

# Adoption and Impact of Tobacco Recommended Varieties among Smallholder Farmers in Tabora Region

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Received: November 4, 2011 / Published: May 20, 2012.

**Abstract:** The research examines the status of adoption of improved tobacco recommended varieties among smallholder farmers with a view to assess the impact of tobacco production on household income in the region. A survey approach was used to collect data from a sample of 160 tobacco farmers who were randomly selected. Descriptive statistics and logistic regression model were used to analyze the data. Results show that farmers have responded appreciably to intervention programme that promote the use of the tobacco recommended varieties with an adoption rate of 61.6%. Information flow from various tobacco companies was the significant factor influencing the decision of farmers to adopt the tobacco recommended varieties. Constraints in the adoption noted include poor germination of seeds, high demand of inputs, unreliable availability of seeds and inadequate knowledge on tobacco production. The mean household income from tobacco production (4,232,415 Tshs) was significantly higher than the mean income of other income sources cumulatively (211,333 Tshs) with an income advantage of 4,021,082 Tshs. The study concludes that farmers are responding appreciably to intervention programmes that promote the use of tobacco recommended varieties in the region. Also tobacco sub-sector has higher contribution on household total income as compared to other enterprises.

**Key words:** Adoption, tobacco varieties, logistic analysis.

## 1. Introduction

Tobacco is an export crop grown worldwide in more than 120 countries [1]. In Tanzania, tobacco is one of the major agricultural export crops. Recently according to the BOT [2] quarterly report, tobacco was ranked as the first foreign exchange earner in Tanzania. Tobacco sub-sector offers employment to many Tanzanians in both tobacco farms and in the tobacco processing factories. In addition, the crop provides raw material for cigarette manufacturing factories, thus offering further employment

opportunities to people in the country [1]. The crop has considerable prospects to expand to the number one slot as the country has great potential to hold acreage or increase productivity or both. About 0.08% of Tanzania's land (about 34,000 hectares) are allocated for growing tobacco [3]. Tanzania is the third biggest producer of tobacco in Africa, after Zimbabwe and Malawi [4]. The country's tobacco output increased seven fold between 1975 and 1998 and continues to grow [5, 6]. In Tabora region, flue cured tobacco production and its social profitability dates back several decades since colonial era. The crop creates much employment per hectare of cultivated land [7]. This fact depicts the potential of tobacco farming to farm families in the region.

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Despite tobacco farming having a significant contribution in the economy of the country, the sector performance in the region is low due to among others interlocking contracts, market distortions, poor credit arrangement and weak farmers cooperative societies [1]. Elsewhere several studies such as study on technological gap and constraints of bidi tobacco cultivation [8], discrimination and classification of tobacco wastes by identification and quantification of polyphenols [9], biological indicators of air quality [10] have been undertaken. In Tanzania currently a numbers of tobacco research activities are taking place; which include preliminary flue and air cured tobacco varieties evaluation on yield and quality, evaluation of NPK fertilizer in different rations on tobacco production in different soil status, evaluation of the effectiveness of farm yard manure in tobacco production versus inorganic fertilizers and evaluation of different chemical rates in controlling tobacco pests and suckers [11]. Despite all these research activities which have been carried out in different parts of the world few have been undertaken to study the extent of adoption and impact of the improved tobacco varieties. The Tobacco Research Institute of Tanzania (TORITA) and many tobacco companies which are operating in Tanzania and elsewhere have been trying to supply improved tobacco varieties since there has been an ever demand for seed by tobacco growers for decades [11]. However, farmers are still unable to get seed in demanded quality and preferred quality/variety timely and in the right place. In this context, there is a need to go for evaluation of extent of adoption process, adoption of different varieties with reasons for adoption, ruling varieties and farmers' constraints if any. This dub for a complete understanding of the farmers' behavior on adoption of improved varieties in diverse agro ecological and socioeconomic environment is necessary to design appropriate strategies to yoke their potential benefits in target areas [12]. Hence, breeders could get relevant feedback on the performance of varieties released,

underlying reasons for choice and non-preference as well [13]. The government through the Ministry of Agriculture and Food Security and other actors in the sector has invested much in the areas of development, evaluation and dissemination of tobacco varieties, therefore feedback of this effort is important.

