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Contribution of British American Tobacco to Tree Planting In Kenya

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ABSTRACT:- Tobacco industry has been associated with claims of degradation. A study in 2016 addressed the environmental impact of tobacco growing, paying special attention to soil degradation and loss of vegetation. The objective of the tree census was to evaluate the effect of afforestation programs by BAT tree planting project to its contracted farmers in Kenya that is Eastern, Western and Nyanza regions. The study targeted 517 farmers sampled from the total number of farmers estimated at 5500. Consultative and participatory approaches mainly key informant interviews, documents reviews, questionnaires and focus group discussions were used. These targeted various levels of BAT customers/beneficiaries. Desk reviews on existing secondary data and documents were undertaken for: study preparations, reconnaissance, to understand the study area, methodologies, types of land uses and micro-climates, suitable preferred tree species and their uses, benchmarking with other similar studies and to develop a comprehensive report. The study suggests three triggers that lead to vegetation loss associated with tobacco growing namely; forest degradation, deforestation due to curing and deforestation due to clearance for more growing land. The study noted that, although the global share of agricultural land used for tobacco growing is less than 1%, its impact on global deforestation is 2–4%, making a visible footprint for climate change.

Key words: Tree census, tree planting, Participatory, tobacco growing, degradation, deforestation

I. INTRODUCTION

Every year 6.7 million tons of tobacco are produced throughout the world. The top producers of tobacco are China (39.6%), India (8.3%), Brazil (7.0%) and the United States (4.6%), (US Census Bureau-Foreign Trade Statistics, Washington DC; 2005).Tobacco is one of the Kenya's largest industries contributing both to export earnings and creating employment locally. The history of tobacco production in Kenya can be traced back from the year 1935, when a native tobacco industry was started by settlers in Nyanza province for making cigarettes. The area increased in 1954, due to the Swynnerton Plan of improved agriculture in Kenya and in 1956, a cigarette factory was constructed in Nairobi. However, production remained low until the late 1960s. There was expansion of areas under tobacco in late sixties due to stable political environment compared to the other East Africa Community member states.BAT Kenya started growing tobacco in Kenya in 1975, with small-scale farmers on a contract basis. It is the largest tobacco company in Kenya with about 73% of the estimated annual 6 billion stock market.

Tobacco production was organized by BAT on the concept of contract farming- a system whereby schemes or companies use small holder farmers to produce cash crops. BAT became the third British company to use the contract system in Western Kenya following initiatives in Tea and Sugar (BabereKerataChacha, 1969-1999).

The tobacco crop takes six months to grow and mature, from the nursery to the time it is harvested. It has been a major income earner for farmers in Teso and Bungoma West, providing stability for an estimated 30,000 farmers. The farmers and co-operative unions in Kolanya, Malakisi, Changara and Tamlega said they earn more than KShs 250,000 every six months. Farmers are currently planning to increase the acreage under tobacco, despite sustained efforts by several local non-governmental organizations to get them to grow more wholesome food crops, http://www.standardmedia.co.ke/business/article/2000142451/tobacco-farming-on-rise-as-growers-bag-lucrative-deals.

Tobacco industry has been associated with claims of degradation. A study in 2012 addressed the environmental impact of tobacco growing, paying special attention to soil degradation and loss of vegetation. The study suggests three triggers that lead to vegetation loss associated with tobacco growing namely; forest degradation, deforestation due to curing and deforestation due to clearance for more growing land. The study noted that, although the global share of agricultural land used for tobacco growing is less than 1%, its impact on global deforestation is 2–4%, making a visible footprint for climate change. However, the claims on the fact that tobacco is a major cause of deforestation also do not take into consideration another factor highlighted by the FAO that population growth is a major determinant of land clearing in shifting cultivation, through the growth

in requirements for food and other agricultural products. The need for additional land, in this case, is roughly proportional to the growth in food requirements of the population.

In reality, it is quite normal that agricultural expansion takes place in areas which have already been free of trees for several years, and therefore deforestation cannot be solely associated with cutting of trees for tobacco farming. It is worth to note that tobacco industry is involved in afforestation programs in different parts of the world. Demand for wood fuel is a major driver of deforestation in developing world as wood fuel is the primary source of energy for most households and therefore forest resource in and around the most heavily populated regions have been depleted (Kariuki J. G et al., 2008). The exploitation of forests and tree resources to meet demand for wood fuel has resulted to environmental degradation. The problem is to such a scale that the Kenya constitution in Chapter 4a has obligated to have the environment protected for the benefit of present and future generations. It has also under section 69b stated that the State shall work to achieve and maintain a tree cover of at least 10% of the land area of Kenya. The Forest Conservation and Management Act, 2016 article 6 (3a, iii) also requires for a program to achieve and maintain a tree cover of at least 10% of the land area of Kenya. The Agriculture (Farm Forestry) Rules, 2009 Section 6 also requires maintenance of 10% tree cover on the farms.

BAT Kenya Ltd began an afforestation program in 1976 as way of ensuring that the company replenishes the wood used for tobacco curing, and also to contribute to the international and national environmental conservation initiatives. The company started afforestation program that works with farmers as well as with government agencies, commercial tree farmers, NGOs, private and public institutions. The company's aim is to increase the tree cover and conserve the environment in tobacco growing areas and other parts of the country.

