



# The Economics of Tobacco Farming in Kenya

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## EXECUTIVE SUMMARY

Tobacco use continues to be one of the most significant preventable risk factors to most non-communicable diseases. Put simply, tobacco kills millions of people prematurely each year and these numbers are increasing particularly in low- and middle-income countries. Thus, decreasing tobacco use should be at the core of all governments' public health strategies. Yet, tobacco control continues to face dogged, well-organized and well-financed opposition.

The opposition to tobacco control often comes in the form of supposed economic logic. In particular, opponents of tobacco control all over the world continue to use the alleged harm of tobacco control policies to smallholder tobacco farmers as a reason to curtail these public health efforts. Moving beyond the well established dynamic that it is global markets driving demand for any one country's tobacco leaf – tobacco control in Kenya will have little or no short-run effect on its tobacco farmers – it has not been made sufficiently clear if tobacco farming is even an economic livelihood worth pursuing for Kenyan farmers. In this report, we tackle this knowledge gap by reporting the results of and analysing a nationally-representative individual-level, economic survey of nearly 600 Kenyan smallholder tobacco farmers.

The results of this rigorous survey demonstrate that the livelihoods of most smallholder tobacco farmers are rarely financially lucrative. In fact, the results suggest strongly that many tobacco farmers are making only minimal profits when the principal (non-labour) inputs are subtracted from the sales of their tobacco leaf. Moreover, tobacco growing is one of the most labour-intensive crops and if you include even a conservative estimate of the cost of the farming household's labour, a significant proportion of tobacco farmers are operating at a net financial loss. Put simply, many Kenyan tobacco farmers would likely improve their livelihoods by pursuing other economic activities.

Kenya is a Party to the WHO Framework Convention on Tobacco Control, which compels parties to help tobacco farmers find viable alternative livelihoods (Article 17). This research demonstrates that many farmers are unhappy with growing tobacco and open to switching to alternatives. It also suggests that improved access to credit and better supply chains for alternative products could serve Kenyan tobacco farmers particularly well as they seek to switch away from tobacco. As well, the government should consider playing a more active role monitoring the tobacco companies that grade and price the tobacco, oftentimes within the constraints of contracts that appear to strongly favour the tobacco leaf buying companies over the farmers.

## INTRODUCTION

Tobacco-related diseases are among the leading causes of premature death globally, accounting for nearly 6 million deaths annually (Forouzanfar et al., 2015) and approximately 4% of total disease worldwide. It is expected that by 2030, tobacco use will produce the highest burden of premature mortality and disability in the world compared to other health risk factors, with low- and medium-income countries being affected significantly more by this burden than high-income countries (Mathers and Loncar, 2006).

Every year, approximately 6,000 Kenyans die of tobacco-related diseases, while more than 220,000 children and more than 2,737,000 adults continue to smoke each day (Eriksen et al, 2015). In an effort to mitigate this problem, Kenya ratified the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) in 2004. The treaty both compels and sets out guidelines for countries to implement comprehensive and intersectoral tobacco control measures at the national and sub-national levels. One hundred and eighty countries are now parties to the convention. In Kenya, the legislature passed the comprehensive Tobacco Control Act (TCA) in 2007 to address the production, sale, labelling, advertising, promotion and sponsorship of tobacco products, among other provisions. In addition to efforts to mitigate the use of tobacco products in the country, the WHO FCTC seeks to address the supply side of tobacco control by promoting alternative livelihoods for tobacco farmers. Article 17 of the WHO FCTC addresses promotion of economically viable alternatives to tobacco growing. There are probably greater than 50000 Kenyan households that depend on tobacco farming directly. A deep understanding of the social and economic context in which tobacco growers operate will better equip policy makers in generating targeted, sustainable and viable alternatives to tobacco farming.

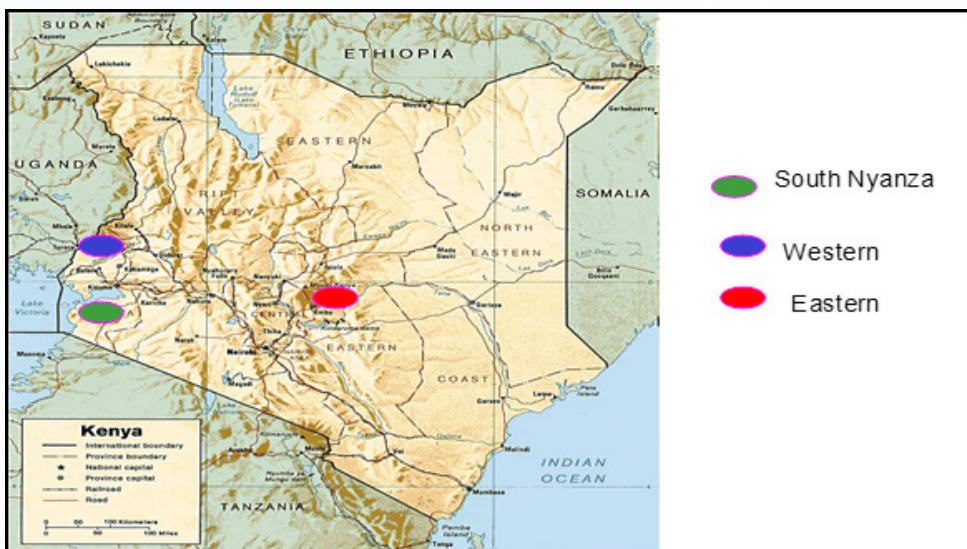
Tobacco interests often use tobacco farmers to justify their opposition to tobacco control measures. The principal argument presented by these interests is that tobacco control will be detrimental to the fragile economic livelihoods of tobacco growers. This argument is often couched in terms of social and economic development and is compelling in its rhetorical appeal to the protection of an economically vulnerable group. Policymakers, however, lack sufficient nationally-representative data on farmers' livelihoods both to address the industry's claims (which lack an evidence base) and to inform tobacco farming policies particularly around efforts to implement the WHO FCTC Article 17. In addition, the relationship between the leaf-buying firms and the farmers, particularly through formal contracts, has been identified as potentially problematic by both researchers and advocates (see Leppan et al, 2015). Accordingly, this study seeks to provide a rigorous examination of the economic livelihoods of Kenyan tobacco farmers,

