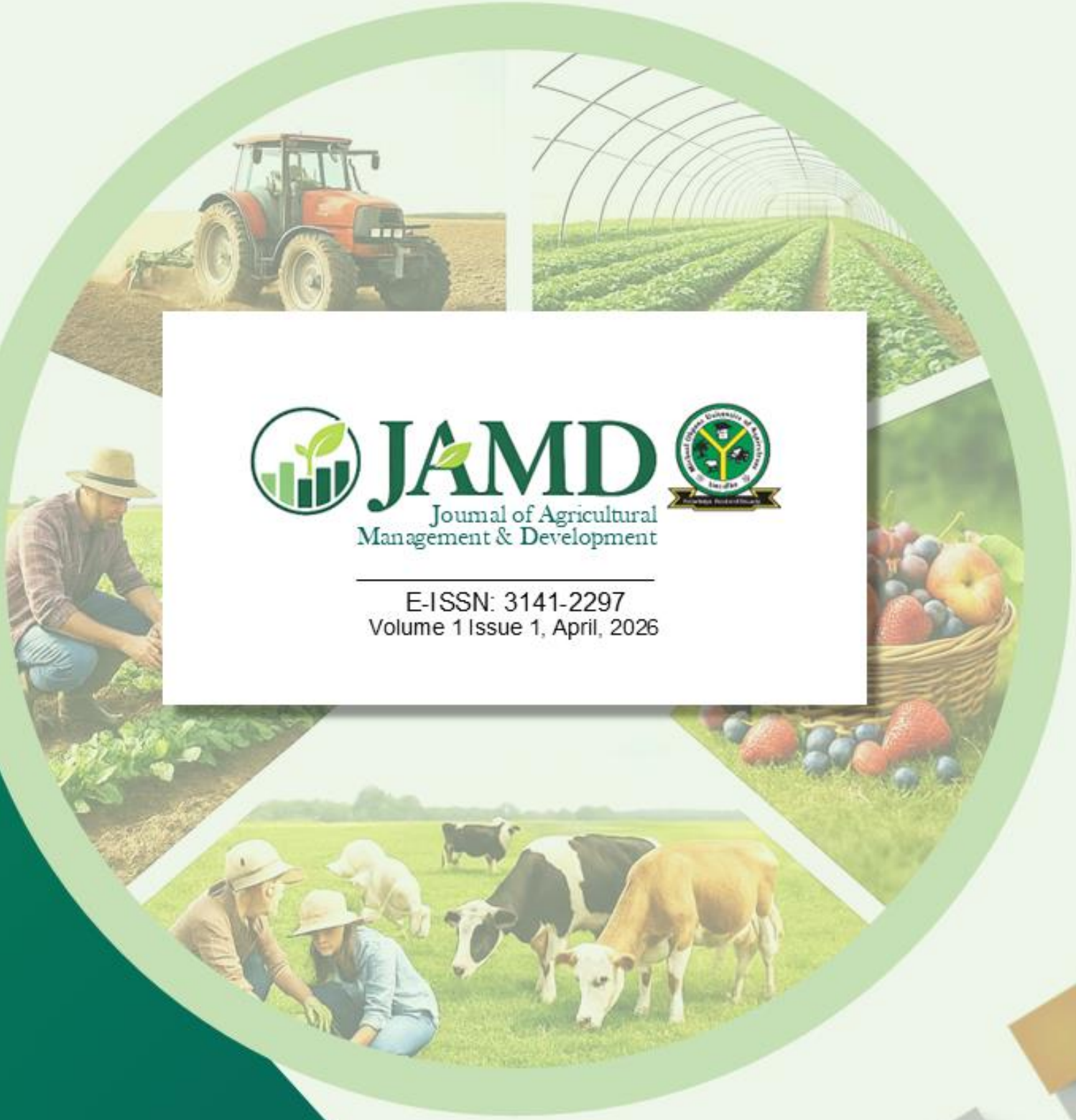

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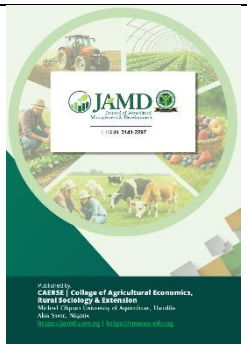