This study was conducted on the understanding that past interventions in smallholder farmers have failed because they have been based exclusively upon the perception of outsiders to the farming community. It should be recognized that success in the adoption of tobacco recommended varieties requires an understanding of the priorities and concerns of the smallholder farmers. This paper is the synthesis results of the study which was conducted in Tabora region to assess the adoption and impact of tobacco recommended varieties among smallholder farmers.

## **2. Material and Methods**

### *2.1 Study Area*

The study was conducted in Sikonge, Uyui and Urambo districts in Tabora region. The districts were chosen to represent potential tobacco growing areas in the country.

### *2.2 Methods*

This study employed a cross-sectional research design whereby data were collected at a single time. Multi-stage, purposive and random sampling techniques were used to draw a sample size of 160 respondents. Sample frame for this study consisted of all farmers growing tobacco in the study area. Out of these respondents in Sikonge district were 57, Uyui district were 58 and Urambo district were 45 respondents. Both primary and secondary data were collected. Primary data were collected using structured questionnaire which were administered to 160 respondents who are tobacco growers. Secondary data were collected from reports, research institutes and relevant district council's reports in the study area. Analytical tools included simple descriptive statistics

like frequency distribution, mean, multiple responses and cross tabulation. Paired Samples Test was also done. Rate of adoption and determination of specific variables that influence the probability of adoption of tobacco recommended varieties was done by using Logistic regression model. SPSS Version 12 and STATA Version 11 Computer Programmes were used to analyze the collected data.

### 2.3 Specification of Empirical Model

Different adoption models have been used in describing the factors affecting adoption of technologies. These include Logistic models [14], Probit models [15, 16] and Discriminant models [17]. In all these models the nature of dependent variable is to be considered. In this study the adoption of tobacco recommended varieties at farm level was quantified by using a binary dependent variable (i.e., adopters = 1 and non-adopters = 0). In this case adopter was defined as those farmers who have grown at least one of the tobacco recommended varieties.

### 2.4 Specification of the Logistic Model

Collected data were coded and analyzed using dummy variable as dependent variable (i.e., 1 = adopters and 0 = non-adopters), hence the logistic model was used. The model was specified as follows:

$$Y_i = \frac{e^{(\alpha + \beta_j x_{ij})}}{1 + e^{(\alpha + \beta_j x_{ij})}} \quad (i)$$

This was further transformed into the logistic regression model by a linear function of explanatory variables:

$$\text{Logit} (Y_i) = \alpha + \beta_j x_{ij}. \quad (ii)$$

Where:

$Y_i$  = adoption decision of farmer (1 = adoption and 0 = non-adoption);

$x_{ij}$  =  $j^{\text{th}}$  predetermined covariates (household characteristics, institutional factors and technology attributes);

$\alpha$  = constant term of regression equation to be estimated;

$\beta_i$  = are coefficients/parameters to be estimated.

In this particular study, the independent variables or covariates included were: (AGE) age of the respondent; (SEX) sex of the respondent; (TLANDSZ) total land size owned by the household; (MEMBTOB) membership in local tobacco cooperative societies; (ACCFIN) access to financial services; (ACCEXT) access to extension services from district council extension officers; (LBRNO) number labourers; (EDUC) level of education of the respondent, and (INFCOMP) information flow from tobacco companies. The above relationships were then estimated using STATA version 11 computer program using maximum likelihood method.

## 3. Results and Discussion

### 3.1 Socioeconomic Characteristics of Farmers and Institutional Factors in Relation to Adoption of Tobacco Recommended Varieties

Table 1 shows some of socioeconomic characteristics of farmers and institutional factors in relation to their choice of use of tobacco recommended varieties. The result has revealed that majority of male farmers (94.7%) are adopters while the majority of female farmers (93.1%) are non-adopters. This result is supported with that result from the logistic regression in Table 2 which shows that female have less chance of adopting tobacco recommended varieties (16.5%) as compared to their counterpart male. Both age and total land size owned by a farmer had positive relation to adoption of the improved tobacco varieties.