including the nature of and consequences of these contractual relationships.

Despite tobacco being grown extensively in some regions in Kenya, it is not a significant crop in terms of broader national agricultural production with recent government data indicating that it constitutes a mere 0.6% of total agricultural gross marketed production (Republic of Kenya 2015). This is equivalent to just 0.03% of GDP, based on total crops grown in Kenya accounting for 19.7% of GDP in 2014 (Republic of Kenya 2015). It is currently grown for commercial purposes in three regions where it is considered to be a significant crop. Figure 1 illustrates that South Nyanza (Migori, and Homa-Bay counties), Western (Bungoma, and Busia counties), and Eastern (Meru, Embu and Kirinyaga counties) regions are the main centres of cultivation.

While the South Nyanza region dominated tobacco leaf production (~80%) from the 1970s until at least 2010 (Chacha 1999, Kibwage 2012), there is evidence from farmers in these regions suggesting that tobacco companies have been promoting production in the Eastern and Western regions while reducing their production in South Nyanza (even though production remains here high in real terms). In particular, Alliance One, once the dominant tobacco leaf-buying firm in South Nyanza, has exited the region, while BAT is increasing its presence in Western and Eastern regions. Studies demonstrate that the number of households dependent on tobacco leaf production was fairly static in the 1990s and early 2000s, with estimates of 31,398 households in 1996 and 29,000 in 2000 (Mureithi 2003). Thereafter, however, the numbers grew: in 2006, the estimate was 35,000 households (Patel et al, 2007), while in 2011 observers estimated 55,000 households (Kibwage et al 2014).

**Figure 1 – Tobacco Farming Regions in Kenya**



Source: Kenya Tobacco Control Research Group



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## Survey Methodology

In order to examine the economic livelihoods of tobacco farmers, this research focuses on the three counties where tobacco is most widely grown in Kenya (Migori, Meru and Bungoma/Busia). Specifically, we implemented a survey of 600 tobacco farmers designed to solicit an understanding of different social and economic factors

To determine the sample size of the survey, we first defined the population size  $N$  of tobacco farmers in Kenya to be approximately 55,000. For the simple random sampling process, we adopted the conservative standard deviation  $\hat{p}$  to be 0.5, confidence level as 95% ( $Z=1.96$ ), and we allowed the margin of error  $e$  to be 4.5%.

$$n_1 = \frac{z^2 \hat{p}(1-\hat{p})}{e^2} \quad (1)$$

Based on equation (1), we obtained the unadjusted sample size needed to be 494. To adjust for population size, equation (2) was then considered.

$$n_2 = n_1 \frac{N}{N+n_1} \quad (2)$$

As the population size is large, the adjusted sample size remains at 494. Based on previous agricultural surveys in the country, we expected the response rate to be between 85% and 90% and sought to reach out to 600 tobacco farmers. We aimed for equal geographic distribution by recruiting 200 smallholder farming households in each of the 3 study sites.

One administrative location with the highest concentration of tobacco farmers was chosen in each country with Kuria East and West sub-counties in Migori; Imenti central sub-county in Meru and Malakisi - a town centre at the border of Bungoma and Busia counties. In Malakisi, the Mastermind tobacco leaf centre is located on the Bungoma side and generally its farmers have been reducing in numbers because of non-payment or delayed payment, while BAT's leaf center is located at the Busia side and has more farmers. It follows that farmers on the Bungoma side are predominantly contracted to Mastermind with on the Busia side, the farmers are predominantly contracted to BAT. Because of this reason, most of the respondents in this study site were therefore from the Busia site as will be seen later in table 1. The county border in this area is particularly difficult to identify and using the strict transect walk to collect the data randomly led to this dynamic. We ended with a sample size of 585 (a response rate of ~97.5%).

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While we had no a priori reason to suspect that there were large regional differences, we nonetheless chose to implement the survey evenly across each of the 3 study sites.

Qualitatively, we implemented key informant interviews with Ministry of Agriculture extension officers and relevant county government officials in all the three regions. We also held a focus group discussion in Imenti central sub-county in Meru where 20 participants were randomly drawn from villages where data was collected, drawing a mix of experience in tobacco farming and gender.

Questions asked included, historical timeline of farming in the area, seasonal and daily schedules of household members, livelihood mapping, historical resource analysis, resource flow matrix analysis and stakeholder analysis.