Expository Analysis of Utilization of Improved (Taro) Cocoyam Production Technologies among Farmers in Abia State, Nigeria

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ABSTRACT

Cocoyam is one of the major subsistent crops that plays an important role in the lives of many Nigerians as a food security crop and it has become an important component of rural development because of cocoyam rebirth programme embraced upon by NRCRI. This study examined utilization of improved cocoyam production technologies among farmers in Abia State, Nigeria. Specifically, the study ascertained cocoyam technologies that had been transferred to farmers; identified source (s) of information on cocoyam production technologies to farmers; assessed the level of utilization of cocoyam production technologies by farmers in the study area; and ascertained the socio-economic factors that significantly influence utilization of improved technologies on cocoyam production in Abia State, Nigeria. Multi-stage random sampling technique was used to select 90 taro (cocoyam) farmer. Objectives were achieved using simple descriptive statistics and O L S multiple regression the model. The results shows that the main technology transfer were 25g set of cocoyam (80%), Time of planting (May -June) (68.89%), Crop mixture (Arable Cropping) (64.44%), use of manure (56.67%) and weed control (56.67%). NRCRI (70%), Market place (65.56%), Health center (52.22%) and radio (52.22%) were the dominant sources of information for taro (cocoyam) farming technology in the area. Result on level of utilization of cocoyam farming technologies revealed that 25g set of taro (cocoyam) ($\bar{X}$= 2.878), use of mulching materials has mean of ($\bar{X}$= 2.822); Time of planting (May -June) ($\bar{X}$= 2.8) and spacing adopted (100cm × 50cm) " ($\bar{X}$=2.6) have high level of level of utilization of cocoyam storage techniques by farmers in the study area. OLS estimate on socio-economic factors influencing utilization of improved cocoyam technology Shows that positive relationship exists between education attainment, farmer experience, household size and labour while there is an inverse relationship between Farm sizes of the farmers. The study therefore recommended that an awareness creation in the use of the various technologies by extension would be a necessary step towards increased cultivation and production of cocoyam.

Introduction

Agriculture is the mainstay of the economy of most countries in the region hence it contributes substantially to export earnings and employs majority of total labour force (FAO, 2021). Within the sector, crop production (e.g Taro) remained the fastest growing subsector at 3.64% followed by forestry, livestock and fishery which grew by 3.31%, 1.61% and 1.34% respectively. Agriculture is the dominant sector in the economy of Nigeria which plays a major role in the economy and it contributes about 21.91 percent to Nigeria's GDP (FAOSTAT, 2021). The agricultural sector has been performing very noteworthy roles in providing food and income to majority of people in the rural areas of Sub-Saharan Africa, including Nigeria. The sector in recent years has contributed significantly to improved economic growth performance in Nigeria (Anyiam *et al.*, 2023).

One of such crops that has improved the economic growth performance in Nigeria is Taro (Cocoyam). Taro (Cocoyam) is grown in the tropical regions of the world especially in Africa, where it is cultivated for food (Food and Agricultural Organization, (FAO), 2015). The food crop which is mainly grown in the rural communities across Africa by subsistent farmers is highly valued among other tuber and root crops consumed among different households, the high cost of production is mainly due to the high labour requirement during cultivation amid the use of indigenous planting materials, application of total weed controls as well as limited value addition have led to a general decline of the cocoyam subsector (Boakye-Achampong, *et al*. 2017).

Colocasia originated in South East Asia and was introduced to Africa through Egypt and has been known for over 2,500 years. It then spread across the east coast of Africa and across the continent to West Africa (Otekunrin *et al*, 2021). *Xanthosoma* originated in tropical America and was introduced to West Africa by Indian missionaries (Anyiam *et al.*, 2023). Taro (Cocoyam) as a tuber crop is intensively cultivated and consumed by resource poor families in South Eastern and South Southern parts of Nigeria (Shiyam; Obiefuna; Ofoh; Okoh and Uko, 2015), the leaves are often used as wraps for foods in some parts of African and Asia; the crop most times is grown as ornamentals (Mikami and Tsutsui, 2019). Cocoyam leaves are nutritious spinach-like vegetable which gives a lot of minerals, vitamins (A and C), and thiamine (Sharma *et al.*, 2020). There are two main species commonly cultivated in Nigeria the species are *Xanthosoma* called Tannia and *colocasia* called Taro (Otekunrin, *et al.*, 2021).

