Innovations

Resorting to traditional way of water conservation: The Case of Tassa Farming technology in Delta State, Nigeria

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Abstract

The study was assessed the adoption of tassa farming technology among farmers in Delta State. Specific objectives were to: describe the socio economic characteristics of the farmers; ascertain the awareness of the respondents of Tassa farming technology; determine the proportion of farmers involved in Tassa farming technology; determine the perception of farmers of tassa farming technology; ascertain the knowledge level of farmers of tassa farming technology; and examine the constraints to the use of tassa farming technique. A total of 108 farmers were selected for the study. Data were analyzed using descriptive and inferential statistics (binary logit regression model). Results show that majority of the respondents (91.7%) are very much aware of the technology, although the adoption index of 0.43 showed low adoption of Tassa farming technique. Respondents' perception of Tassa farming indicates that respondents affirm the statement that Tassa farming technology is easy to use compare to other agricultural technologies; Tassa farming technology improves yields and increases income. However, they perceived Tassa as labour intensive. The most serious constraints experienced by the respondents included lack of finance (mean = 3.35), lack of labour force (mean = 3.11), government policy on the use of Tassa pits (mean = 4.1), lack of extension information and follow-up (mean 3.64) and lack of technical know-how for digging Tassa pits (mean = 1.71%). It was recommended that farmers in the state be sensitized on Tassa farming technology through increased knowledge of the technology as a way of encouraging farming all year round.

Key words: *Adoption index; extension implication; irrigation; Zai farming.*

Introduction

Harnessing the great potential of African cultural, medical and scientific knowledge is prerequisite for sustainable development in agriculture and other sectors across the continent. Therefore, Africa's advancement rests simply in the recognition, validation, harnessing and mainstreaming of Africa's own traditional, genuine, original, and aboriginal knowledge in education, research and policy formulation across all sectors.

There are lot of traditional African knowledge of technologies in agriculture that are working in modern times and succeeding where things imported from the Western World are struggling to succeed. But unfortunately some of these powerful technologies have never gained recognition in our societies and educational system (Ezeanya 2019). For instance, there is an ancient and well-documented tradition in the Sahel zone, found specifically in the North of Burkina Faso, about technologies that make farming more productive through improved rainwater management and conservation of the soil. The Tassa farming technique is probably the most renowned example of such a technology which is employed to improve impoverished soils (Sawadogo, 2011).

Tassa farming technology (planting pockets, planting basins, micro pits and small water harvesting pits) is an indigenous and traditional African technology of soil and water conservation practice, rehabilitation of degraded lands, improving soil fertility, and an effective

irrigation method whereby 20cm to 30cm wide and 20cm to 30cm deep holes that are spaced apart at 60 – 80cm are dug uniformly across a field that is to be cultivated in order to collect rainwater during the off seasons. The use of Tassa with the presence of organic materials in the pit attracts termites, which play a crucial role as they dig channels in the soil and by so doing improve its assimilation. The termites also digest the organic substances in the pit, making nutrients more easily available to the crops planted (Danjuma and Mohammed 2016). Tassa system plays a critical role in collecting and concentration of water stress in regions of low and erratic rainfall. Tassa therefore combines water and nutrients management into a technology that requires little external inputs and is financially accessible for use by farmers. In northern Burkina Faso, tassa farming technique is also referred to as Zai system by the indigenous farmers (Motis*et al*., 2013). In most cases, organic substance are placed in the holes so that moisture can be trapped and stored more easily and then increase soil fertility. Seeds are then planted both along the edges of each hole and inside the holes. When it rains the holes are able to store the water and appropriate it to the extent that the plant needs the water and the plant can only assimilate as much water as needed until harvest time (Danjuma and Mohammed, 2016). This simple and inexpensive traditional technique has resulted in major increase in crop yield and helped farmers to build resilience against drought in areas where the technique has been well adopted such as Ghana, Niger Republic, Kenya, Mali, and Burkina Faso (Ezeanya, 2019). The practice has helped to rehabilitate between 200,000 and 300,000 hectares of land and produced an additional 80,000 tons of food per year in Burkina Faso (Reij, Tappan, and Smale, 2009)