## RESULTS

### Socio-Demographic Characteristics of Survey Respondents

The socio-demographic characteristics of the survey respondents are presented in Table 1. First, slightly more than three quarters of the farmers interviewed were male (76.07%) while roughly one quarter were female (23.93%). Generally, men make most of the family decisions on agricultural production and the control of cash crops (Kiriti and Tisdell, 2003). The male head of the household also typically determines the use of the proceeds from selling the crop.

It is important, however, to note that tobacco is a family activity with both males and females participating in tobacco growing, as illustrated below in Figure 2. Because men tend to manage the farm finances more than women, they may be better sources of the financial information that comprises most of the survey. Most farmers are in a monogamous marriage (75.73%), are between 30 and 49 years of age (60.35%), and have a primary level education (56.09%).

**Figure 2 – Men, Women and Tobacco Farming**



Source: Author (Magafi)

**Table 1 – Socio-Demographic Characteristics of Survey Respondents**

Characteristic	N=585	Percentage
<b>County</b>		
Bungoma	31	5.30%
Busia	176	30.09%
Migori	163	27.86%
Meru	215	36.75%
<b>Gender</b>		
Male	445	76.07%
Female	140	23.93%
<b>Marital Status</b>		
Single	64	10.94%
Married – Monogamous	443	75.73%
Married - Polygamous	49	8.38%
Divorced	4	0.68%
Widowed	11	1.88%
No information	14	2.39%
<b>Age (Years)</b>		
19-29	85	14.53%
30-49	353	60.35%
50>	113	19.32%
No information	34	5.81%
<b>Primary Occupation</b>		
Farming and livestock	491	84.08%
Salaried employed	21	3.60%
Self-employed – off farm	29	4.97%
Casual worker	3	0.51%
Business (non-farm)	9	1.54%
Other	31	5.31%
<b>Education</b>		
Primary	318	56.09%
Secondary	197	34.75%
Tertiary	52	9.17%

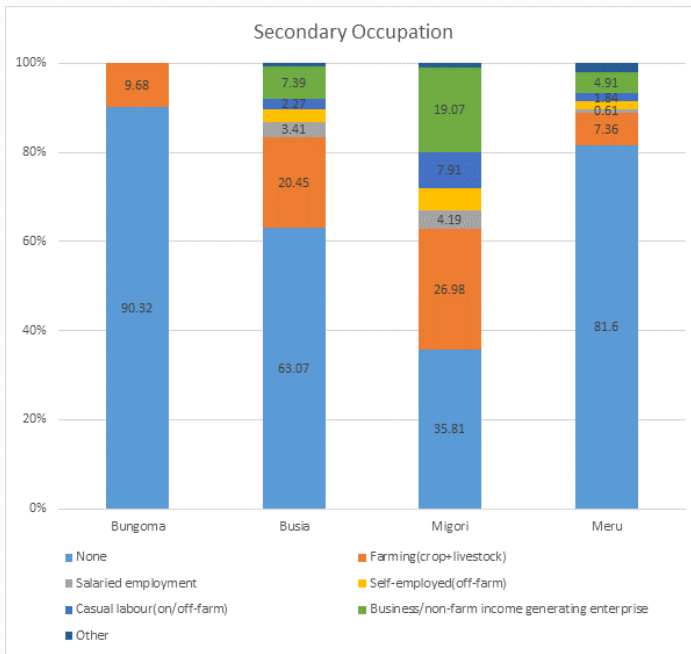
Beyond the socioeconomic characteristics, the survey also examined the type of land ownership of tobacco farmers, which is presented in Table 2. The vast preponderance of respondents (77.57%) identified their land as freehold/inherited/purchased. Notably, few farmers reported renting land for tobacco farming (<1%).

**Table 2 – Legal Entitlement of Land**

Category	n	Percent
Freehold /Inherited / Purchased	453	77.57
Leasehold	19	3.25
Communal	1	0.17
Owned with title deed	109	18.66
Owned with allotment letter	2	0.34
Total	584	100.00