According to Olatunji and Nwakor, (2015) there were at least 16 categories of root and tuber crops technologies that the NRCRI had developed. Some of these include, improved cassava varieties, improved sweet potato varieties, improved yam varieties, value addition, and improved taro (cocoyam) production. Taro (Cocoyam) (colocasia sp. and xanthosoma sp.) is an important food security crop grown mostly by women in the South-Eastern, South Southern and South-Western Nigeria (Ikwelle Bauchi, Madukwe and Onwubiya, 2003). The National Root Crops Research Institute (NRCRI), Umudike had promoted colocasia and Xanthosoma varieties of Taro (cocoyam) with the following cultivars or species: *cocoindia* (NCe 001), *edge ofe* green (NCe 002), *ede ofe* purple (NCe 003), *ede giant* (NCe 004) *ede upong* (NCe 005), *ede ghana* (NCe 006), *ede ocha* (NXS 001), *ede Uhie* (NXS 002) and *ede okorokoro* (NXS 003) (Olatunji and Nwakor, 2015). It was expected that these technologies would be transferred from the research station to the end users that is, the farmers) via the extension service. The goal of achieving agricultural transformation would be a mirage if developed technologies remain in the research stations. One way of achieving the goal of food security is to have an effective, well-conceived, well-planned and well-executed system of technology transfer. In order to have expected impact on national development, improved technologies must be made available to those in the production systems (That is, the farmers). Transfer of technology is usually the responsibility of the agricultural extension service (Olatunji et al., 2015).

Based on this the National Root Crop Research Institute (NRCRI) Umudike which had the national mandate to research into root and tuber crops developed some processing technologies to reduce the perishability of the products and add value to these crops. The essence is to ensure that these crops can be put to wider uses in the home, for income generation and probably for export purposes. To this effect, groups and individuals all over Nigeria appreciated this development and requested to be trained in those technologies.

Cocoyam (*Xanthosoma sagittifolium)* is among the world's six most important root and tuber crops (FAO, 2012). It is pantropical and has been domesticated in most communities in Oceania, Africa, and Asia and

providing sustenance for over 400 million people (Anyiam et al., 2023). Africa is the major producer with West and Central Africa, notably, Nigeria, Ghana, and Cameroon contributing to over 60% of the total African production. Thus, the importance of cocoyam to regional food security cannot be overstated, In spite of its high productivity, levels and better storability compared to other tropical root and tuber crops, *Xanthosoma sagittifolium* has been marginalized in agricultural policies and research interventions on root and tuber crops. It remains an underexploited food resource, with a reported decline of production levels (Onyeka, 2014).The challenge of underutilization is exacerbated by the existing confusion in improved technology on cocoyam production which limits researchers in exploiting data from one area of indigene to another (Anyiam et al., 2023).

Combination of factors like farmers' socio-economic and socio-cultural characteristics were observed to exert influence on different ways of technology utilization (Onyeka, 2021). Risks involved in technologies were considered to determine farmers' opinion to use them or not. It is therefore, of opinion that those technologies which have risk characteristics when compared to their traditional alternative or practices were utilized faster than technologies with low relative risk (Nwaobiala et al., 2014). Information and innovation which are intended to improve agricultural production should be disseminated to farmers (male and female) and ultimately meet their need. However, variations exist on relevant production technologies needed by farmers; lack of adequate access to extension service, low knowledge and skills in performing various farm operations have been impediments to increased agricultural production (). Farmers have been by and large rejected by existing extension system, receiving about 5-7% of extension service due to their limited control over assets and decision making that are evident in agricultural institutions).