According to Ezeanya (2019), Tassa farming technique was a huge success in Niger Republic where the World Bank project failed. In Mali the success of Tassa farming technique has been documented all over the Sahel region. In 1989-1990, a project implemented by the Djenne Agriculture System project (SAD) showed that agricultural yields increased by over 1000kg/ha as compared to traditional ploughed control plots (IFAP, 2005). The Tahoua Rural Development Project (TRDP) in Niger focused on improving community land on Plateau, slopes and farm, using Tassa farming, and it was a huge success (Maisharou, 2007). Variations of Tassa have also been used in several areas in Kenya including the Katumani pit in Machakos District, the "five by nine" pit in the Kirinyaga, Mbeere, Murang'a and the large tumbukiza pits in the Nyando District of Kenya (Malesu*et al*.; 2007). Amede*et al* (2011) showed that Tassa farming was effective in highland areas of Ethiopia that receive in excess of 1300mm annual rainfall and where water infiltration into soil is limited by losses of rainwater to run-off, lack of organic matter, and hardpans.

Asher (2014) opined that one of the major constraints to agricultural development is land degradation. Asher (2014) opined that tassa can lead to sustainable land and water management and thus provides farmers with the window of opportunity to improve crop performance in the harsh changing climate conditions.

Agriculture dominates the economies of most West African countries and impacts considerably on the income of poor, 70% of whom live and work in rural areas (Barry, Olaleye, Zougmore and Fatoudji, 2008). One of the reasons for underdevelopment of the agricultural sector is that there has in the past been a lack of strategic vision linking agriculture water development to poverty reduction and growth (AFDB, FAO, IFAD, IWMI, and World Bank, 2001). Improving the awareness for efficiency of water use in farm activities sounds rational, and ensures that water is conserved for future generations (IFAP, 2005).

However, farmers have reasons to smile in appreciation of the tassa farming technique which has been introduced not just in areas with low rainfall but as well in degraded lands and soils of very low fertility to revive soil fertility and conserve water for plant use and growth efficiency, through the activities of extension programs implemented by agricultural extension agents. Although tassa farming technique might appear to be labour intensive, it substantially boosts yield by up to 500% if done properly (World Bank, 2011). Agricultural farm families have remained locked in a low-input low-income system, with low and stagnated yields (Rosegrant*et al*, 2005). Agricultural output has not kept pace with the increase population and demand for food especially in developing countries like Nigeria (FAO, 2003; Rosegrant*et al*, 2005).

Irrigation for sustainable agriculture can boost crop productivity, but is expensive and out of the reach of most small holder farmers; most farmers cannot afford modern irrigation facilities to boost crop productivity, while lands are degrading with a lot of unfertile soils to battle with for cultivation, making agriculture in most developing countries a largely subsistence-based activity. Lack of adequate water is a constant problem in farming due to seasonality of rains and frequent droughts caused by climate change. This has led to total crop failures, and harvest that are too low for farmers to break-even.

Many scientific reports have indicated that the world is growing drier with time. The exact rate of global warming has been highly contested by scientists and many tend to agree with this reality that Africa will be particularly worst hit. Farmers therefore need to realize it is no longer business as usual. Rain fed agriculture is becoming increasingly unreliable, especially in dry areas and with the ever changing climate.

Small holder farmers are facing a constant challenge to produce enough food to feed their families and generate much needed income. In areas where population growth is high, the challenge is even more difficult due to increased pressure on the land to produce crops. Consequently, innovation is critical to survival in these areas where traditional methods, such as long fallow periods, are no longer adequate and feasible for farming. To sustain livelihood, farmers need good strategies for capturing and conserving rainfall water, rehabilitation of degraded lands and revival of unfertile soils to enhance and increase food production to generate income to manage their households.

Researchers have developed many simple and useful technologies to optimize rain fed agriculture, but farmers have tended not to adopt them on a significant scale for various reasons, farmers' problems and researchers' solution have not connected. And many farmers do not realize that is possible to double or triple their crop yield through rainwater harvesting. Farmers in various parts of West Africa such as Ghana, Kenya, Niger and Mali are reviving and adopting Tassa, a traditional soil and water conservation practice, at a very surprising rate, (Motis et al., 2013).