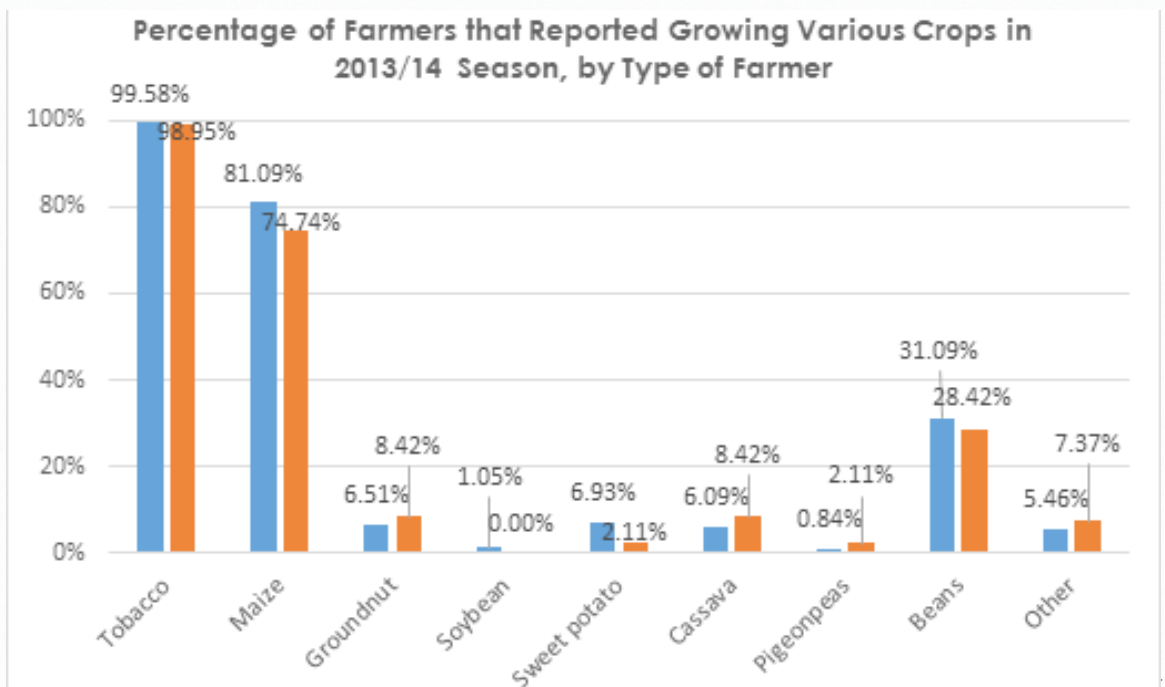
Figure 3 below shows the secondary occupation of the farmers interviewed and suggests that farming is the general mainstay in these areas. But, only 9.68% of farmers interviewed in Bungoma and 7.36% in Meru indicated that they are involved in another agricultural activity other than tobacco farming. In Busia (20.45%) and Migori (26.98%), the percentages of farmers growing other crops and/or livestock farming are higher. In Migori, there was a greater variety of economic activity in general: nearly two thirds of respondents indicated a second occupation of some type (either agricultural or non-agricultural).

**Figure 3 – Secondary Occupation of Tobacco Farmers**



Generally, as indicated in Figure 4, most farmers grow a mix of tobacco, maize and sometimes beans in a given year. This preference for mostly other food crops could suggest that either a farmer’s engagement in an economic activity is pegged on how food secure they feel their households is or a lack of other viable cash crops in the regions, or perhaps both. The report expands on this line of inquiry below.

**Figure 4 – Patterns of Cropping**



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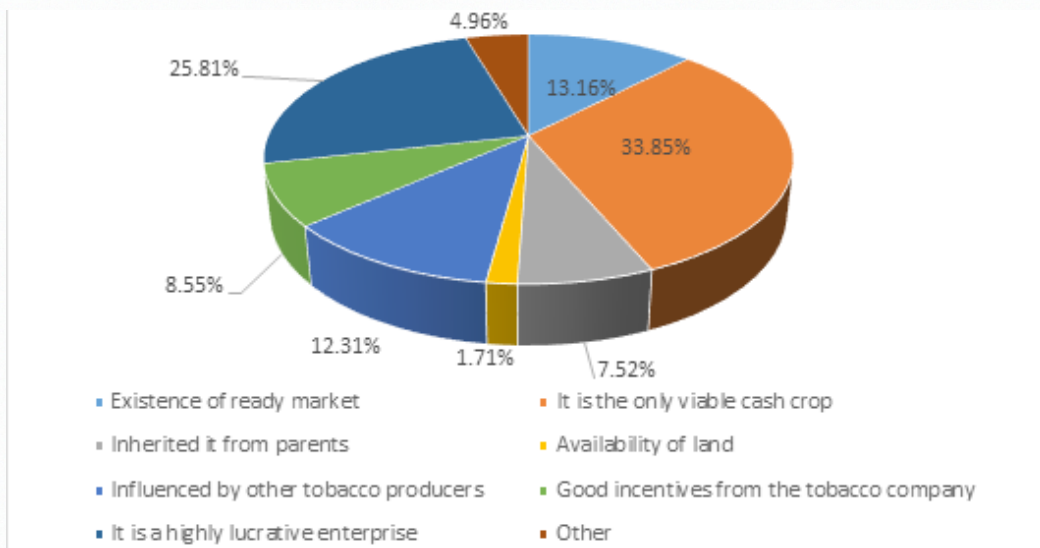
## Why Do Farmers Grow Tobacco?

There is compelling existing evidence that economic livelihoods for tobacco farmers are poor (e.g., Kibwage et al 2008), yet an estimated 55,000 farmers in Kenya report growing tobacco as their main livelihood (Kibwage et al 2014). Because these two points seem contradictory, namely that tobacco growing appears not entirely economically viable in many circumstances but remains the principal source of livelihood for many farmers, it is important to identify which factors most influence the decision to start growing tobacco. Understanding this dynamic is also likely to inform efforts to move farmers to other viable alternative livelihoods.

As Figure 5 illustrates, the survey results suggest that it is in considerable part the perceived viability of cultivating tobacco that most motivates farmers to start to grow the crop. Of the tobacco farmers interviewed, 33.85% indicated that they started growing tobacco because they believed that it was the only economically viable crop in their area. This finding was consistent with the focus group discussion, in which farmers indicated that although tobacco did not rank highest in terms of importance when compared to growing food, they often considered it to be the only crop that brought consistent cash earnings. One participant opined: "Even in the worst of harvest, there is money that you will receive from the tobacco companies. We always have to grow food first for the family but also need money to pay for other essentials"

A small percentage – 25.81% – was much more sanguine indicating that they grew tobacco because it is lucrative crop. Another 13.61% were attracted to growing tobacco because it has a ready market. While there are other crops grown in the areas, the tobacco industry has a well-established value chain that mostly assures farmers that they will receive at least some financial reward for their efforts. The findings from the focus groups also suggested that the value chains for alternative products in these areas are weak, which prevents farmers from getting other crops to market and/or obtaining a reasonable price for them.