Technology adoption by farmers is an essential pre-requisite for the economic prosperity in Nigeria (Otekunrin *et al.*, 2021). However, in recent years, individual farmers have started to adopt and use the improved technologies including machineries and planting of improved seed varieties. However, many farmers show different attitudes towards the adoption of these agricultural technologies and this has greatly affected the availability of food in the economy. To further corroborate many other research, this study specifically:

a) ascertained Taro (cocoyam) technologies that had been transferred to farmers in Abia State.
b) identified source (s) of information on cocoyam production technologies to farmers;
c) assessed the level of utilization of taro (cocoyam) production technologies by farmers in the study area; and
d) ascertained the socio-economic factors that significantly influence utilization of improved technologies on taro (cocoyam) production in Abia State, Nigeria.

Methodology

The study was carried out in Abia State. Abia State is one of the 36 states of Nigeria and lies in the south eastern of Nigeria with Ariaria international market, Aba as its capital and largest city. Aba is a city and in the southeast of Nigeria and the main trading center in Abia State. Upon the creation of Abia state in 1991, Aba was divided into two local government's areas namely; Aba south and Aba North. Aba south is the main city center and the heartbeat of Abia State, south-east Nigeria. It is located on the Aba River. Aba is made up many villages such as; Umuokpoji Aba, Eziukwu-Aba, Obuda-Aba, Aba Ukwu and other villages from Ohazu merged due to administrative convenience. Aba was established by the Ngwa clan of Igbo People of Nigeria as a market town and then later a military post was placed there by the British colonial administration in 1901. It lies along the west bank of the Aba River, and is at the intersection of roads leading to Port Harcourt, Owerri, Umuahia, Ikot Ekpene, and Ikot Abasi. The city became a collecting point for agricultural products following the British made railway running through it to Port Harcourt. Aba is a major urban settlement and commercial center in a region that is surrounded by small villages and towns. Multi-stage random sampling technique was used to select 90 taro cocoyam farmer, used as respondent for the study. Data for this study were collected from primary sources. Objectives i, ii and iii were achieved using simple descriptive statistics while **iv** was tested using the O L S multiple regression the model

The Ordinary Least Square multiple regression the model for socio-economic factors that significantly influence utilization of improved technologies on cocoyam production in Abia State, Nigeria is implicitly specified as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, e) \quad (1)$$

Where,
Y = utilization of improved technology on cocoyam (Number of improved technologies utilized)
X_1 = Sex (male 1, female 0)
X_2 = Age of the farmers (years)
X_3 = Education attainment (number of years in school)
X_4 = Farmer experience (number of years)
X_5 = Household size (number of persons)
X_6 = Access to credit (₦)
X_7 = Extension contact (number of visitations)
X_8 = Farm size (hectare)
X_9 = Labour (man days)
e = error term

Results and Discussion

Table 1 shows that the main technology transfer were 25g sett of Taro (cocoyam) (80%), Time of planting (May -June) (68.89%), Crop mixture (Arable Cropping) (64.44%), use of manure (56.67%) and weed control (56.67%) as they were ranked 1st, 2nd, 3rd, 4th and 5th respectively. Efforts are needed to effectively disseminate the remaining two technologies whose transfer was found to be at low. It has been shown that an effective system of technology transfer is capable of bringing about sharp increases in agricultural productivity (Nzeakor *et al*., 2020).

Furthermore 11 out of the 13 technologies on cocoyam production (representing 84.62%) were transferred to farmers in the study area. It is commendable that much of the cocoyam technologies has been transferred to farmers in Abia State. This may be an indication that the Research/ Extension/Farmer/Input Agencies linkage was effective in the State. Agricultural Extension has been described as the kingpin in the process of technology generation, technology transfer and technology utilization (Okezie *et al.*, 2021).

A critical look at the result in Table 2 shows that NRCRI (70%), Market place (65.56%), Health centre (52.22%) and radio (52.22%) were the dominant sources of information for cocoyam farming technology in the area. Giving farmers access to a variety of information sources, which are accessible, affordable, relevant and reliable is the ultimate aim of providing agricultural (Aphunu and Agwu, 2014). Interpersonal communication is more robust with built-in feedback mechanism. It is however instructive to note that the farmers never indicated any of the electronic media (Radio, Television Internet) as sources of information. Findings also corroborate this fact that the internet and library are still an elitist communication media for most people. The implication of this is that stakeholders in the provision of agricultural information need to do more in the a real of information delivery and dissemination to cocoyam farmers.