On the other hand, institutional factor such as farmers' membership to local tobacco cooperative societies had influence to adoption. As revealed by the results in Table 1, the majority of farmers who had membership with local cooperative societies (96.9%) are adopters while the majority of them who had no membership (96.6%) are non-adopters. Similarly, Nchinda [18] found that respondent's membership to farmers' organization was highly and positively

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**Table 1 Socioeconomics characteristics of respondents and institutional factors in relation to tobacco recommended varieties adoption.**

Variables		Adopters	Non-adopters	Chi-square value	Sign. asymp.
Sex	Male	94.7 (124)	6.9 (2)	0.108	0.743
	Female	5.3 (7)	93.1 (27)		
Membership with LCS	Yes	96.9 (127)	3.4 (1)	0.012	0.912
	No	3.1 (4)	96.6 (28)		
Access to financial services	Yes	63.4 (83)	34.5 (10)	0.048	0.827
	No	36.6 (48)	65.5 (19)		
Access to extension services	Yes	72.5 (95)	27.6 (8)	0	0.991
	No	27.5 (36)	72.4 (21)		

Figures in parentheses are numbers of count of respondents.

**Table 2 Logistic model for adoption rate of tobacco improved recommended varieties.**

Variables	Coefficients	Std. err.	z	$P >  z $
AGE	0.0110841	0.019356	0.57	0.567
SEX	0.1659101	0.8621122	0.19	0.847
TLANDSZ	0.0080955	0.0150893	0.54	0.592
MEMTOB	-0.1225593	1.244593	-0.10	0.922
ACCFIN	0.1367149	0.5586596	0.24	0.807
ACCEXT	-0.0988794	0.5666083	-0.17	0.861
LBRNO	-0.0066755	0.0853733	-0.08	0.938
EDUC	0.0725924	0.6449279	0.11	0.910
INFCOMP	1.264636	0.5744527	2.20	0.028
CONSTANT	0.495083	1.761491	0.28	0.779

LR  $\chi^2$  (9) = 7.20, prob >  $\chi^2$  = 0.6161, log likelihood = -72.124187, pseudo  $R^2$  = 0.0476.

significant to the adoption intensity of improved yam seed technology. The study also revealed that tobacco recommended varieties were widely adopted by a larger proportion of farmers who had access to financial or extension services while the majority of non-adopters were those who had no access to financial and/or extension services (Table 1). Using a choice experiment approach, Asrat [19] also had the similar finding whereby among others contact with extension services was the major factor causing household heterogeneity of crop variety preferences.

### 3.2 Tobacco Recommended Varieties

The respondents in the study area identified various tobacco recommended varieties which are currently grown. These include K326, Rg17, K51E, PD4, and ULTF10. Among of these the prominent varieties are K326 and Rg17. Also respondents identified different sources of these varieties. Tobacco companies and

extension officers belonging to these companies were identified as major suppliers of these tobacco recommended varieties. Others sources comprise research institution (i.e., TORITA), local tobacco cooperative societies and from their colleague farmers.

### 3.3 Sources of Information for the Existence and Use of Tobacco Recommended Varieties

The overall results revealed that most farmers had information on the existence and use of tobacco recommended varieties through tobacco companies' extension officers (64.1%), local cooperative societies (12.2%) and from the district council extension officers (10.9%). In Sikonge district, farmers have a higher percentage of receiving information on the existence and use of tobacco recommended varieties through fellow farmers (60%), public media (50%) and parents for young farmers (50%). Most farmers in

Uyui district learned about tobacco recommended varieties through parents (50%), fellow farmers (40%) and extension officers from different tobacco companies (36%) (Table 3). This might be influenced by the existence of most tobacco companies head office in Tabora municipality. On the other hand, in Urambo district farmers learned about tobacco recommended varieties through district extension officers (64.7%) and local cooperative societies (36.8%). This has been mainly contributed by the existence of enough number of district extension officers as compared to other districts in Tabora region. Also these results suggest that the district has strong and well organized tobacco local cooperatives societies.