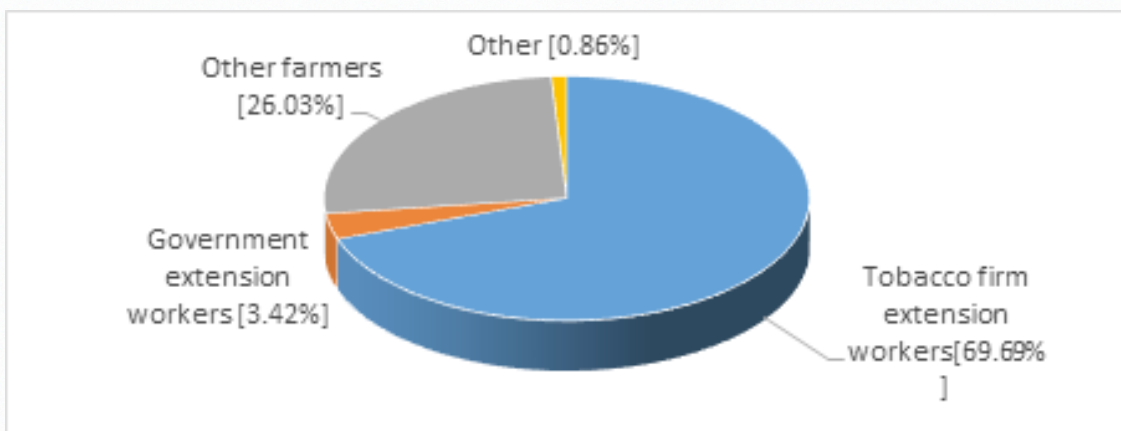
**Figure 5 – Factors Influencing the Initiation to Tobacco farming**



Note: Data generated from a multiple response question allowing the frequency to vary beyond 100%

As Figure 6 below illustrates, recruitment into tobacco farming takes various forms but is driven largely by tobacco firm extension staff at 69.69%. The other major agent of recruitment was other tobacco farmers at 26.03%. Notably, a tiny percentage reported recruitment by government extension staff (3.42%). These respondents are almost certainly older farmers because the current government policy categorizes tobacco as a non-scheduled crop, meaning government staff are no longer involved in advising on tobacco farming. This policy came into effect 1991 when the state published the schedule of growing tobacco indicating that the tobacco firms at the time (BAT and Mastermind) had their own adequate extension services.

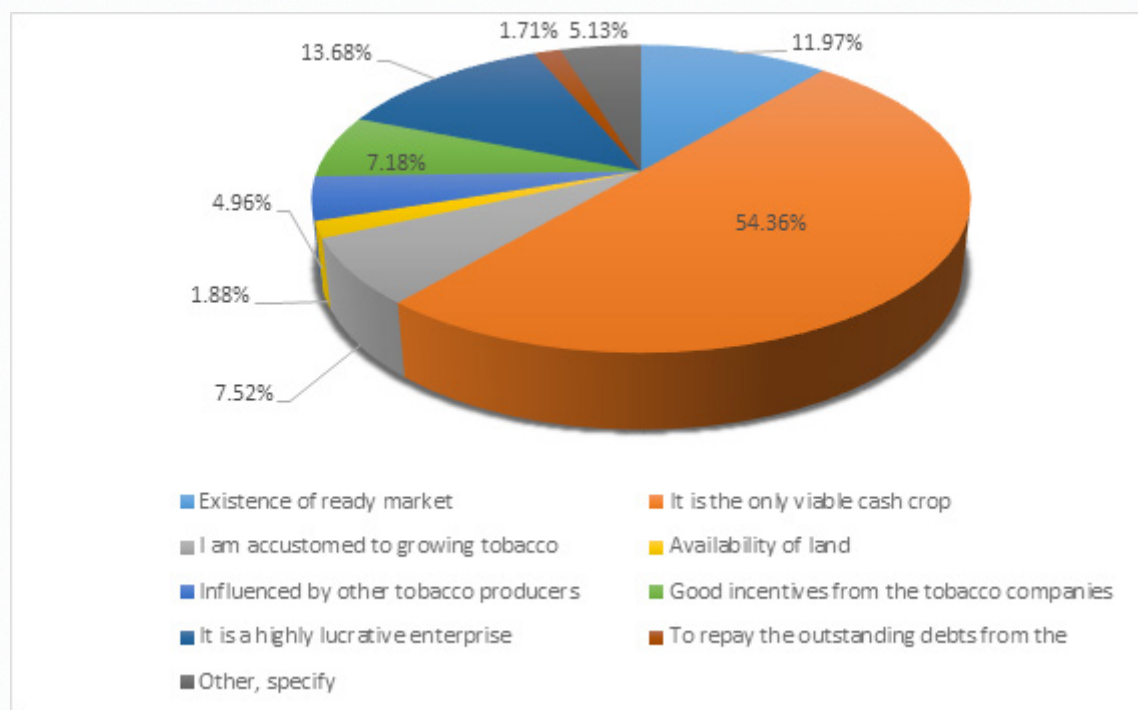
**Figure 6 – Recruitment into Tobacco Farming**





