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Socio-Economics Factors Affecting Adoption of Tissue Culture Bananas in the Semi-Arid Areas of Lower Eastern Region of Kenya

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Abstract: **The importance of bananas cannot be underestimated worldwide. A survey was conducted to determine the socio-economic factors affecting adoption of tissue culture (Tc) bananas in Kalawa, Thaana and Kithimani clusters using a total of 176 respondents randomly selected. The sample size for each region was as follows:- Thaana cluster- 68, Kalawa cluster- 72 and Kithimani cluster 60.**

The data collected was analyzed using the *SPSS* version 17. The results showed that the major socio-economic factors affecting adoption of Tc bananas were: gender (p=0.0150); education (p=0.0380); total land size (p=0.0110); farmer's experience (p=0.0168); Tc bananas knowledge (p=0.0100) and Tc bananas market (p=0.0030). Others included access to either public or private extension services reported by 35 percent of the respondents; Tc multiplication by government or other development stakeholders within the clusters was mentioned by 77 percent; awareness and acquisition of credit services for farm activities from the financial services was important for 64 percent. The study recommended the need to improve and access extension services; ways of making available the Tc bananas plantlets closer to farmers ; new policy framework to reduce the effect of wild life on Tc bananas farms; enhanced farmers' education and general capacity building on Tc banana growing and more opportunities of irrigation for use in Tc banana growing.

Keywords: **Tc Banana, technology, Adoption, Food Security.**

1. INTRODUCTION

Globally, Bananas (*Musa* spp.) are the fourth most important food security commodity to many households after rice (*Oryza sativa*), wheat (*Triticum aestivum*) and milk (Swennen, 1991). Banana belongs to the family of *Musaceae* and genus *Musa.* Modern day banana is a cross between two wild species, *Musa acuminata* and *Musa balbisiana*. By 1991, bananas had a worldwide production of 74 million metric tons (Mt) per year, of which 34 percent was from Africa (Swennen, 1991). In 2013, this figure had almost tripled to 201million Metric tons per year. (FAO, 2014).Today, banana is the most cultivated fruit crop globally being grown in 140 countries.

Although the origin and center of diversity for banana is believed to be Southeast Asia, the East African highlands are recognized as a secondary center of diversity. It is the world's most widely known and distributed fruit (Bassette, 2003), eaten either raw or cooked, and may be processed into starch, chips, puree, beer, vinegar or dried. Bananas are rich in energy (128 kilo calories/100 grams), and vitamin C and A (Chandler, 1985). Banana fruits have a very high content of potassium (K) and a wide K: Na ratio, imparting a protective effect of K against excessive Na intake in diets (Tripathi *et al.*, 2002). Banana is rich in natural antioxidants such as vitamin C and vitamin E (Someya *et al*., 2002; Amorim *et al*., 2009a, b). Banana consumption reduces deficiencies that arise in several countries; such as vitamin A deficiency that leads to serious health problems, especially in children in low-income regions of the world, such as parts of Asia, Africa and

Latin America (Bloem *et al.*, 2005). Similarly, it reduces micronutrient deficiencies of iron and zinc which results in serious health problems such as mental and physical retardation, reduced resistance to infections and hypogonadism (Whittaker, 1998). The genetic enhancement of micronutrient content (i.e., biofortification) of banana by conventional breeding combined with the use of biotechnological tools has the potential to increase the concentrations of micronutrients (Fe, Zn) and vitamin A in new cultivars (Amorim *et al*., 2011). Improving the nutritional content of *Musa* spp. would have a significant impact on vitamin and nutrient intake for millions of people who depend on the crop for food. The Kenya National Food and Nutrition Security Policy of 2011(GOK, 2011) states that all Kenyan households should at all times have access to safe food of sufficient quantity and quality to satisfy their nutritional needs for optimal health. The study area has fallen short of this with food insecurity at 60 percent, a status aggravated by the fact that the average poverty level is over 62 percent.

Tissue culture technological development is a major scientific milestone widely accepted as a means of addressing food productivity, food unavailability, its access and affordability to many households with surpluses reaching the market to generate the much needed income to many peasant farmers' worldwide (Chandler, 2005).