Farmer to farmer information and parents to children information dissemination regarding to the existence and use of tobacco recommended varieties was not very apparent in Urambo district (Table 3). These results suggest that social relationship within Urambo district is poor and hence farmers in this district do lack social capital which can be used for their development. Contrary to this phenomenon which existed in Urambo district; in Sikonge and Uyui districts results show that there are potentials for farmer to farmer and parents to children induction information dissemination in tobacco recommended varieties in the future. Similar results have also given by Sekondo [16] in his study where farmer to farmer dissemination techniques was observed to be one of the potential techniques for information dissemination.

**Table 3 Percentage distribution of respondents by sources of information on the existence and use of tobacco recommended varieties by district.**

Name of district	Tobacco extension officers	companies' officers	Govt. officers	ext. Local societies	coop societies	Research institutes	Public media	Inputs shops	Fellow farmers	Parents
Sikonge	35		5.9	36.8		33.3	50	33.3	60	50
Uyui	36		29.4	26.3		33.3	25	33.3	40	50
Urambo	29		64.7	36.8		33.3	25	33.3	0	0
Total %	100		100	100		100	100	100	100	100
Chi-square value	0.106		14.019	1.178		0.084	0.395	0.041	2.332	0.793
Asymp. sign	0.948		0.001	0.555		0.959	0.821	0.98	0.321	0.673

### 3.4 Extent of Adoption of Improved Tobacco Recommended Varieties

In this study, adoption of tobacco recommended varieties was examined in one way, namely the rate of adoption as categorized by Sekondo [16]. The rate of adoption of tobacco recommended varieties implies the proportion of farmers who have adopted at least one of the tobacco recommended varieties. Table 4 shows the rate of adoption by districts. The overall results show that 81.9% of the respondents are using tobacco recommended varieties in their farms and 18.1% are not growing them. The result also shows that the rate of adoption was the highest in Uyui district (41.2%) compared with that of Sikonge (31.3%) and Urambo (27.5%) districts.

### 3.5 Constraints in Adoption of Improved Tobacco Recommended Varieties

Various reasons were given as to why some farmers did not adopt tobacco recommended varieties. Poor germination of seeds in the seedbed was ranked first while high demand of inputs (i.e., pesticides and fertilizers) was ranked to be the second constraint. Others in their ascending order were unreliable

**Table 4 Percentage distribution of respondents on adoption of tobacco recommended varieties by district.**

Districts	Adopters	Non-adopters
Sikonge	31.3 (41)	55.2 (16)
Uyui	41.2 (54)	13.8 (4)
Urambo	27.5 (36)	31.0 (9)
Total	100 (131)	100 (29)

Numbers in parentheses are respondents.

availability of seeds, lack of technical knowhow and membership in the local tobacco cooperative societies.

### 3.6 Empirical Determination of Factors Influencing Adoption of Recommended Tobacco Varieties

The regression analysis shows that the level and direction of influence of certain socioeconomic, institutional factors and technological characteristics of the recommended tobacco varieties on farmers' decision adopt tobacco recommended varieties. The description of the factors is shown in Table 5.

The results of the Logistic likelihood regression model in Table 2 indicate the likelihood ratio (LR chi-square (9) = 7.20). This value is greater than the tabulated value (3.325) which is an indicative of strength of the joint effect of the covariates on probability of adoption among smallholder tobacco farmers in the region.

The results also show that the decision whether or not to grow/use tobacco recommended varieties is determined by age, sex, total land size owned by the household, access to financial institutions, education level and information flow from tobacco companies which have positive influence. Also the coefficient indicating the relative contribution of individual variable to probability of adoption of tobacco recommended varieties shows that the information flow from tobacco companies was the most important significant factor determining choice of cultivation/use of tobacco recommended varieties among tobacco farmers. Similar results were observed

by other studies that education level of the household [20] and access to credit/financial services [21] were found to positively affecting the adoption of improved maize and sorghum varieties, respectively. Contrary to the findings of this study whereby sex and land ownership variables had positive coefficients, Atemnkeng [22] in his study had negative coefficients for both variables on adoption of maize and cassava production technologies. This suggests having a comparison study of different factors on their influence to adoption between cash and food crops. Number of labourers, access to extension services from district councils and having membership with local tobacco cooperative societies had negative coefficients indicating that these factors had negative influence on the adoption of tobacco recommended varieties. This might be due to the fact that most of extension services which are provided by the district extension officers have left tobacco industry to tobacco companies. The Prob > Chi<sup>2</sup> = 0.6161 from the logistic regression analysis indicates that the probability of adoption of tobacco recommended varieties is 61.6%.