Beyond addressing the initiation of tobacco farming, the survey also sought to examine the reasons that farmers continue growing tobacco. The survey results presented in Figure 7 show that although only 33.85% reported starting to grow tobacco because it was the only viable crop (Figure 5), 54.36% gave this answer as the reason for why they continue to grow it. Notably, the percentage of farmers who cited tobacco growing's 'lucrative nature' fell from 25.81% for those starting to grow to 13.68% for those choosing to continue to grow. In short, it appears that the reality fell short of their expectations for many tobacco farmers. The explanation that it was influence from other tobacco farmers also decreased from 12.31% (starting to grow) to 4.96% (continuing to grow). Thus, these results indicate that many experienced farmers may be engaging in tobacco production not because they anticipate rich economic rewards, but because of a perception of a lack of viable alternatives that could match or improve upon even their limited gains from tobacco production.

**Figure 7 – Factors Influencing Continuation of Tobacco farming**

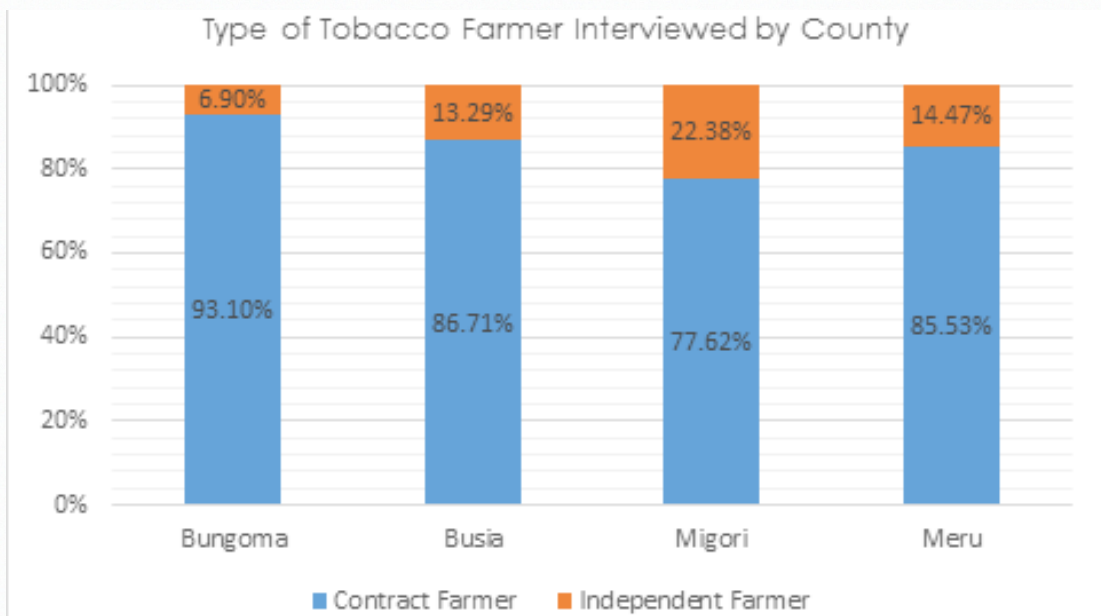


Note: Data generated from a multiple response question allowing the frequency to vary beyond 100%

## Contract Farming

Most of the tobacco production in Kenya is by smallholder farmers and most of these farmers (83.36% in this survey) operate in contractual arrangements with tobacco leaf-buying firms. Within these contracts, tobacco farmers agree to conditions under which firms will buy the leaf from them at the end of the season in exchange for loaned inputs and extension services. The input costs are deducted from the final sale of the tobacco leaf. Figure 8 shows the distribution of the type of farmer across the counties indicating that most of the farmers interviewed were contract farmers.

**Figure 8 – Type of Tobacco Farmer Interviewed by County**



There are three main tobacco companies involved in the management of tobacco contract farming schemes. The firms generally agree to and assign amongst themselves specific geographical “concession” areas, where they provide inputs and extension assistance to smallholder tobacco farmers on credit and are granted veritable monopsony (i.e., one buyer only) rights that entitle them to purchase all of the output at prices that they set. The farmers are not involved in the price determination of the harvested leaf and accept the price allocated to each grade of leaf harvested and sold at the auction floor each season.

As Table 3 illustrates, BAT holds the majority of contracted farmers, followed by Alliance One, and then Mastermind. Alliance One, however, just recently exited the Kenyan market citing a substantial shift in the global demand and supply of flue-cured Virginia tobacco which is negatively affecting the company's performance (Chege 2015).

**Table 3 – Market Share by Firm**

Tobacco Firm	Share
BAT	55.04%
Alliance One	31.09%
Mastermind	18.91%

Table 4 shows how the firms are distributed in the study areas and that Alliance One is the dominant firm in Migori while BAT is dominant in Busia and Meru. Mastermind holds the smallest share of contract farmers in all regions.