This semi-arid region has not benefited from the advanced technological development of tissue culture bananas due to low adoption linked to a combination of factors that require to be determined in order to overcome the prevailing food insecurity and high poverty level. The aim of the study was therefore to determine and assess the socio economic related factors influencing adoption of tissue culture bananas in the three representative clusters namely Kalawa, Kithimani and Thaana within the three counties of Makueni, Machakos and Kitui respectively in the lower Eastern Kenya.

2. MATERIALS AND METHODS

Study area and its description:

This study was carried out in three clusters (Wards) namely Kalawa ($1^0$39'12.8'S/$3^0$7'42'08.6'E), Thaana Nzau ($1^0$22'1.06'S/$38^0$00'37.98'E) and Kithimani ($1^0$11'11'S/$37^0$26'45'E), located in Makueni, Kitui and Machakos counties respectively. The clusters are situated along the major rivers of Athi in Makueni and Machakos counties, Thaana (also variously called Tana) in Kitui County and along the tributaries of Athi, namely Thwake and Kaiti all in Makueni County. The entire region covers 5,713 with a combined population of 363,374where 49 percent are male whereas 51 percent are female. The poverty index is at a mean score of 62.4 percent. According to UNICEF (2011), the youthful population of less than 18 years was 55 percent while according to UNWHO (2012); the child nutrition index showed an average of 16.4 percent of children below 5 years were underweight with73 kids in 1000 likely to die before age 5. These latter figures indicate the grave food security situation as well as the available youth perhaps majorly unemployed in the three counties. The UNWHO defines the study area as highly vulnerable in terms of food access, availability, affordability and adequacy (UNWHO, 2012).

Research design:

Qualitative research was used for descriptive research whereby a survey targeting households was carried by use of a structured questionnaire. Quantitative data was also collected for regression analysis.

Determination of sample size:

The sample size for the study was determined using the following formula (Magnani et al. 2007).

$$n = \frac{t^2 \times p(1-p)}{m^2}$$

Where:

n= required sample size

t = confidence level at 95 percent (standard value of 1.96)

p = estimated percent of adoption of technological practices like TC in the study area is 20 percent.

m = margin of error at 5 percent (standard value of 0.05)

Based on this, a total of 176 households were selected from the list of all the villagers in the three clusters, with each village being represented using random sampling method. These villages were further clustered into Thaana, Kalawa and Kithimani clusters with 65, 60 and 51 households respectively.

Sampling Procedure:

Out of the 176 respondents, systematic sampling was carried out to identify the respondents which resulted in 65 households, 60 households and 51 households picked from Thaana, Kalawa, and Kithimani clusters respectively

Data Collection and Analysis:

Data Collection:

A Semi-structured questionnaire was used to elicitinformation on household characteristic (size, land holding, composition, sources of income, and their quantitative aspects), , social economic related factors affecting growing of TC bananas in the Thaana, Kalawa and Kithimani located in Kitui, Machakos and Makueni counties respectively. The questionnaire was pre-tested in a pilot survey involving 2 villages outside the study area but in a place near the study sites (Kyase sub-location) before the main survey. The pre-tested, structured questionnaire was used. This had two sections, the general household characteristics as well the technical part that had details of socio-economic parameters. The data collection took twelve days with a group of 6 enumerators.

Data Analysis:

The collected socio economic data was analyzed as per the counties as follows; Kalawa in Makueni county having 60 respondents; Kithimani in Machakos county having 51 respondents and Thaana: Kitui: 65 respondents. These were successfully interviewed. The data was entered into excel computer sheets.

The data collected using structured questionnaires was analyzed to determine the relationship between household characteristics and the level of adoption of Tc bananas and factors affecting its adoption using Package for Social Science (SPSS) Version 17.

Binary logistic regression model (Hailu (1990), Cramer (1991), Nkamleu *et al.*, (2000)) was used to determine the significant socio economic related factors and bringing out relationship between household characteristics and the level of adoption of the tissue culture bananas.

Model specification:

The simple reduced form of adoption model is as

Follows, $Zi = f(x)$

$X = xi$

$I = 1, 2 \ldots\ldots\ldots N$

Then the model form is,

$Zi = ß_0 + ß_1X_{1i} + ß_2X_{2i} \ldots\ldots\ldots\ldots ß_nX_{ni} + µi$, the so called linear multiple regression model.

Where;

Zi = TC Bananas adoption (dependent variable) or regress and while X1, X2 are the explainable variables (or repressors); the disturbance µ, the error term, is considered to be a random term that represents pure chance factors in the determination of Z.