### 3.7 Contribution of Tobacco Sector in Respect to Other Enterprises on Household Income

Comparison of the income from the tobacco sub-sector and other income generating enterprises in the household revealed a significant different with a *P*-value of 0.000 (Appendix 1). Mean income from tobacco (4,232,415 Tshs) was significantly higher

**Table 5 Description of variables included in the logistic regression model.**

Variable (X <sub>i</sub> ) name	Description of variables/covariates
AGE	Age of the respondents (years)
SEX	Sex of the respondent (1 = Male, 0 = Female)
TLANDSZ	Total land size owned by the household (acres)
MEMBTOB	Membership in local tobacco cooperative societies (1=Yes, 0=No)
ACCFIN	Access to financial services (1 = Yes, 0 = No)
ACCEXT	Access to extension services (1 = Yes, 0 = No)
LBRNO	Number of labourers for tobacco farming (continuous)
EDUC	Level of education (1 = Primary education, 0 = Otherwise)
INFCOMP	Information flow from tobacco companies (1 =Yes, 0 =No)

**Table 6 Paired samples statistics of total income between tobacco and other sources cumulatively.**

Variable	Mean	N	Std. deviation	Std. error mean
Total cumulative income from all other sources of income except tobacco	211,333.33	159	600,749.476	47,642.532
Total income from tobacco	4,232,415	159	6,448,358.133	511,388.1

than the mean income of other enterprises cumulatively (211,333 Tshs) (Table 6). Given an income differential of 4,021,082 Tshs between tobacco and other enterprises cumulatively, then the recommended tobacco varieties could be said to have contributed much on household income.

### 3.8 Uses of Income from Tobacco Production

The result shows that there are four major household expenditure items accounted for high shares of the income from tobacco. These were food and clothing (27.4%), building residential houses (21.2%), education for children (15%), and payment for labourers in tobacco production operations (13.8%). Other expenditures in their ascending order include building of tobacco curing barn (7.9%), payment of debts (6.4%), buying agricultural inputs (5.2%), and saving as capital for agricultural purposes and small business (3.1%).

### 3.9 Tobacco Varieties Which Farmers' Like Mostly but They are not Available

The study revealed that white gold (31.1%), K51E (23%), Zambia (7.4%) and K110 (5.9%) were the most liked tobacco varieties compared to others which currently are not available (Table 7). Farmers who were interviewed in this study gave reasons as to why they do like the aforesaid varieties. In their ascending order provision of tobacco with good quality (37.7%) was ranked first. Another characteristic which was ranked second is provision of good number of leaves (21.1%). Others in their ascending order included less ambiguity during curing (14.3%), resistance to pests and diseases (9.1%), reliable market (7.4%), need little use of fertilizers (6.3%), resistance to drought (2.3%), and lastly is that it can be dried through the use of sun (1.7%). These results suggest that farmers

**Table 7 Tobacco varieties which farmers' like mostly but they are not available.**

Variety name	Count	Percentage	Rank
White gold	42	31.1	1
K51E	31	23.0	2
Zambia	10	7.4	3
K110	8	5.9	4
Rg 17	7	5.2	5
Senate	7	5.2	5
ULTF10	5	3.7	6
Uturuki	5	3.7	6
K326	3	2.2	7
Brazil	3	2.2	7
Magereza	3	2.2	7
Mchelemchele	3	2.2	7
Tengesa	3	2.2	7
C91	2	1.5	8
Ukiliguru	1	0.7	9
PD4	1	0.7	9
Caroline	1	0.7	9
Total	135	100	

are likely to adopt easily tobacco varieties with these characteristics. Therefore there is a need for research institutions to look into the above mentioned tobacco varieties and see how they can combine them in order to release socially acceptable and affordable varieties.

### 3.10 Tobacco Varieties Which Farmers Don't Like Although They are Available

The study revealed that Rg17 (35.3%), K326 (19.1%), PD 4 (17.6%) and ULTF10 (16.2%) were the most disliked tobacco varieties compared to others which currently are supplied by tobacco companies to tobacco farmers (Table 8).