From the result eleven (11) of the variables in the table were accepted by the mean range used for decision which is 2.0 and above. 25g sett of cocoyam has on the average the highest mean ($\bar{X}$= 2.878) i.e. the farmers indicated strong agreement to the statement; this was followed by "Use of mulching materials has mean of ($\bar{X}$= 2.822); this was followed by "Time of planting (May -June)" has mean of ($\bar{X}$= 2.8); this was followed by "Spacing adopted (100cm × 50cm) " ($\bar{X}$=2.6). Others are shown on the table. Also from the table two items were rejected since is less than 2.0, which were Crop mixture (Tree Cropping) and Side dressing application. Furthermore, the clustered mean was 2.226 which was accepted, this therefore implies that there is high level of level of utilization of cocoyam storage techniques by farmers in the study area.

Table 4 shows the results of ordinary least square regression (OLS) the model (linear, exponential, semi-log and double-log) were tried. The choice of appropriate functional form for this study was made based on the economic, statistical and econometric criteria. Based on the criteria stated above the linear functional form was chosen as the lead equation. From the linear functional form result, R^2 value of 0.724 implies that the specified explanatory variables explained about 96.6% of the total variables in profit. The F-statistic of 28.333 which is statistically significant at 1% probability level, indicate that the equation has goodness of fit.

The five out of nine variables significantly influenced the level of utilization of cocoyam farming technologies. The Table shows that positive relationship exists between education attainment, farmer experience, household size and labour. This implies that as more of these variables are employed, there will be an increase in level of utilization of cocoyam farming technologies. The result also shows that there is an inverse relationship between Farm size of the farmers.

Education and farmers experience were positive and significantly influence level of utilization of cocoyam farming technologies at 5% and 1% level respectively. This showed that an increase in one year of education and years spent in farming increase the level of utilization some particular technologies for cocoyam farmers in the study area. The implication of this result is that more years of formal education and stay in farming will help cocoyam farmers to increase their literacy level and this is an asset as the farmers would be exposed to many information sources, embrace innovations such as improve farming technologies. This corroborate with conformity with *a- priori* expectation that the level of education of the farmers enhances their knowledge, technical and managerial efficiency and the findings of Okute (2017) where he reported that the educational level of farmers is expected to increase level utilization.

The coefficient of household size was positive and significant at 5%. This implies that increase in the household size will lead to increase in level of utilization of cocoyam farming technologies. This connect with finding of Nzeakor *et al.*, (2021) where they obtained a positive relationship between household size and level of utilization of new innovation.

The coefficient of labour was positive and statistically significant at 1% level. This implies that an increase in number of workers in the farm, increases the level of utilization of cocoyam farming technologies. The plausible reason may be that more workers in the farm is significant enough to carry out major operation in the farm and enhance farmers' confidence in the level of utilization of cocoyam farming technologies hence as labour increases the probability of level of utilization of cocoyam farming technologies increase.
Furthermore, the coefficient of farm size was significant 1% and negatively related. This implies that increase in the farm size will lead to decrease in level of utilization of cocoyam farming technologies in the area.

Conclusion and Recommendations

Based on this finding it can be concluded that there is high level of utilization of cocoyam production technology in Abia State, Nigeria which is attributed to opulence of technical information on improved cocoyam production technology in the area among the cocoyam farmers studied. Also, education attainment, farmer experience, household size, labour and farm size of the farmers has significant influence on level of utilization of cocoyam production technology by farmers in the study area.

The study recommended the following:

a) Awareness creation in the use of the various technologies by extension would be a necessary step towards increased cultivation and production of cocoyam.
b) The study also revealed that education and farming experience were positive. The result therefore calls for policies aimed at provision of free education ~~esp~~ecially to the girl – child and encourage those who are experience to study the production and increase utilization of cocoyam technologies.
c) The Agricultural Extension Service should invigorate efforts at transferring the two cocoyam technologies which the study noted had not been effectively transferred to the end-users (farmers)