Tassa farming technique, in few places where it has been practiced has proven to be a better farming technique in terms of improving crop productivity, rehabilitation of degraded lands, enhancing and reviving soil fertility and inexpensive to practice, unlike other forms of farming technique which could be expensive to purchase and hazardous to the natural environment as in the case of chemically manufactured fertilizers, and some farming techniques such as fallowing and traditional ploughed control practices which are becoming ineffective due to climate change. Tassa farming technique has not been reported to impose any form of hazard or negative effects to the natural environment and has even proven to give better results where other techniques have failed. With Tassa farming technique in agriculture, seasonal crops such as maize, cucumber, okro, groundnut, soyabeans, melon, peppers, tomatoes, water melon and many other crops can be cultivated all year round. According to Motis*et al*. (2013), Tassa farming technique addresses problems of land degredation, low soil fertility, and poor soil moisture.

However, in spite of the benefits accruable from this farming technique and its practice in some countries of West Africa, the assessment of the extent of practice and benefits of Tassa farming technique in Delta State in particular and Nigeria in general is yet to be ascertained. In fact, the concept of Tassa farming technique sounds strange to many people in Delta State. Therefore assessing the practice of this farming technique becomes necessary. Therefore, this research study attempts to answer the following questions: What are the socio economic characteristics of farmers who adoption of Tassa farming technology? What is the extent of adoption of the technology? What is the knowledge level of farmers of Tassa farming technology? What is the perception of farmers of Tassa farming technology? What are the constraints to the use of tassa farming technology? The specific objectives of the study are therefore to: Describe the socio economic characteristics of farmers in the study area; ascertain the awareness of the respondents of Tassa farming technology and the proportion of farmers involved in Tassa farming technology, hence the adoption index; determine the perception of farmers of tassa farming technology; ascertain the knowledge level of farmers of tassa farming technology; and examine the constraints to the adoption of tassa farming technology. This null hypothesis was tested: there is no significant relationship between the socio economic characteristics of the farmers and their adoption of tassa farming technology.

Research methodology

Study area

The study was carried out in Delta State. The state is generally low-lying with no remarkable hills. It has a wide coastal belt interlaced with rivulets and streams, which form part of the Niger Delta. It is part of the oil and agricultural producing states of Nigeria, located in the region of South-South geo-political zone. Lying approximately between longitude 5°00 and 6°45, East and Latitude 5°00 and 6°30 north, the State has a population of 4,098, 391 persons and occupies an

area of 16,842 km^2 (National Population Commission, 2006). The temperature is high, ranging between 28°C and 34°C with average temperature of 30°C and an average annual rainfall of 266.5cm in the coastal areas and 190.5cm in the Northern Fringes. The state is endowed with fertile soils and favourable climate making it important producers of food and cash crops. The state produces rubber oil palm, yams, cassava, maize, rice, plantains and citrus including other local food both for consumption and for export.

Sampling technique and sample size

For the purpose of this study, the research was conducted in forty communities of Delta State where tassa farming is practiced. The farmers in the area were the primary targets, because they lived in communities where Tassa farming technique has been applied. They were the primary target because some farmers in these communities have implemented the technology in their farming. The multistage sampling procedure was used to compose the sample needed for the study. In the first stage 8 communities were selected from the 40 communities where tassa farming technique is practiced. The second stage involves the random selection of 216 farmers (representing 5% of farmers from 8 communities that were randomly selected) for the purpose of this study.

Data collection

Primary data were collected with the aid of a well-structured simple questionnaire and administered randomly to farmers and collected back for analysis after each respondent finished the process. Trained enumerators were employed in distributing the questionnaire.