Farmers who were interviewed in this study gave reasons as to why they dislike the aforesaid varieties. In their ascending order provision of tobacco with low quality (20.8%) was ranked first. Another characteristic which was ranked second was low interval between harvesting phases and less resistance

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**Table 8 Tobacco varieties which farmers don't like although they are available.**

Variety name	Count	Percentage	Rank
Rg 17	24	35.3	1
K326	13	19.1	2
PD4	12	17.6	3
ULTF10	11	16.2	4
K51E	6	8.8	5
Marinda	1	1.5	6
White gold	1	1.5	6
Total	68	100	

ability to pests and diseases (14.6%). Third was high demand of fertilizers (12.5%). Others in their ascending order included poor seed germination in the seedbed (9.4%), ambiguities during curing (8.3%), high demand of tobacco curing barns due to low interval of harvesting phases (8.3%), low price secured in the market (6.3%) and less resistance to pests and diseases (5.2%). These results suggest that farmers are likely to adopt easily tobacco varieties which are cost effective. This is due to the fact that farmers have insufficient capital to invest in tobacco farming which can accommodate all the cost to be incurred yet the farmer secures profit.

### *3.11 The Impact of Tobacco Research Activities/Programme in the Study Area*

The result has revealed that the majority of the respondents (68.1%) had realized the impact of research activities which are taking place in the study area. On the other hand, the minority of the respondents (31.4%) have not yet realized significant impact of tobacco research programme in the area. The impact of tobacco research programme have been realized through an increased tobacco production with good quality, increase in tobacco production expertise among smallholder farmers, increase in household income and hence improvement in well-being and lastly is availability of improved tobacco varieties seed.

## **4. Conclusion and Recommendations**

### *4.1 Conclusion*

The study has clearly shown that farmers are

responding appreciably to intervention programmes that promote the use of tobacco recommended varieties in the region with an adoption rate of (61.6%). The empirical result also indicates that the choice of adoption of tobacco recommended varieties is jointly influenced positively by the age, sex, total land size owned by the household, access to financial institutions, education level and information flow from tobacco companies. Among these factors, information flow from tobacco companies was the most important significant factor determining the choice of cultivation/use of tobacco recommended varieties among tobacco farmers. Constraints in the adoption noted include poor germination of seeds, high demand of inputs (i.e., pesticides and fertilizers), unreliable availability of seeds and inadequate knowledge on tobacco production. The mean household income from tobacco production (4,232,415 Tshs per annum) was significantly higher than the mean income of other income sources cumulatively (211,333 Tshs per annum) with an income advantage of 4,021,082 Tshs. White gold and K51E were the most demanded tobacco varieties, although currently these varieties are not readily available in the study area. The study also, concluded that tobacco production has brought significant improvement in household income in the study area.

### *4.2 Recommendations*

Given the observed rate of adoption and constraints to adoption of tobacco recommended varieties, the following are recommended:

(1) Provision of minimum support to farmers and local cooperative societies both internal and external in the form of technical advice and financial assistance can have significant impact in tobacco recommended varieties adoption.

(2) Wider and effective coverage of extension services both from private sector and government sectors will ensure reasonable adoption of the tobacco recommended varieties provided that the technology



has secured appreciable acceptability with tobacco farmers. This may be in the form of recruitment of more extension staffs complemented with technical skills on tobacco production.

(3) Further research especially in the area of breeding programme is needed. This will ensure development of tobacco varieties that are socially accepted and affordable with the tobacco farming communities.

### Acknowledgment

The research team is grateful for financial support by the Zonal Agricultural and Development Research Fund (ZARDEF). The Zonal Director for Research and Development-Western zone and his management team provide all administrative issues promptly which made the study to be accomplished within its time frame. The active participation of all collaborators at Sikonge, Uyui and Urambo district councils in the study is greatly acknowledged.

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**Appendix 1 Paired Sample Test**

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Total cumulative income from all other sources of income except tobacco – total income from tobacco	-4021082	6435186.348	510343.5	-5029057	-3013106	-7.879	158	0.000