X_1 = Age of household in years

X_2 = Education level of the farmer

X_3 = Farm size in acres

X_4= Access to extension service by farmers

X_5=Gender of the farmer

X_6 = Household income

X_7 = Farm size in acres under finger millet.

X_8=Experience

X_9=Off Farm Employment

X_{10}=Marital status

X_{11}=Family Size

X_{12}=TC Bananas Market

X_{13}=TC Bananas Knowledge

μ = error term

n= 1, 2,3,4,5,6,7,8,9,10,11,12 and 13

The dependent variable is the natural log of the probability of adopting Tc Bananas variety (p) divided by the probability of not adopting it (1-p).The value of the dependent variable is therefore a linear combination of the value of independent variables plus an error term. The error term is assumed to be normally distributed with a mean of zero and constant.

This is the principle underscored by multiple regression, which an involvement of more than one explanatory variable in a single regression equation (Thad *et al.*, 1988) and (Triola *et al.*, 1999), which is an expression of a linear relationship between one variable Zi and two or more independent variables (X1, X2,,,,,, X13)

3. RESULTS AND DISCUSSION

The results of the household demographic characteristics are shown in Table 1. Across the three respective clusters, majority of the households were male headed with Kalawa, Thaana and Kithimani having 65 %, 61 % and 66.2 %, respectively. On gender, on average there were 64 % of male headed households and 36 % headed by females. With regard to age, on average, 31 % were between 40-50 years and 37 % between 50-60 years and 11 % above 60 years. People less than 40 years old were the least at 21 %. In Thaana, the aged (50-60 years) formed the majority (45 %) compared to Kithimani (37 %) and Kalawa (27.7 %). TC bananas farming experience is directly related to adoption of technology by of the household head (Robert *et al*, 2010). The study showed that knowledge in Tc bananas farming significantly influences the adoption of Tc bananas. From the analysis, a unit increase in farmer Tc bananas knowledge would lead to an increased adoption of Tc banana by about 1% (Table 3). The county governments should put in place strategies to improve farmer's knowledge about Tc banana. On average 62 percent of the household heads were found to have group affiliation or membership while 38 percent were not members (Table 2). This characteristic was shown as a significant factor in influencing adoption of Tc bananas (Table 3). Majority of the respondents (43.3 %) had an income of below Ksh. 10,000 per month with those earning between ksh.10, 001-30,000 being 38.5% on average. The lowest (18.2%) earned over ksh.30, 000. Kalawa had more household heads earning ksh.10, 000 at 50.8% followed by Thaana and Kithimani at 40% and 39.2%.

Socio-economically, (Table. 1) majority of the respondents had an income of less than Ksh. 10,000 per month which was low as per the UNDP, 2015 statistics. Thus, there would be need for intensive agriculture investment through adoption of modern farming technologies to supplement source of family income and food availability especially in the arid and semi-arid areas. Income generation from farming in ASALs is highly weather-driven. Adoption of technologies that counteract the adverse weather like drought tolerant cropping systems and new crop varieties are notable options in solving food insecurity in the arid areas (UN-FAO, 2014). Regionally, crop incomes have remained an important contributor to household income in the western and central highlands, western transitional and high potential maize zones, contributing between 41 percent and 65 % over the decade (Mutero, 2012). In the semi-arid areas such as coastal and eastern lowlands and marginal rain shadow areas crops generally contribute less to total household incomes between 10 % and 43 % compared to the high potential agricultural regions. The production interventions such as adoption of tissue culture bananas, using water harvesting and efficient water use systems like drip irrigation along water sources like dams and rivers are feasible today though highly dependent on households income, education and knowledge (Mutero, 2012).