1.1 Statement of the problem

Every year 6.7 million tons of tobacco are produced throughout the world. The top producers of tobacco are China (39.6%), India (8.3%), Brazil (7.0%) and the United States (4.6%). Tobacco industry has been associated with claims of degradation. A study in 2012 addressed the environmental impact of tobacco growing, paying special attention to soil degradation and loss of vegetation. Demand for wood fuel is a major driver of deforestation in developing world as wood fuel is the primary source of energy for most households and therefore forest resource in and around the most heavily populated regions have been depleted (Kariuki J. G et al., 2008).

1.2 Justification

British American Tobacco has been in Kenya since the beginning of 20th century following the opening to trade of the interior of East Africa. The company has a policy that demands its contracted farmers to grow trees to ensure sustainability in tobacco curing process. BAT Kenya Ltd began an afforestation program in 1976 as way of ensuring that the company replenishes the wood used for tobacco curing, and also to contribute to the international and national environmental conservation initiatives. The company started afforestation program that works with farmers as well as with government agencies, commercial tree farmers, NGOs, private and public institutions. The company's aim is to increase the tree cover and conserve the environment in tobacco growing areas and other parts of the country. This study highlights the **c**ontribution of BAT and other organizations to tree planting in achieving 10% tree cover in Kenya.

1.3 Objectives

1. To verify area planted with trees on community land and proportion contributed by BAT in comparison with other organizations.
2. To verify the survival rate of trees planted by BAT farmers both from company issued seedlings and other sources by area and species

II. METHODOLOGY

2.1 Study areas

The study was done in all the three regions of BAT operation in Kenya that is Eastern, Western and Nyanza. The Eastern region covers Meru, Tharaka-Nithi and Embu counties. Meru lies between latitudes 1 30' South and 0 35' North and between longitudes 30 20' and 39 5' East whereas Embu lies between 0º - 35'0 North and 37° 40' 0 East. The topography in Meru ranges from 5200 m above sea level (Mt. Kenya) to the flat lands of Giaki/Gaitu and lower Nkuene, Igoki and Abogeta of 400 m above sea level, whereas in Embu the altitude ranges from 760m to 2070m above sea level. The climate and rainfall in this region is greatly influenced by Mt. Kenya. The long rains occur between March and May and the short rains from October to December. Rainfall varies from 2,600 mm annually in the upper highlands of Mt. Kenya to 500 mm in the lower dry parts. The soils in Meru region are dominated with Ferralsols and Acrisols which are well drained, light and

moderately deep, dark red, friable, with sandy to clay loam textures (Jaetzold et al., 2009). From Siakago to the south, the region consists mostly of excessively to well drained, shallow, reddish brown to dusky red, stony and rocky, friable sandy with clay in some areas and with a humic top horizon soils classified as either Lithosols and as Cambisols (Jaetzold et al., 2009). Towards North to Ena the soils are predominantly Ferralsols and Acrisols. These soils are well drained, moderately deep to deep, dark red to yellowish red, friable, with sandy to clay loam textures. Kanyuambora is in the agro-ecological zone of Lower Midlands (LM3) classified as a cotton zone with annual rainfall of about 1100mm. The area is dominated with Ferralsols and Acrisols which are well drained, very deep, dark red or sometimes yellowish red with very friable clays (Jaetzold et al., 2009).

The Western region has 4 areas of tobacco growing namely Malakisiand Mt Elgon (in Bungoma county) and TesoNorth and Teso South (Busia county). The entire province experiences very heavy rainfall all year round, with the long rains in the earlier months of the year. The soil in the region are predominantly Acrisols and Cambisols which are well drained, deep, reddish brown or dark yellowish, friable, gravely sandy clay to clay, with acid humic topsoil. In some areas, the soils are poorly drained, deep to very deep, greyish brown to very dark grey and black, mottled, firm to very firm clay to cracking clay; in places with saline and sodic subsoil classified as Gleysols and Vertisols. The sampled area of Bungoma County (Sirisia, Malakisi, Lwandanyi) falls into a semi humid Lower Midland (LM 3) a marginal sugar cane zone with a long cropping season with very good yield potential. The region receives rainfall of 1400-1600mm annually and is predominated by well drained, very deep, reddish brown or dark yellowish brown, friable, gravely sandy clay to clay, with acidic humic topsoil classified as Acrisols, Ferralsols or and Cambisols (Jaetzold et al,. 2009).

In the Nyanza region (Oyani), there are three administrative districts namely Migori, Rongo (Migori county), and Homa Bay (HomaBay county), (Figure 1). Migori has an altitude of 1150 – 1700m above sea level, temperatures between 25 – 33^0C, and a mean annual rainfall ranging from 900 – 1800mm. Homabay has an altitude of between 1100 to 1200m above sea level, temperatures 17 – 340 C, and an annual rainfall of between 500 – 1000mm. The sampled counties were Migori (Uriri, Suba West, Nyatike, Suna East, Awendo and Kuria West) and Homabay (Ndhiwa sub-county). Suba, Kuria and the region around Migori town fall in the Lower Midland agro ecological zone (LM3) which is tobacco or cotton zone having a medium to long growing period with intermediate rainfall. The soils are well drained, moderately deep to deep, reddish brown, friable, very gravelly sandy clay loam, with acid humic topsoil classified as Acrisols. In dry areas towards Nyatike are imperfectly drained, moderately deep to deep, dark yellowish brown to very dark brown, mottled, firm silty clay; in places abruptly underlying a topsoil of friable loamy sand to sandy loam; in places rocky and shallow; in slight depressions (50%) classified as gleyic Luvisols or Cambisols. Uriri, Mirogi, Marinde and rangwe strip fall onto LM 2 (sub-humid Lower Midlands) a marginal sugarcane zone with a long to medium cropping season, followed by a (weak) medium to short one. The soils in Uriri are mostly well drained, moderately deep to deep, reddish brown to brown, friable, gravelly clay loam to clay; over petroplinthite/murram; in many places with humic topsoil; classified as Phaeozems and Luvisols. Ndhiwa region lies in LM 3 (semi-humid Lower Midland) cotton zone with a medium to long cropping season, followed by a (weak) short to medium one. This strip stretches towards Kosele all the way from Masara in Migori County. Ndhiwa is dominated by poorly drained, very deep, very dark grey to black, firm to very firm clay to cracking clay; in places with an acid humic topsoil; in some places saline and/or sodic horizons classified as Vertisols, Gleysols and Solonetz (Jaetzold et al., 2009).