Measurement of variables

Socio-economic characteristics of the respondents measured were as follows: Age was measured in years, sex as dummy male and female, marital status categorized as single, married, divorced or widowed; household size measured by total number of persons in a household; educational qualifications categorized as no formal education, primary education, secondary education or tertiary education; Farming experience measured in years; farm income; measured in Naira (N), membership of association as dummy (either yes or no); size of farm measured in hectare, and extension contact as number of visits per year.
Farmers' perception of tassa farming technique was assessed by the use of likert type scale with values 1 = strongly disagree; 2 = disagree; 3 = agree; and 4 = strongly agree to determine their opinions about seven statements presented in a positive manner. The statements are: tassa improves yields, tassa increases income, tassa conserves soil, tassa conserves water, and tassa makes all year farming possible, tassa is easy to adopt and tassa is not labour intensive. The cutoff point is 2.5; average score above 2.5 indicates that respondents agree with the statement, otherwise they disagree.
To assess the respondents that adopted tassa level of knowledge, seven knowledge test items were provided with the help of the extension agents in Delta state. The likert type scale was then use to determine the extent of knowledge of these practices as 1 = very poor; 2 = poor; 3 = good; and 4 = very good. The cutoff point is 2.5; average score above 2.5 indicates good knowledge, otherwise the knowledge is poor. The likert type scale was also used to measure constraint using the scale 1 = not serious; 2 = not very serious; 3 = serious; and 4 = very serious.

Method of data analysis

Data were analyzed using descriptive and inferential statistics. Descriptive statistics such as frequency count, percentages, means, standard deviation, four point likert type and five-point likert scale were used to analyze data. The hypothesis was tested with the use of binary logit regression model. The regression model was used to test the stated hypothesis.The logit regression model is as specified below. The explicit form of the logit regression model is expressed as:
The model employed in the analysis is explicitly specified as follows:
$Ln\ Y = Ln\ (P/1-P)$……………………………………………………………..(1)
$Ln\ (P/1-P) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \dots \beta_{10} X_{10} + U$…………..(2)

Or,
Logit (Y_i) =$\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\ldots+\beta_{10}X_{10}+U$ ..... (3)
Where: (Y_i) = adoption of Tassa farming technology (Adoption=1; 0, otherwise)
X_1=Sex
X_2=Age
X_3= Marital status
X_4= Level of education
X_5= Farm size
X_6=Household size
X_7= Years of experience in farming
X_8= Membership of association
X_9= Extension contact
X_{10}=farm income
U=Error term
B_0= intercept
$B_{1.....}B_9$=parameters to be estimated

Result and discussions

Socio-economic characteristics of the respondents

Sex of respondents

The result in Table 1 shows that 57.4% of the respondents were females and 42.6.0% of them were males. It implies that females are more dominant in farming in this study area than the males. The findings agree with Okonya and Kroschel (2016) that women in Sub-Saharan African contribute about 70% to 75% of agricultural food production in rural areas.

Age distribution
The percentage distribution of the respondents according to age are 20 years and below (6.5%), 20 – 40 years (47.2%), 41 – 60 years (38.0%) and above 60 years (8.3%), which indicates that the people between 20 – 60 years were more involved in farming, since they are in their very active age (economic active age bracket). According to Nwankwo (2007) and also studies by Ojo*et al* (2013) and Oluyole*et al* (2013) people that are mainly involved in farming are in the prime age of strength and vigor which is required to perform farm operations.

Marital status
The result shows that most of the respondents (59.3%) were married which suggests that a lot of the respondents have family responsibilities; Ebewore and Isiorhovoja (2019) is of the view that majority of the small scale farmers in Nigeria are married and are involved in farm labour supply in order to meet their family needs. Thus most family members supply the labour needed to work on the farms.

Educational level
The result showed that 61.1% of the respondents had primary education, 24.1% had secondary education, and 3.7% had tertiary education; only about 11.1 had no formal education. This indicates that majority of the farmers in the study area had one level of formal education or the other. Formal education is expected to influence farmers' level of adoption of Tassa farming technology. Okoye*et al* (2011) and Kemobonta*et al*. (2014) are of the opinion that formally educated farmers are expected to have a higher acceptance level of agricultural technologies than those with low level of formal education or without formal education. They are also more likely to practice soil and water conservation technologies to boost their farm output.

Farm size
About of 44.4% of the farmers have farm size of 1 hectare or below, 31.0% had between 1.1 – 2.0 hectares, 16.7% had between 2.1 – 3.0 hectares, while only about 7.9% had more than 3.0 hectares. The implication of the finding is that most of the respondents are smallholder farmers. Various studies have shown that farm size has been found to be one of the variables that influence adoption of farm technologies (Overfield and Flemming, 2001; Bonabona- Wabbi, 2002; Onu and Simonyan (2015).