Adoption of new production techniques like tissue culture bananas is driven by the need to produce more for attainment of food security and income generation (UN-FAO, 2014). According to Mwangi (2011), disaggregation of household income revealed that crop income related to adoption of high value crops like fruits and vegetables is a major component of household income today, contributing to over 40 % in 1997, 50 % in 2000, 46 % in 2004 and 44% in 2007. Low incomes reflect poor adoption for technologies whose acquisition is assumed to be costly, while improved incomes create more opportunities to adoption of technologies such as tissue culture bananas. Variations over time in agriculture within the arid and semi-arid areas are linked to adoption of technologies or even the non-adoption to the same. On Tc bananas knowledge, the highest number of respondents at 88.1% (Table 1) had no technical knowledge about the crop husbandry skills of Tc bananas while 11.8 % had knowledge or were knowledgeable about Tc bananas. Kalawa data showed the highest at 93.8% without Tc knowledge followed by Thaana and Kithimani at 88.3% and 82.4% respectively in the same category. On livestock ownership across the study areas, (Table. 2) Thaana recorded more households without livestock at 34 percent out of 60 percent while Kithimani (33 out of 60) and Kalawa (40 out of 65) had livestock The results were found significant ($p<0.05$) (Table 2). Wambugu (2013) described the upper eastern Kenya region to have had perennial food deficits occurrences, thus calling for technologies that could improve food security and poverty alleviation. Experience amongst farmers on Tc bananas was low, which was comparable to a study done by Wambugu (2009) on promoting tissue culture banana plantations. This suggests that investment in farmers training on production skills on the Tc bananas could lead to increased adoption as was the case in Middle Eastern region of Embu, Tharaka, Meru and Mbeere (Wambugu, 2009). Nguthi (2007) on Adoption of agricultural innovations by smallholder farmers argued about the importance of understanding nutrition and poverty in addressing issues of food security by the developing countries through policy. Further UNDP, 2016 defines poverty and hunger as the lead areas in the globally accredited sustainable development goals.

Table 2 also shows results of detailed analysis of factors derived from household data as they influence adoption. On gender, Thaana and Kithimani had more females growing the bananas at 39% and 32 %, respectively compared to Yatta which had more men (39 %) than female adopters (26 %). The chi- square statistics at 9.5729, with a p-value of 0.008342 was found significant ($p<0.05$) (Table 2). This could be due to the fact that male headed household are likely to have more access to resources and information than women household heads due to traditional and cultural gender roles which tend to discriminate against women. These findings agree with Nyerere *et al*., (2000) who showed that men usually have more access. Similar findings were also reported by Nyang *et al.*, (2011), that male have more power to make decisions regarding the factors of production on the farms than females. Rine, (2004) noted that gender is a determinant for technological adoption.

On Education level, the result showed that all the respondents had attained some level of education (Table 1). Majority of the respondent had attained secondary education (57 %). The 23 % attained primary education while 20 % had tertiary education. The average land size per house hold was 5.51 acres, with Kithimani having the largest parcels at 6.5 acres while Thaana and Kalawa reported 5.11 and 4.92 acres respectively. The average area under the Tc Bananas was 1.23 acres per house hold, with Kithimani having the largest parcels at 1.35 acres while Thaana and Kalawa reported 1.03 and 1.31 acres respectively. The percentage acreage under Tc bananas against total available land size per house hold is 22.23%. The number of households that had family members ranging between 5-10 members was the highest at 57 percent followed by households with 3-5 members at 35 percent. It was also found that 8 percent of households had less than 3 members. Regarding households that had undergone training on tissue culture bananas production only Kalawa had more households (48 out of 65) trained while Kithimani and Thaana had more untrained households (39 and 48 respectively) the results were similarly found significant ($p<0.05$). On Education characteristic significantly affected adoption of tissue culture bananas, Kalawa (38 out of 65 had more households educated up to primary level while Kithimani and Thaana had more households educated up to secondary level and beyond

On the Availability of extension services (public or private) to the household's heads in the study area, in Table 2, Kalawa and Thaana results revealed non availability (at 40 out of 65 and 41 out of 60 households heads respectively) compared to Kithimani which had extension services available (at 31 out of 51 Extension services were important in TC bananas farming as a means to modern technology transfer between researchers and the farmers (World Bank, 2006). This calls for more extension services from both the public and private sectors to enhance adoption of such technologies like TC bananas. The results suggest that the probability of adoption of Tcbananas could be enhanced by taking cognizance of these variables in order to meet the priority needs of smallholder farmers who were the target group to alleviate the food

shortage problem in the country and particularly in the study area. Farmer's exposure to more extension services leads to increased adoption since farmers are able to gain knowledge on Tc bananas farming (Wanyama, 2014). Due to this knowledge, the national and county governments and other development partners should put in place measures to improve extension services through extension officer's facilitation as well as increasing the service providers' number (Nyang et al., 2011).