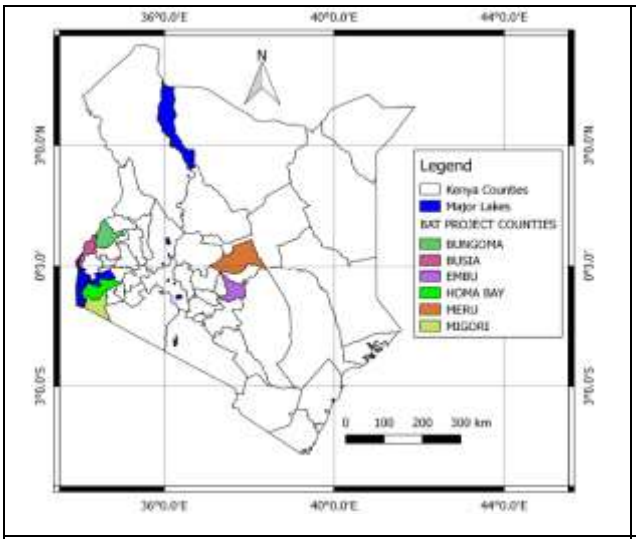

Plate 1: Location of BAT regions in Kenya

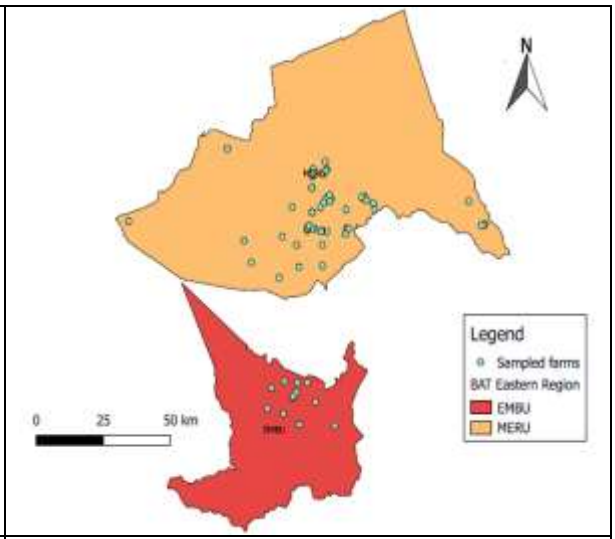

Plate 2: BAT Eastern region

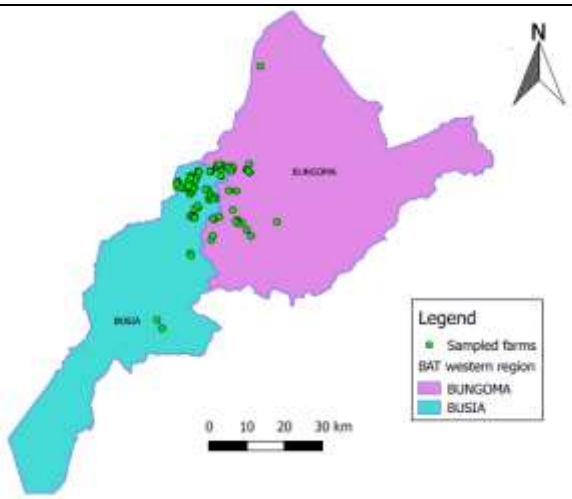

Plate 3: BAT Western region

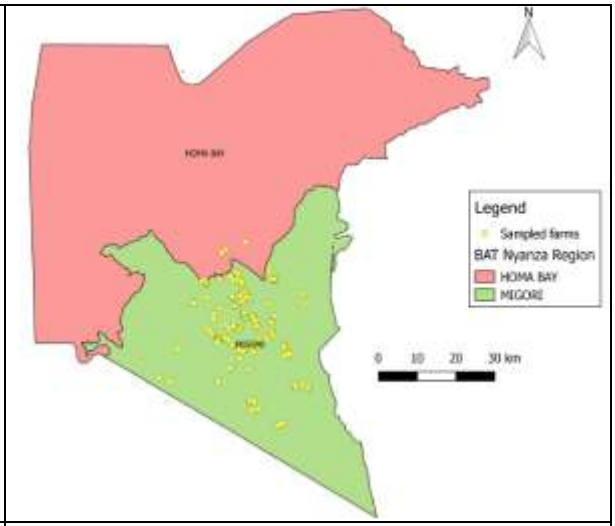

Plate 4: BAT Nyanza region

Figure 1: Study sites

2.2 Farmers Sampling

The estimated number of BAT contracted farmers in Kenya is approximately 5500 farmers. Working with a confidence level of 95% and a confidence interval of 5 (margin error of 0.05), conditions widely accepted for a social science survey, the calculated sample size would have been 360 farmers (www.surveysystem.com/sscal.htm, www.raosoft.com/samplesize/html). As per the above sample size (360 farmers) a sample of 131 farmers would have been interviewed in each of the Western and Nyanza regions while a total of 98 farmers would have been interviewed in the Eastern region. However, the actual farmers interviewed were 132 for Eastern region and 168 for Western and 217 for Nyanza regions, making a total of 517 farmers. Consultative and participatory approaches mainly key informant interviews, documents reviews, questionnaires and focus group discussions were used. These targeted various levels of BAT customers/beneficiaries.

2.3 Desktop Review

Desk reviews on existing secondary data and documents were undertaken for: study preparations, reconnaissance, to understand the study area, methodologies, types of land uses and microclimates, suitable preferred tree species and their uses, benchmarking with other similar studies and to develop a comprehensive report.

2.4 Tree enumeration

To estimate total number of surviving trees in the 7 counties, questionnaires were used to find out the number of seedlings initially supplied by BAT to contracted farmers and other stakeholders and the year supplied. Secondary data was also sourced from BAT records to triangulate information given by the farmers. Physical counting was also conducted to establish the actual number of trees on selected farms per species. Similar verification was done on community land within the same locality. Species identification and classification was undertaken by KEFRI taxonomists and reference made using local vernacular and scientific names.

2.5 Planting support in the regions

To determine the organizations that have contributed in tree planting in these areas, the questionnaire was used to establish the proportion of trees supplied by BAT in comparison to other stakeholders. Regional stakeholders' meetings were also organized to share the experiences on tree planting programs. Other forms of tree planting support given by BAT and partners to farmers and local institutions were also established.

Consultative and participatory approaches mainly key informant interviews, documents reviews, questionnaires and focus group discussions were used. Desktop reviews on existing secondary data and documents were also undertaken. To estimate total number of surviving trees in the three regions, questionnaires were used to find out the number of seedlings initially supplied by BAT to contracted farmers and other stakeholders and the year supplied. Determination of Tree planting support by BAT and other organizations both to farmers and institutions, wood sufficiency determination, tree planting assessment.

2.6 Data analysis