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Appendix

Table 1: Farmers' awareness of cocoyam farming technologies

Cocoyam Farming Technologies	*Frequency	Percentage
25g sett of Taro (cocoyam)	72	80.00
Time of planting (May -June)	62	68.89
Spacing adopted (100cm × 50cm)	44	48.89
Use of mulching materials	25	27.78
Fertilizer (NPK 20:10:10)	36	40.00
Planting depth (10 cm)	17	18.89
Pest control	10	11.11
Weed control	51	56.67
Crop mixture (Tree Cropping)	11	12.22
Crop mixture (Arable Cropping)	58	64.44
Use of manure	51	56.67
Side dressing application	13	14.44
Harvesting (8-12 months)	32	35.56

Source: Field survey, 2024. *Multiple responses recorded

Table 2: Sources of information on cocoyam farming technologies

Source	Frequency*	Percentage
Radio	47	52.22
Television	25	27.78
Newspaper / magazines	17	18.89
Health centre	47	52.22
Spouses	30	33.33
Friends	29	32.22
Market place	59	65.56
NRCRI	63	70.00

Source: Field survey, 2024. *Multiple responses recorded

Table 3: Level of Utilization of Cocoyam Farming Technologies

Technologies	Always	Sometimes	Never	Mean	Std. Dev.	Remark
25g sett of cocoyam	81	7	2	2.878	0.4786	Accepted
Time of planting (May -June)	75	12	3	2.800	0.3691	Accepted
Spacing adopted(100cm × 50cm)	58	28	4	2.600	0.3250	Accepted
Use of mulching materials	76	12	2	2.822	0.1763	Accepted
Fertilizer (NPK 20:10:10)	31	50	9	2.244	0.6237	Accepted
Planting depth (10 cm)	33	53	4	2.322	0.5574	Accepted
Pest control	18	61	11	2.078	0.5654	Accepted
Weed control	50	36	4	2.511	0.5853	Accepted
Crop mixture (Tree Cropping)	4	3	83	1.122	0.2881	Rejected
Crop mixture (Arable Cropping)	28	45	17	2.122	0.7004	Accepted
Use of manure	22	49	19	2.033	0.6779	Accepted
Side dressing application	5	12	73	1.244	0.5469	Rejected
Harvesting (8-12 months)	33	39	18	2.167	0.7382	Accepted
Grand mean				**2.226**		

Source: Field Survey, 2024. Decision mean ≥ 2.0

Table 4: Socio-economic factors influencing utilization of improved cocoyam technology

Variables	+Linear	Exponential	Semi log	Double log
Intercept	110083.6	5.599027	-19095.61	-1.925356
	(1.55)	(11.37)***	(-0.11)	(-8.41)**
Sex	0.0454642	3.28e-07	31092.77	0.0598499
	(1.10)	(1.14)	(5.20)***	(7.35)***
Age of the farmers	6805.75	0.5813647	1.247883	2.87e-06
	(1.43)	(17.55)	(1.58)	(2.67)***
Education attainment	0.097208	3.28e-07	42739.53	0.8308869
	(2.52)**	(1.23)	(1.58)	(22.56)***
Farmer experience	0.2402157	5.22e-06	49136.12	0.0954723
	(4.55)***	(14.23)***	(1.92)**	(2.74)***
Household size	0.4003172	3.02e-06	-2373.839	-0.0151381
	(2.65)***	(2.87)***	(-0.30)	(-1.38)
Farm size	-0.0898305	3.38e-07	-45090.88	-0.0202486
	(-3.01)***	(1.63)***	(-4.62)***	(-1.52)
Labour	90644.12	0.1732413	463944.8	0.9494328
	(72.76)***	(20.01)***	(44.60)***	(66.99)***
Access to credit	2568.89	0.031459	34058.04	0.0140612
	(0.91)	(1.60)*	(3.49)***	(1.06)
Extension contact	0.1027072	7.18e-07	9609.037	0.0149972
	(0.74)	(0.75)	(1.07)	(1.23)
R^2	0.724	0.612	0.711	0.691
R^{-2}	0.698	0.576	0.683	0.661
F-ratio	28.333***	17.015***	25.083***	22.808***

Source: Field survey, 2024. +lead equation, *** Significant at 1%, ** Significant at 5%,*significant at 10%.