From the logistic regression results (in Table 3) on socio-economic related factors, the following factors were found significant (at $p<0.05$) in influencing the adoption of Tc bananas in the study areas: gender (p=0.0150); education (p=0.0380); total land size (p=0.0110); experience (p=0.0168); Tc bananas knowledge (p=0.0100) and Tc bananas market (p=0.0030).The following other factors were found insignificant (at $p>0.05$) in influencing the adoption of Tc bananas in the study areas: Age (0.9060); income level (p=0.0730); groups affiliation (p=0.5420); family size (p=0.5630); marital status (p=0.5100) and off farm employment (p=0.6980). It was also found that education significantly affected adoption of tissue culture bananas in the study area ($p<0.05$). Majority of the respondents had attained some level of education as indicated by 57% having attained secondary education and 27% having primary education. According to KDHS (2014), education and knowledge are key determinants of the lifestyle and status of an individual in a society. Adoption of new food sources increases with education and knowledge on the importance of this to nutrition and health. Farmers' education significantly influences the adoption (Wambugu *et al.*, 2007). Therefore, a strategy to increase farmer's education would greatly lead to increased adoption of Tc bananas (Wambugu *et al.*, 2007). According to the World Bank (2014), education influences farmers' decision to adopt new technologies like tissue culture bananas with countries being advised to invest heavily on education and skills development to enhance adoption levels (World Bank, 2014).

Table 1 Households Socio -Demographic Characteristics

Research Parameters		**Thaana**	**Kithimani**	**Kalawa**	**Mean**	**Std. Deviation**
N=176		**% (f) (n=60)**	**% (f) (n=51)**	**% (f) (n=65)**	**% (f)**	
Gender	Males	65 (39)	61(31)	66.2 (43)	64 (8)	29.29
	Females	35 (21)	39 (20)	33.8 (22)	36 (21)	16.01
Age	Less than 40yrs	20 (12)	22 (11)	21.5 (14)	21 (12)	9.53
	40-50 yrs	31.7 (19)	28 (14)	33.8 (22)	31 (18)	14.33
	50-60yrs	45 (27)	37 (19)	27.7 (18)	37 (21)	18.79
	More than 60yrs	3.3 (2)	14 (7)	16.9 (11)	11 (7)	8.1
Education	Primary	28.3 (17)	20 (10)	21.5 (14)	23 (14)	11.23
	Secondary	65 (39)	47 (24)	58.5 (38)	57 (34)	26.45
	Post-Secondary	6.7 (7)	33 (17)	20 (13)	20 (12)	8.99
Total family Land Size	Acres	5.11	6.5	4.92	5.51	2.46
Area under Tc Bananas	Acres	1.35	1.03	1.31	1.23	0.022
Family Size members	Less Than 3	11.7 (7)	2 (1)	9.2 (6)	8 (5)	1.91
	Between (3-5)	40(24)	29.4(15)	35.4(23)	35 (21)	10.58
	Between (5-10)	48.3 (29)	68.6 (35)	55.4 (36)	57 (33)	16.25
Group Affiliation	Yes	60 (36)	59(30)	67 (44)	62 (37)	28.59
	No	40 (24)	41 (21)	33 (21)	38 (22)	17.35
Experience in growing Tc bananas	Less than 5 years	41.2 (29)	49 (25)	43 (28)	44 (37)	28.14
	10 years	34.1 (16)	29 (15)	29 (19)	31 (17)	25.52
	15 years	13.6 (10)	16 (8)	17 (11)	16 (10)	4.77
	More than 20 years	11.4 (5)	6 (3)	11 (7)	9 (5)	7.08
Marital Status	Married	81.7 (49)	74.5 (38)	86.2 (56)	81.3 (48)	0.445
	Single	18.3 (11)	21.6 (11)	12.3(8)	17.0 (10)	0.551
	Divorced	0.0 (0)	3.9 (2)	1.5 (1)	1.7 (1)	0.761
Income Level(In ksh)	(Below 10,000)	40.0 (24)	39.2 (20)	50.8 (33)	43.3 (26)	0.7464
	(10,001-30,000)	45.0 (27)	41.2 (21)	29.2 (19)	38.5 (22)	0.665
	(Over 30,000)	15.0 (9)	19.6 (10)	20.0 (13)	18.2 (11)	0.776
Tc bananas Knowledge	1 (Without)	88.3 (53)	82.4 (42)	93.8 (61)	88.1 (52)	0.615
	3 (With)	11.7(7)	17.6 (9)	6.2 (4)	11.8 (7)	0.221
Numbers in parenthesis represent frequencies						