SPSS was used for data analysis and results were presented as tables, graphs, pie charts and plates**.**

III. Results and Discussions

3.1 Tree planting support by different agencies

3.1.1 Tree planting support by BAT

Farmers in ~~by~~ BAT ~~for~~ tobacco growing areas in the Eastern region get free polythene tubes for raising seedlings (42.7%), loans to support their farming activities (18.1%), subsidized seedlings (13.1%) and training on tree planting (11.9%) as shown in Table 3. In the Western region, farmers ranked highly the issuing of subsidized seedlings (61.4%) and soft loans to support their farming activities (30.1%) as the major support given by BAT. A few (less than 1%) reported as having no support from BAT in their tree planting program. Quite a significant response (55.3%) of farmers in Nyanza termed the provision of subsidized/loaned seedlings supplied by BAT for planting as its support in tree planting program. Provision of loans also featured prominently (26.6%) as another treasured support by BAT to its contracted farmers.

Table 3: Tree planting support by BAT to their contracted farmers

	Region, % frequency			Frequency (n)
Support	Western	Nyanza	Eastern	
Subsidized /Loan seedlings	61.4	55.3	13.5	278
Loan	30.1	26.6	18.1	165
Free polythene tubes	0.0	0.0	42.3	110
Training on tree planting	4.0	4.9	11.9	50
Free seedlings	2.3	6.6	8.1	41
Tree protection from pests and disease attack	1.7	4.1	4.2	24
None	0.6	2.5	0.0	7
Free tree seeds	0.0	0.0	1.9	5

BAT has a policy and a tradition of supporting its contracted farmers with tree planting. This is due to the realization that trees are very vital in the tobacco curing. The support is much appreciated since even if the farmer does not have the capacity to plant the trees, BAT through its extension agents do support them in ensuring that they provide the necessary support. Farmers are provided with loaned/subsidized seedling according to their capacity to produce tobacco (10 seedlings per every 100 kg of tobacco produced). Though some farmers talked of provision of free seedlings, they were actually loaned to be deducted during the sale of their tobacco.

The farmers contracted to raise seedlings on behalf of BAT (Figure 5), are also supported in various ways. First, they are assured of the market for the raised seedlings since they will be supplied to the BAT contracted tobacco farmers and institutions for planting. Tree nursery operators are usually paid for the raised and supplied seedlings in stages. These stages include after potting the seedlings (20%), after pricking out (20%), after root pruning (20%) and upon issue of the seedlings (40%). The nursery operators are also provided with potting bags and relevant chemicals for pests and diseases control.

Figure 5: A tree nursery in one of contracted operators

In Eastern region, the total number of seedlings issued by BAT from 2013 to 2015 from sampled farmers was 36,789, which was projected to 285,672 to cover all the BAT contracted farmers in the region (Table 4). However, the survival rate was 52.5%, which is below the accepted survival rate of 80%. In the Western region, approximately 1,061,916 seedlings were issued by BAT to its contracted farmers for planting from 2013 to 2015. The percentage survival was 62.3%.The estimated number of seedlings supplied by BAT to its contracted farmers in Nyanza region was 951,304. Out of the total issued, about 66.4% seedlings survived.