Household size
The household size distribution indicated that about 16.2% of the respondents had household members of between 1 – 5 persons; 78.7% had between 6- 10 household members; and only about 5.1% had above 10 household members. This implies that farmers with large household size enjoy the advantage of family labour since a large family size implies large farm labour supply especially in the African setting. Effiong (2005) and Ajani, Onwubuya and Nwalieji (2012) also reported that household sizes that are relatively large promote labour availability.

Farming experience
Majority (72.2%) of them had farming experience of 10 years and above as 21.3% had farming experience of 5-10 years and only 6.5% had 1 – 5 years of experience. The number of years of experience of the farmers is enough for the farmers to be able to indicate when an agricultural technology works in their favour.

Farmers' association
With respect to membership of farmers cooperative/associations 71.3% of the farmer did not belong to any cooperative or association, while 28.7% of the farmers subscribed to one farmers' cooperative/association or the other. Ofuoku*et al* (2008) and Ofuoku and Chukwuji (2012) are of the view that farmers subscribe to cooperative or associations for the reasons of easy access to credit facilities and extension information. Thus belonging to an association could serve as an avenue for the farmer to obtain information about new ideas that can help him to improve his farm operations

Extension contact
About 92.1% of the farmers had no contact with extension agents, while 7.9% had contact with extension agents only once in a month, which is attributed to the dearth of extension agents experienced in Nigeria in general and in Delta State in particular. Agbamu (2005) suggests that the ratio of extension agents to farmers is very poor in Nigeria and affects their frequency of contact between extension agents and farmers.

Annual farm income
Most (59.9%) of the farmers earned an annual farm income of N100,000 and below. in fact only about 13.9% of the respondents earn above N200000 naira per annum. Income earned is expected to be one of the motivating factors in adoption of agricultural technologies. The implication of this finding is that most of the respondents belonged to the low- income group (LIG). This may serve as an impediment to the adoption of innovation.

Table 1. Distribution of socioeconomic characteristics of respondents

S/n	Variables	Freq (216)	% (100)
1	**Sex**		
	Male	92	42.6
	Female	124	57.4
2	**Age**		
	<20	14	6.5
	20 – 40	102	47.2
	41 – 60	82	38.0
	Above 60	18	8.3
3	**Marital Status**		
	Single	42	19.4
	Married	128	59.3
	Divorced/Widowed	46	21.3
4	**Educational Level**		
	No Formal Education	24	11.1
	Primary Education	132	61.1
	Secondary Education	52	24.1
	Tertiary Education	8	3.7
5	**Farm Size (hectare)**		
	1.0 & below	96	44.4
	1.1 – 2.0	67	31.0
	2.1 – 3.0	36	16.7
	3.1 & above	17	7.9
6	**Household Size**		
	1-5	35	16.2

	6-10	170	78.7
	Above 10	11	5.1
7	**Farming Experience (Years)**		
	1 – 5	14	6.5
	6 – 10	46	21.3
	Above 10	156	72.2
8	**Farmers Association**		
	Yes	62	28.7
	No	154	71.3
9	**Ext Contact per year**		
	No contact	199	92.1
	Contact	17	7.9
10	**Involvement in tassa farming**		
	Yes	55	25.5
	No	161	74.5
11	**Annual Farm Income**		
	10,000 – 100,000	129	59.7
	101, 000 – 200,000	57	26.4
	201,000 – 300,000	30	13.9

Source: Field Survey, 2019

Respondents' awareness and adoption of tassa farming technology

The computation in Table 2 shows that majority of the respondents (91.7%) are very much aware of the technology, while very few (8.3%) of the respondents are totally unaware of the technology. The result in Table 2 also shows that some of the respondents (43.4%) have been involved in Tassa practice.

From Table 2 the proportion of the respondents involved in Tassa farming technology shows that majority of the respondent are yet to practice this cost effective soil and water conservation farming technique.

The adoption index of 0.43 from the computation shows low adoption of Tassa farming technology (Table 3). According to The North-Central Rural Sociology Sub-committee for the study of diffusion of farm practices (1955) adoption is not an instantaneous act. It is a process that occurs over a period of time and consists of series of actions. Perhaps it is hoped that those still at the awareness stage would probably adopt the technology in the future. This calls for intensive sensitization of the respondents.