**Table 4 – Regional Distribution by Firm**

County	Alliance One	BAT	Mastermind	Don't know	Total
Bungoma		15	14	2	31
Busia		119	36	21	176
Migori	148		27	40	215
Meru		128	15	20	163
Total	148	262	92	83	585

## The Economics of Growing Tobacco

The surveyed farmers produced an average of 1244 kilograms of tobacco, but with significant variation on the production between contract and independent farmers. Results reported in Table 5 show that the contract farmers averaged 1320.7 kilograms while the independent farmers on average produced 822.7 kilograms of tobacco in a season ( $p < 0.05$ ). However, not all of the tobacco that some farmers produced was sold with the data showing that contract farmers sold an average of 1075.97 kilograms while the independent farmers sold 765.06 kilograms ( $p < 0.05$ ). More than one quarter of farmers reported these discrepancies and because the survey asked the question in several ways, the validity of these results is strong. The contract farmers also reported cultivating more land for tobacco (1.86 acres) versus the independent farmers (1.53 acres) ( $p < 0.05$ ).

Average income varied only slightly between the two groups. The average annual income earned from tobacco farming reported by our respondents was Ksh 115,523 (US\$1327.5 using the 2014 Economic Intelligence Unit's US\$-Ksh exchange rate), which accounted for 65% of the total income earned by these farmers. The contract farmers generated Ksh 117,472 (US\$1,349.9) of tobacco-related income on average, which was 64.97% of total income (US\$2,077.65); while the independent farmers generated Ksh 104,806 (US\$1,204.35) in tobacco related income, 64.93% of total income (US\$1,854.76). These differences were not statistically significant.

Some respondents indicated that the average prices offered to the two groups varied, with contract farmers offered a higher price for the tobacco leaf per kilogram at Ksh 129.58 (US\$1.86) against an average of Ksh 114.67 (US\$1.53) offered to independent farmers. However, these measures failed the difference of means test and less than 20% of farmers were willing to report the price. More investigation of this dynamic is necessary in future research.

**Table 5 – Average Production, Land Size, Price and Income**

Type of Farmer	Average leaf Production (Kgs)	Tobacco Sale (Kgs)	Tobacco Land Size (acres)	Average Price (US\$)	Reported Tobacco Income (US\$)
Contract	1320.70	1075.97	1.86	1.49	1349.90
Independent	822.72	765.06	1.53	1.32	1204.35
All	1244.40	972.00	1.81	1.46	1327.51

## Costs – Non-Labour and Labour

Because tobacco cultivation is input intensive, in order to understand farmers' livelihoods, it is critical to explore in depth and rigorously the precise costs of this undertaking. Accordingly, the survey queried farmers on the minute details of growing tobacco, including all material inputs, non-material ones (such as government levies) and labour inputs.

### Non-Labour Costs

Farmers' non-labour costs are presented in Table 6. Note that for the input costs, we include the principal variable costs such as tools, fertilizer, herbicide, pesticide and seeds, but not fixed cost such as land rental (where applicable – though importantly, land rental was not a large part of most farmers' production as illustrated above in Table 2).

**Table 6 – Non-Labour Costs in US\$**

Type of Farmer	Input Cost		Levy		Transport		Interest	
	Per acre	Per Kg	Per acre	Per Kg	Per acre	Per Kg	Per acre	Per Kg
Contract	321.93	0.82	39.02	0.96	13.33	0.03	1.53	-
Independent	257.31	0.83	7.26	0.17	10.24	0.24	0.00	-
All	311.28	0.82	33.76	0.84	12.82	0.03	1.53	

The first set of columns in Table 6 suggests that contract farmers have a higher set of per acre input costs than independent farmers (by 25.11%). This difference was significant at  $p < 0.05$  for per acre input costs though not statistically significant for per/Kg costs. This finding suggests that the costs of the inputs loaned to farmers through their contracts may be inflated. Results also indicate that contract farmers incur higher levies per acre ( $p < 0.05$  for both per acre and per kg measures). Finally, transport costs are more for contract farmers in per acre measures but less for per kg, though neither difference is statistically significant.

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<sup>1</sup>The following tobacco farmer characteristics were the major predictors of who was less likely to report price in the survey: higher tobacco farming-related income, more experience, single, and with larger land size. In contrast, the farmers who pay more in levies, whose food can last them for the whole year, and who are older were significantly more likely to report the price.

## Labour costs

Tobacco farming is typically a labour-intensive practice particularly on smallholder farms (Kibwage, Odondo and Momanyi, 2009). Accordingly, it is vital to evaluate the magnitude of farmers' efforts, particularly to establish farmers' net gains. Table 7 presents data on the average labour hours – combined total of all household members – needed to produce an acre and a kilogram of tobacco leaf. Note that the kilogram measure used in this table is the amount actually sold in the 2013/2014 season (not necessarily the amount produced, which is typically more because, as indicated above, some tobacco is not sold for a variety of reasons, which can include poor quality). Labour hours from household members are lower for contract farmers than independent farmers, though this difference is not statistically significant.

**Table 7 – Labour Hours**

	Contract	Independent
Per acre	476.21	637.89
Per Kg	2.19	2.63

Based on 2013/2014 monthly minimum wage measures from Kenya from the Ministry of Labour Office, and using Kenyan and EIU exchange rates, the average labour cost in US\$ contributed by household members is presented in Table 8.