Table 4: Surviving trees planted by BAT farmers from company issued seedlings

Region	Year	Trees issued (n)	Total survived (n)	Trees issued (N)	Total survived (N)	% survival
Eastern (n=132,N=1025)	2015	23475	10415	182287	80874	44.4
	2014	10916	7234	84764	56173	66.3
	2013	2398	1660	18621	12890	69.2
	Total	36789	19309	285672	149937	52.5
Western (n=168,N=1908)	2015	54039	31897	613729	362259	59.0
	2014	28781	18463	326870	209687	64.1
	2013	10682	7885	121317	89551	73.8
	Total	93502	58245	1061916	661497	62.3
Nyanza (n=217,N=1827)	2015	52271	37173	439606	312630	71.1
	2014	48172	28279	405133	237830	58.7
	2013	12671	9680	106565	81410	76.4
	Total	113114	75132	951304	631870	66.4

3.1.2 Other sources of seedlings apart from BAT

Majority of BAT contracted farmers in the Eastern region (83.9%) rely only on BAT for their planting seedlings requirement. The other major sources of seedlings include private tree nurseries; own tree nurseries (Figure 6 Table 5). About 42% of BAT contracted farmers in Western region get their planted seedlings from other sources. The other major sources of seedlings include private tree nurseries, neighbours/ friends tree nurseries and own tree nurseries. BAT contracted farmers in Nyanza region (56%) conceded that they obtain their seedlings from other sources including private nurseries and own tree nurseries.

Table 5: Other sources of seedlings to farmers apart from BAT

	Region, % frequency			
Source of seedling	Western	Nyanza	Eastern	Frequency (n)
Private tree nursery	40.0	46.2	41.1	173
Own tree nursery	15.8	33.3	27.4	107
Neighbour/friend tree nursery	20.0	5.4	9.5	43
Wildings	5.0	2.7	11.6	22
NGO	9.2	2.2	0.0	15
Group tree nursery	3.3	1.1	6.3	12
Mastermind tobacco	5.0	2.2	1.1	11
Alliance ONE	0.0	4.8	0.0	9
Government tree nursery	1.7	2.2	2.1	8
School	0.0	0.0	1.1	1

Figure 6: A Farmer owned tree nursery

These other sources supplement the BAT's tree planting program by availing more trees and more tree species to the farmers. Among the government entities where trees could be sourced include, the ministry of agriculture, especially through Horticultural Crops Development Authority (HCDA) which specializes on fruit trees and Kenya Forest Service (KFS) for other type of tree species. Since quite a number of farmers indicated that they get their seedlings from their own tree nurseries, wildings or friends, they should be trained on how to select good mother trees, extraction of collected seeds, storage, pre-treatment methods and germination tests to ensure quality planting material.

Table 6 gives the overall survival rate of seedlings sourced by farmers from other sources. Highest survival in was reported in Western (74.2%), followed by Nyanza (69%) and Eastern at 65.4%.Survival had wide variation from year to year.

Table 6: Number of trees sourced elsewhere by farmers and their survival rate

Region	Year	Trees sourced elsewhere (n)	Trees survived (n)	Total seedlings sourced elsewhere (N)	Total seedlings survived (N)	% seedlings survival
Eastern (n=132, N=1025)	2015	1747	1369	13053	10630	81.4
	2014	1071	387	8316	3005	36.1
	2013	340	265	2640	2058	77.9
	Total	3092	2021	24009	15693	**65.4**
Western (n=168,N= 1901)	2015	10891	6760	123690.6	76774.29	62.1
	2014	19700	16359	223735.7	185791.5	83
	2013	2456	1394	27893.14	15831.86	56.8
	Total	33047	24513	375319.5	278397.6	**74.2**
Nyanza (n=217,N= 1827)	2015	50690	40423	426777	340336	79.7
	2014	37153	19329	312804	162738	52
	2013	5057	4387	42577	36936	86.8
	Total	92900	64139	782158	540009	**69**

3.1.3 Comparison of number of seedlings sourced from BAT to other sources

The Eastern region tree planting program heavily relies on BAT for its tree planting material in which 93% of farmers received seedlings from BAT in 2015. In the year 2013, about 81.3% of the BAT contracted farmers in Western region sourced their seedlings from BAT as compared to other sources, Table 7. The trend dropped in 2014 but sharply increased to 83.2% in 2015. In 2013, the proportion of seedlings sourced from BAT was highest (94.7%) decreasing progressively to 50.8% in 2015 in Nyanza. Results from the three regions show that BAT as the main supplier of planting material plays key role in success of tree planting program.

Table 7: Comparison of number of tree seedlings sourced from BAT to other sources

			Region	
Year	Parameter	Eastern	Western	Nyanza
2015	Number of tree seedlings from BAT	23475	54039	50690
	Number of tree seedlings from other sources	1747	10891	52271
	Total number of seedlings planted	25222	64930	102961
	% seedlings sourced from BAT	**93**	83.2	50.8
2014	Number of tree seedlings from BAT	11116	28781	37153
	Number of tree seedlings from other sources	1071	19700	48172
	Total number of seedlings planted	12187	48481	85325
	% seedlings sourced from BAT	**91.2**	59.4	56.5
2013	Number of tree seedlings from BAT	2398	10682	5057
	Number of tree seedlings from other sources	340	2456	12671
	Total number of seedlings planted	2738	13138	13381
	% seedlings sourced from BAT	**87.5**	81.3	94.7

In all the three regions, main source of seedlings was BAT and so has a great effect in afforestation and onfarm tree planting efforts.