Table 2. Respondents' awareness and involvement in Tassa farming technique

Awareness	**Frequency (108)**	**Percentage (100)**
Yes	198	91.7
No	18	8.3
Involvement in Tassa Practice		
Involved	55	0
Not involved	161	0

Source: Field Survey, 2019

Table 3. Adoption index of respondent of tassa farming technique

Technology	**Awareness 1**	**Interest 2**	**Evaluation 3**	**Trial 4**	**Adoption 5**	**Score**	**Mean**
Tassa Technology	198 (1)	0 (2)	0(3)	1(4)	55 (5)	473	2.2

Grand Adoption mean = 4.1

Adoption Index = $\frac{2.2}{5}$ = 0.43

Adoption of Tassa farming technology by farmers = 42%

Assessment of respondents knowledge of tassa farming technique

The result of the assessment of the respondents' knowledge of tassa farming technique is presented in Table 4. The result presented showed that out of the seven knowledge test items

administered, the farmers have good knowledge in 3 while they have poor knowledge in the remaining four items. The respondents have good knowledge of how to dig holes, the time to start dgiing holes and how to plant their crops in the holes. However, they have low knowledge about the holes dimensions, proper way to fill holes with manure, number of holes to dig per unit area of land and the spacing between holes. The implication is that the respondents need more training in these activities where they have low knowledge in order to improve their competency of using tassa farming technique.

Table 4. Respondents' knowledge of tassa farming technique

Knowledge item	Mean	S	Remark
How to dig holes	3.67	0.67	Good
Tassa holes dimension	2.11	0.42	poor
How to fill holes with manure	2.24	0.39	poor
Number of holes/ hectare	1.99	0.55	poor
Time to commence digging	3.58	0.48	Good
How to plant in tassa holes	3.52	0.49	Good
Spacing between holes	1.78	0.38	Poor

Source: Field Survey, 2019

Respondents perception of tassa farming technique

Table 5 presents the results of farmers' perception of the use of tassa farming technique. Seven statements stated in the positive manner were made and the farmers' opinions about these statements were sought. The means of 3.79, 3.77, 3.35, 3.33 and 2.99 for statements tassa improves yields, tassa increases income, tassa conserves soil, tassa conserves water, and tassa makes all year farming possible respectively clearly indicated that the farmers agree with these statement as could be seen in the remark column. However, the respondents disagree with the statements that tassa is easy to adopt (mean = 2.33) and tassa is not labour intensive (mean = 1.45).

Table 5. Respondents Perception of tassa farming technique

Statement	**Respondents' perception of use of tassa**			**Remark**
	Mean	**Std deviation**	**rank**	
Tassa is easy to adopt	2.33	0.45	6th	Disagree
Tassa is not labour intensive	1.45	0.33	7th	Disagree
Tassa improves yields	3.79	0.42	1st	Agree
Tassa increases income	3.77	0.47	2nd	Agree
Tassa conserves soil	3.35	0.56	3rd	Agree
Tassa conserves water	3.33	0.48	4th	Agree
Makes farming all year round	2.99	0.53	5th	Agree

Source: Field Survey, 2019

Constraints to the use of tassa farming technology

Several constraints were reported by the respondents as obstacles to the efficient practice of tassa farming technique as presented in Table 6. The most serious constraints faced by the respondents with the use of Tassa farming technology were inadequate finance (mean = 3.35), lack of labour force (mean = 3.11), government policy on the use of Tassa pits (mean = 3.10), lack of extension information and follow-up (mean 3.04) and lack of technical know-how for digging Tassa pits (mean = 2.76).