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Table 2. Detailed analyses of household factors influencing the adoption of Tc bananas.					
Other factors Cluster/Study Area		F (%)	F (%)	chi-sq. statistic	*p*-value*
Gender of the household heads growing tissue culture bananas	Cluster	Male	Female		
	Kalawa (n=65)	60(39)	40(26)	9.5729	0.00834
	Thaana (n=60)	35(21)	65(39)	8.0041	0.00322
	Kithimani(n= (51)	37(19)	68(32)	7.3002	0.00680
Livestock ownership as it affects adoption of tissue culture bananas	Cluster	With Livestock	Without Livestock	6.2882	0.04311
	Kalawa (n=65)	62(40)	38(25)	5.8021	0.0324
	Thaana (n=60)	43(26)	57(34)	6.1072	0.0411
	Kithimani (n=51)	65(33)	35(18)	6.2100	0.0364
Training on tissue culture	Cluster	Trained	Not Trained	36.6464	0.00001
	Kalawa (n=65)	74(48)	26(17)	29.0121	0.00089
	Thaana (n=60)	37(22)	63(48)	28.0124	0.00001
	Kithimani (n=51)	24(12)	76(39)	32.2132	0.00002
Education as it affects adoption of tissue culture bananas	Cluster	0-Primary	Post-secondary		
	Kalawa (n=65)	58(38)	42(27)	11.519	0.00315
	Thaana (n=60)	28(17)	72(43)	9.0012	0.00219
	Kithimani (n=51)	43(22)	57(29)	9.3201	0.00311
Availability of extension services (public or private)	10.2109Cluster	Available	Not Available		
	Thaana (n=60)	42 (25)	(40) 58	25.3359	0.00001
	Kithimani (n=51)	37 (19)	(41) 63	28.0724	0.00021
	Kalawa (n=65)	60 (39)	(12) 40	32.2312	0.00002
Group membership	Cluster	Yes	No		
	Kalawa (n=65)	60 (39)	40 (26)	7.7608	0.02064
	Thaana (n=60)	42 (25)	58 (35)	7.2110	0.01453
	Kithimani (n=51)	69 (34)	31(17)	6.9005	0.08420
Numbers in parenthesis represent frequencies					

*** Significant at 0.05 level of significance**

Table 3. Regression results of socio-economic factors influencing the adoption of Tcb					
Variables	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t-test	*Significance.
Constant	1.269	0.263		4.832	0.000
Age	-0.004	0.035	-0.008	-0.119	0.906
Gender	-1.155	0.063	-0.149	-2.455	0.015
Education	2.093	0.044	0.120	2.097	0.038
Total Land Size	2.028	0.011	0.166	2.571	0.011
Income Level	-0.088	0.049	-0.131	-1.804	0.023
Experience	0.016	0.009	0.095	1.840	0.0168
TCB Knowledge	1.280	0.051	-0.344	-5.466	0.010
Acreage Under TCB	-1.493	0.070	-0.407	-7.010	0.100
TCB Market	1.178	0.060	0.175	2.968	0.003
Family Size	-0.028	0.048	-0.036	-0.579	0.563
Marital Status	0.181	0.070	0.161	2.603	0.510
Off Farm Employment	-0.025	0.064	-0.025	-0.388	0.698

4. CONCLUSION

From the study it was concluded that the adoption of tissue culture bananas in Kalawa, Kithimani and Thaana located in the lower eastern semi-arid areas of Kenya was evidently low. It was clear from the regression and chi squares analysis that gender, education, total land size, Tc bananas knowledge, acreage under Tc bananas, Tc bananas market and extension services were significant socio-economic factors influencing the adoption of Tc bananas in the study area. Most farmers sold their produce in the local markets and there was high demand and low supply of Tc bananas in the market. The study provides an opportunity for extension services through groups, which saves time and resources in the training of farmers, sourcing of inputs and Tc bananas plantlets, and group production and marketing which in turn enhances economies of scale. The study forms the basis of enactment of policy framework to guide cultivation of tissue culture bananas in the study area.. It also forms a basis for awareness on the factors influencing adoption and which if addressed could result in improved productivity, food security and income to the farmers

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