3.1.4 Comparison of BAT promoted trees species and those from other sources

About half of tree species supplied by BAT were also listed as ones preferred by farmers. The top ten trees species preferred by farmers and BAT are listed in the, Table 9. Those that are preferred by both farmers and BAT include *Grevillea robusta, Senna siamea, Eucalyptus spp, Cordia africana*and *Markhamia lutea.* A record of 25 trees species were supplied by BAT while 14 tree species were sort by farmers from other planting material sources.

Table 9: Comparison of BAT promoted trees species and those from other sources (farmers)

	BAT promoted tree species		Tree species from other sources	
Region	Tree species	% frequency	Tree species	% frequency
Eastern	*Grevillea robusta*	42.1	*Grevillea robusta*	39.4
	Senna siamea	22.1	*Morus alba*	15.2
	Eucalyptus spp	11	*Carica papaya*	15.2
	Markhamia lutea	10.5	*Senna siamea*	11.1
	Jacaranda mimosifolia	2.8	*Mangiferaindica*	4.0
	Cordia africana	1.3	*Eucalyptus spp*	4.0
	Croton megalocarpus	1.3	*Cordia africana*	3.0
	Croton macrostachyus	1.1	*Markhamia lutea*	2.0
	Brideliamicrantha	1.1	*Combretum molle*	1.0
	Acacia spp	1.1	*Citrus spp*	1
Western	*Eucalyptus spp*	41.9	*Grevillea robusta*	43.9
	Grevillea robusta	35.8	*Eucalyptus spp*	36.5
	Markhamia lutea	8.6	*Mangiferaindica*	3.4
	Senna siamea	4.7	*Perseaamericana*	3.4
	Acacia spp	2.7	*Markhamia lutea*	2
	Casaurinaspp	1.5	*Melia azedarach*	1.4
	Jacaranda mimosifolia	0.8	*Podocarpusspp*	1.4
	Syzygiumspp	0.8	*Casimiroa edulis*	1.4
	Cordia fricana	0.6	*Tipuanatipu*	1.4
	Melia azedarach	0.6	*Senna siamea*	1.4
Nyanza	*Eucalyptus spp*	49.1	*Eucalyptus spp*	67.3
	Grevillea robusta	31.9	*Grevillea robusta*	24.1
	Casaurinaspp	4.5	*Casaurinaspp*	2.7
	Markhamia lutea	3.9	*Markhamia lutea*	1.8
	Spathodeacampanulata	2.3	*Cupressus lusitanica*	1.4
	Acacia spp	2.2	*Senna siamea*	0.9
	Senna siamea	1.9	*Balanitis aegyptiaca*	0.9
	Cordia africana	0.8	*Croton macrostachyus*	0.5
	Croton macrostachyus	0.5	*Albiziaspp*	0.5
	Albiziaspp	0.5		

BAT supplies some tree species that are also sourced elsewhere by farmers. This indicates that they consider farmers' preference in their tree species production. The management should however consider other

tree species known to be preferred by farmers, most of which seem to produce multiple products such as fruits. Another consideration while choosing the tree species to promote is the list of tree species the farmers proclaimed that they prefer during tobacco curing (Appendix 2). These are probably the species with high calorific values and hence they produce much heat, burn for a longer time and hence they are consumed in low quantities to cure a given yield of tobacco.

3.1.5 Reasons for tree seedlings mortality

The most prominent causes of tree seedlings mortality in all the regions included; drought and termite attack (Table 8). Other notable causes of mortality are site specific and include poor methods of planting and destruction by animals.

Table 8: Reasons for tree seedlings mortality (farmers)

	Region, % frequency		
Reason for mortality	Western	Nyanza	Eastern
Drought	59.7	69.4	59.1
Termites attack	30.5	15.0	19.2
Poor methods of planting	0.7	1.3	4.9
Inadequate labour	0.2	0.4	2.1
Not compatible for area	0.4	0.8	3.4
Seedlings not mature	0.4	0.0	3.7
Animals	2.8	9.4	4.0
Late planting	4.6	2.7	2.7
Flooding	0.4	0.6	0.9
Hard pan	0.2	0.2	0.0
Poor seedlings transportation	0.2	0.0	0.0
Fire burn	0.0	0.2	0.0

Prolonged drought featured as main reason for mortality of seedlings planted in the field. This could easily be lumped together with late planting and wrong tree species site matching. When quality trees seedlings, of the right size are carefully grown in their correct agro-climatic zones and at the correct timing, the chances of their survival are very high.

3.1.6 Main planting niches of trees

Majority of the tobacco farmers in the Eastern region have their trees planted along external boundaries (Table 10). In the Western region, trees were mostly configured as woodlots (47.5%) while in Nyanza region most of their trees appeared as woodlots (68.6%). Other popular sites include home compound and trees scattered on farms. These planting niches are shown in plates of Figure 7.