Table 6. Constraints to the use of tassa farming technique

	Frequency (108)	**Percentage(100)**	**Mean**
Inadequate finance			
Not very serious	7	7.07	
Not serious	9	9.09	
Serious	25	25.25	**3.35**
Very serious	58	58.59	
Lack of labour force			
Not very serious	8	8.08	
Not serious	14	14.14	
Serious	36	36.36	**3.11**
Very serious	54	41.41	
Government policy on the use of Tassa pits			
Not very serious	89	89.90	
Not serious	10	10.10	
Serious	0	0	**3.10**
Very serious	0	0	
Lack of extension information and followup			
Not very serious	4	4.04	
Not serious	8	8.08	
Serious	8	8.08	**3.04**
Very serious	79	79.80	
Lack of technical know-how for digging tassa			
Not very serious	38	38.38	
Not serious	54	54.55	**2.76**
Serious	5	5.05	
Very serious	2	2.02	

Source: Survey data, 2019

Relationship between the socio economic characteristics of the farmers and their adoption of tassa farming technique

Table 5 shows the variables, magnitude and statistical significance of the estimated parameter for adoption of Tassa farming technique using the binary logistic regression model. The log likelihood is 220 and the model rightly predicted 84% of the variation in the adoption of Tassa farming technique by farmers. The model results indicate that five variables out of the ten variables significantly influenced the adoption of Tassa farming techniques by the respondents. All the five significant variables had a positive influence on the adoption of Tassa farming technique and they are: educational level, farm size, household size, farming experience and income (Table 5). This indicates that farmers who are highly educated, with a bigger farm size, lot of experience, with larger household members, and with high income are more likely to embrace the adoption of Tassa farming technique. Rogers (1995) opined that the adoption of any agricultural innovation is dictated by factors like characteristics of the farmers, characteristics of the innovations, and social circumstances.

Table 7. Relationship between the socio economic characteristics of the farmers and adoption of tassa farming technique

Variable	Marginal effects	coefficient	Standard error	Z-value	p-value
Sex	0.558	0.432	0.433	1.994	1.2004
Age	0.988	-0.006	0.007	1.672	0.344
Marital Status	0.023	0.023	0.142	0.946	0.884
Education level	8.991	0.332	0.345	3.422	0.004**
Farm size	14.799	4.121	1.566	3.778	0.036**
Household size	10.002	1.337	0.777	3.664	0.001**
Farming exp.	6.771	0.244	0.118	3.114	0.029
Farm Association	8.101	0.999	0.139	4.774	0.000**
Ext. Contact	0.945	-0.189	0.387	1.088	0.631
Farm income	0.071	6.002	0.000	3.99	0.001**
Constant	0.002	-7.455	1.698	4.11	0.000**

Source: Survey data, 2019; Hosmer and Lemeshow Test: Chi-square= 5.894, Sig. = 0.699, -2 Log likelihood = 219.999, Cox and Snell r^2 = 0.51; Nagelkerke r^2 = 0.71; overall percentage of right prediction = 84%; sample size = 108 respondents. ** significant at $p<0.05$,

Conclusion

The study has been able to establish that although the level of awareness of tassa farming technique was high, the adoption rate, as indicated by adoption index of 0.43 was quite low . Their positive perception of tassa farming technique influenced the adoption. The farmers also realize that Tassa technology is a very good technique that enhances crop productivity, increase yields and income. However, the farming technique is labour intensive and lack of enough man power to dig tassa pits could be serious constraint. Extension services offered to farmers in regard to adoption of tassa was poor as majority of the respondents lack access to extension services. Adoption of Tassa farming technique was influenced by socioeconomic characteristics such as, education attainment, farm size, household size, membership of association andincome, finance and extension. It was also influenced by farmers' knowledge and perception of technology. Considering the findings of this research, the following recommendations are made:

1. There is a great need for orientation on tassa farming technique to be given to farmers. This orientation should be given in the form of enlightenment campaign in the form of group discussion with farmers, organizing workshops and seminars. This will boost the knowledge status of the farmers and enable them to practice tassa farming technique effectively.
2. Extension contact can be improved by increasing the number of extension personnel in the area. These personnel should also be trained so that they can provide the right package of services to the farmers.
3. Farmers should be encouraged to belong to associations as they can easily obtain reliable information and technological packages through these associations.

Acknowledgments

Our sincere gratitude goes to the Dean of faculty of Agriculture and the Head, Department of Agricultural Economics and Extension, as well as all lecturers in the department of agricultural Economics and Extension who contributed immensely to the completion of this

work. We also appreciate the contribution of the extension agents who assisted us when designing the questionnaire.

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