Table 10: Main planting niches of trees

	Region, % frequency			Frequency
Main planting niche	Western	Nyanza	Eastern	(n)
Woodlot	47.5	68.6	15.5	233
External boundaries/fence	18.7	19.1	30.1	99
Scattered on farm	23.7	3.2	18.4	59
Home compound	6.5	5.5	22.3	44
Rows of trees with crops/hedge row/internal boundaries	0.0	1.8	6.8	11
Contours/conservation structures	2.9	0.5	4.9	10
River/riparian reserve	0.0	1.4	1.9	5
Improved fallow	0.7	0.0	0.0	1

Plate 1; Trees on soil conservation structures

Plate 2; Trees planted on internal boundary

Plate 3; Trees scattered on farm

Plate 4; A woodlot

Figure 7: Main tree planting niche

3.1.7 Challenges/ Constraints to tree planting

Several challenges were associated with tree planting program in the regions. Terminate attack was attack and drought were ranked by most of the respondents as the major challenges, (Table 11). See Figure 8 below for the challenges. For challenges/ constraints to tree growing by species see Appendix 3.

Table 11: Constraints to tree growing by farmers

	Region, % frequency		
Challenge/constraint	Western	Nyanza	Eastern
Stunted growth	4.9	2.9	15.5
Pests/Termites /Psyllids/ Bronze bug	40.1	37.1	24.3
Drought	34.0	35.3	16.4
Occupies a lot of space	4.9	2.9	19.9
Seedlings not available	2.7	3.2	4.9
Inadequate labour	0.9	3.2	2.2
Poor ecological zone	1.5	1.4	1.3
Theft of seedlings	1.5	1.1	1.3
Destroyed by animals	3.3	4.3	1.8
Diseases	.6	2.9	8.0
Late planting	3.3	2.9	4.0
Poor potting bags	0.3	0.4	0.4
Heavy rainfall	0.9	1.1	0.0
Hard pan	0.6	0.4	0.0
Long distance from nurseries	0.3	0.4	0.0
Species does not coppice	0.0	0.4	0.0
Overgrown seedlings	0.0	0.4	0.0
Frequency (n)	329	278	226

Plate 1; Trees/Seedling attacked by termites

Plate 2; A tree attacked by Cuscutaspp, a parasitic plant

Plate 3; Eucalyptus lerp psyllids

3.2 BAT Tree Planting Support to Institutions

BAT support to Eastern region institutions was issuance of free seedlings (66.7%), training on tree planting (22.2%) and tree protection from pests and disease attack (11.1%). In Western region, BAT was reported to support institutions in their tree planting initiatives largely by provision of free seedlings (45.5%) and training on tree planting. BAT support to Nyanza institutions was on free seedlings (70%), training on tree planting (20%) and provision of subsidized seedlings (10%) as shown in Table 12.

Table 12: BAT Tree Planting Support to Institutions

	Region, % frequency		
Planting support given by BAT	Western	Nyanza	Eastern
Free seedlings	45.5	70.0	66.7
Subsidized seedlings	9.1	10.0	0.0
Free polythene tubes	9.1	0.0	0.0
Free tree seeds	9.1	0.0	0.0
Training on tree planting	18.2	20.0	22.2
Tree protection from pests and disease attack	9.1	0.0	11.1
Frequency (n)	11	10	9

The results established BAT's outstanding support to institutions in tree planting which demonstrate BAT Corporate Social Responsibility (CSR) within tobacco growing region. These trees provide fuel wood and construction materials to the respective institutions; contribute to the country's tree cover while at the time conserving the environment and rehabilitating degraded sites.

3.2.1 Comparison of survival rate among trees issued by BAT and those sourced elsewhere by institutions

The appraisal established that a total of 35,720 seedlings supplied by BAT were planted on community land of Eastern region between 2013 and 2015 (Table 13), 7,558 in Western and 29,620 in Nyanza. Survival rate of those provided by BAT in Eastern region was at 47.7%, 68.5% for Western and 78.5 % for Nyanza whereas seedlings from other sources, the percentage survival was 57.8%, 61.8% and 78.9% for Eastern, Western and Nyanza respectively. This shows that survival of seedlings from other sources was higher than those supplied by BAT. However, considering BAT is the main source of seedlings there should be efforts to improve survival of BAT supplied seedlings.

Table 13: Comparison of survival rate among trees issued by BAT and those sourced elsewhere by institutions

BAT sponsored trees					Trees sourced elsewhere		
Region	Year	Number of seedlings issued	Tree seedlings survived	% survival	Number of seedlings issued	Tree seedlings survived	% survival
Western	2015	5078	3754	73.9	1200	660	55.0
	2014	2480	1420	57.3	434	291	67.1
	2013	-	-	-	152	152	100
	Total	7558	5174	**68.5**	1786	1103	**61.8**
Nyanza	2015	15920	12389	77.8	3	3	100
	2014	10500	7980	76.0	700	640	91.4
	2013	3200	2890	90.3	1000	700	70.0
	Total	29620	23259	**78.5**	1703	1343	**78.9**
Eastern	2015	17300	6330	36.5	100	50	50.0
	2014	12820	7590	59.2	80	75	93.8
	2013	5600	3130	55.8	2600	1440	55.4
	Total	35720	17050	**47.7**	2780	1565	**56.3**

Additional information on survival by species of seedlings from BAT and those sourced elsewhere is in Appendices 4a and 4b.

3.2.2 Reasons for seedling mortality

The general reasons for mortality in different regions were as shown in Table 14

Table 14: Reasons for mortality in seedlings planted in institutions

	Region, % frequency		
Reason for mortality	Western	Nyanza	Eastern
Drought	44.8	36.0	29.6
Bad practice when planting	0.0	8.0	3.7
Lack of water	0.0	0.0	7.4
Termites attack	20.7	24.0	37.0
Poor timing	13.8	0.0	14.8
Poor soil	3.4	0.0	7.4
Damage by animals	17.2	32.0	0.0
Frequency (n)	29	25	27

Different tree species were faced with different growing constraints. Reasons for mortality amongst different species of tree seedlings include drought, poor timing and pests attack, especially termites as highlighted in Appendix 5.

3.2.3 Challenges / Constrains to Tree Growing and Possible Intervention for Institutions

The respondents in institutions found in different regions mentioned drought and termite attack as the key challenges they face while planting different tree species as shown in Table 15

Table 15: General constrains to growing different tree species by institutions

	Region, % frequency		
Challenges/constraints	Western	Nyanza	Eastern
Drought	57.1	57.1	33.3
Termite attack	35.7	28.6	50.0
Few seedlings provided	0.0	0.0	5.6
Pesticides	7.1	0.0	5.6
Cutting of branches for sweeping by students	0.0	14.3	0.0
Destruction to pave way for construction	0.0	0.0	5.6
Frequency (n)	14	14	18

Challenges/constraints by species are shown in Appendix 6. Possible solutions suggested include watering trees during dry seasons, provision of pesticides and timely supply of seedlings by their respective administrations and BAT management Table 16.

Table 16: Possible solutions for the constraints to tree growing by institutions

		Region, % frequency		
Challenges/constraints	Possible intervention	Western	Nyanza	Eastern
Drought	Water trees during dry season	42.9	50.0	100.0
	Provision of termiticides/ pesticides	14.3	0.0	0.0
	Increase the number of seedlings	14.3	0.0	0.0
	Timely supply of seedlings	28.6	50.0	0.0
Termite/ pests attack	Water trees during dry season	0.0	0.0	12.5
	Provision of termiticides/ pesticides	75.0	66.7	75.0
	Increase the number of seedlings	0.0	0.0	12.5
	Timely supply of seedlings	25.0	0.0	0.0
	Right species	0.0	33.3	0.0
Few seedlings provided	Timely supply of seedlings	0.0	0.0	100.0
Cutting of branches for sweeping by students	Restriction by teachers	0.0	100.0	0.0
Destruction to pave way for construction	Increase the number of seedlings	0.0	0.0	100.0
Frequency (n)		13	13	13

V. CONCLUSION

The key tree planting support that BAT gave to institutions was provision of free seedlings. In Western, the survival rate was higher for trees issued by BAT compared to trees sourced elsewhere. In Eastern and Nyanza, survival rate was lower for trees issued by BAT. The major reasons for mortality amongst different species of tree seedlings include drought, poor season timing and pests attack, especially termites. The key challenges to tree growing mentioned were drought and termite attack and the possible interventions for the challenges were watering trees during dry seasons and provision of pesticides/ termiticides. The company should supply tree seedlings in good time and provide termiticides to institution which will increase survival rate of planted trees.

The study revealed that most of the tree species promoted by BAT in tree planting program are also preferred from other sources. The Eastern region is leading in the number of farmers wholly relying on BAT for tree planting support. The most significant support provided by BAT to farmers and institutions in tree planting initiatives include provision of free, subsidized or loaned seedlings. The most preferred niche for tree planting in eastern is external farm boundaries while in western and Nyanza include woodlots and external boundaries. The trend of seedlings survival rate is generally low in eastern region, improving in western and Nyanza regions.

The major reasons for tree seedlings mortality were noted as drought, termites attack, late planting and destruction by animals.

General Recommendations

Several recommendations were drawn from the study. To improve on tree planting initiatives:

1. BAT should continue and enhance its tree planting policy
2. Contract more farmers to do tree nurseries to increase number of seedlings raised and reduce distance for farmers to collect the seedlings
3. Pests and disease monitoring and control need to be enhanced
4. The time for tree planting to be coincided with rainfall to reduce issues of reported drought and late delivery of seedlings as well as tackling other constraints.
5. The tree-site matching need to be encouraged as well niches, densities and other management aspects for optimal growth and minimal competition.
6. The farmers to be consulted on their favorable tree species for planting. The listed preferred tree species for tobacco curing need to be evaluated for their promotion as well as fruit and other multi-purpose tree species.
7. BAT should expand its tree planting collaboration efforts. The Kenya Forest Service (KFS) needs to be a major partner. The county government also has forestry and environmental programs that could really complement the company's tree planting efforts.

LIST OF REFERENCES

[1]. Okalebo, J. R., Gathua K. W, and Woomer P. L. (2002). Laboratory methods of soil and plant analysis: A working manual. TSBF-CIAT and SACRED Africa, Nairobi;

[2]. Jaetzold R., H. Schmidt., B. Hornetz and C. Shisanya (2009). Farm Management Handbook of Kenya, Natural Conditions and Farm Management Information. Ministry of Agriculture, Nairobi. Volumes IIB and C

[3]. Moore, J.M., and G. Harris, (2013). NUTRIENT UPTAKE IN TOBACCO FERTILIZATION.

[4]. Http//www. commodities.caes.uga.edu/fieldcrops/tobacco/.../documents2013/5Fertilization2013.p.

KCCAP, 2015

Kariuki J. G et al., 2008

ref/ Zimbabwe/ Malawi

www.surveysystem.com/sscal.htm,

www.raosoft.com/samplesize/html

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