**Table 8 - Average Labour Cost in US\$**

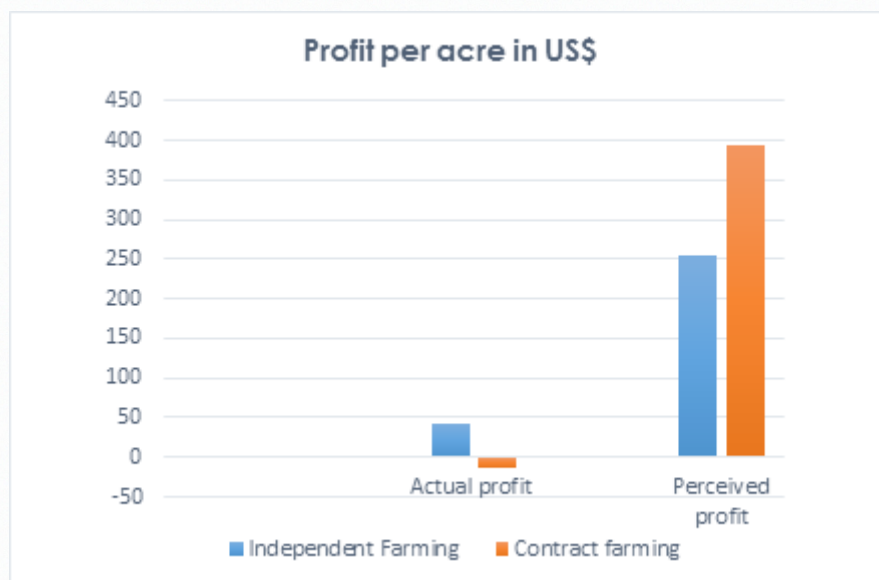
Type of Farmer	Household Members		Hired Labour	
	Per acre	Per Kg	Per acre	Per Kg
Contract	252.87	0.35	117.08	0.29
Independent	338.72	0.56	109.95	0.25
All	265.90	0.36	116.40	0.26

<sup>2</sup>EIU 2013 2014 and average exchange rate 87.02265. Kenya daily minimum wage for farm foreman or farm clerk from legislative supplement #57 is 370 hourly minimum rate is  $(370/87.02265)/8=0.531$  \*/

## Profits

We calculated a profits-per-acre measure that includes personal and household labour so that we could compare the actual profit to the perceived income of the tobacco farmers who were not incorporating this significant set of costs. In focus groups, we learned that many tobacco farmers do not include the cost of the time they or their household members spend working on the farm. While the two columns on the far right of Figure 9 suggest a perceived profit for contract farmers of US\$254/acre compared to US\$394/acre for independent farmers, the actual profits drop precipitously once labour is included: a US\$13/acre loss for contract farmers and US\$42 for independent farmers.

**Figure 9 – Profit per Acre in US\$**



A cross-regional comparison of profits of real and perceived profits per acre demonstrates significant variation. Table 9 suggests that farmers in Migori County receive the highest returns from tobacco farming when compared to other regions. The actual profit from tobacco farming is lowest for farmers in Meru and Busia, with an average net loss.

**Table 9 – Cross-Regional Comparison of Profits**

County	Real Profit Per Acre		Perceived Profit Per Acre	
	Contract	Independent	Contract	Independent
Busia	-23.39	-551.88	196.22	193.75
Bungoma	40.69	197.03	249.96	530.38
Meru	-308.31	241.15	155.90	590.31
Migori	283.15	235.76	410.45	381.36

The survey further sought to compare the earnings by farmers contracted by the tobacco companies. Table 10 demonstrates that farmers contracted with Alliance One earned the highest margins followed by those with Mastermind. Farmers contracted to BAT earned the least. As is shown in Table 4 above, Alliance One is the dominant firm in Migori meaning that its recent exit is likely to have an adverse impact on farmers who grow tobacco in Kenya – more so generally, too, because Migori is the largest tobacco-producing region in the country.

**Table 10 – Profit Earning Comparison by Firm**

Firm	Real profit per acre	Perceived profit per acre
Alliance One	311.93	436.03
BAT	(179.45)	169.65
Mastermind	72.65	276.98
Don't Know	36.99	411.36

As noted above, some of both the surveyed contract and independent farmers indicated that they sell less than they harvest. This may be of particular concern to contract farmers who are supplied inputs by tobacco companies and might expect that the output produced from utilizing these inputs supplied to them will lead to their crop being sold. The survey results suggest that tobacco companies first buy the leaf from the tobacco farmers initially to the extent that the firms recover the input costs supplied to each farmer before returning to purchase the rest of the tobacco leaf. The finding that many farmers sold less than they grew would suggest that in the 2013/2014 farming year the tobacco leaf harvest was plentiful and the tobacco companies met their leaf purchase target before farmers could sell all of the harvested leaf. Clearly, this puts farmers at a potentially meaningful financial disadvantage and significant risk.



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## Why Then Contract ?

With such poor earnings, particularly for contract farmers, we sought to understand better why farmers chose to enter into contracts with leaf companies. In order to analyse the farmers' decisions we used multivariate analyses. To begin to identify key independent variables, we worked from earlier studies on the determinants of smallholder farmers' adoption of agricultural technology in nearby countries with common crops, such as groundnuts, maize and pigeonpea (e.g., Giné and Yang 2009; Simtowe et al 2010; Shiferaw, Kebede and You 2008). We elected to use these studies because there are not comparable studies on tobacco farming. Findings from the FGDs supported these initial choices and helped to identify other key independent variables. We used logistic regression to examine the farmers' decisions to contract formally with tobacco leaf-buying companies. The dichotomous "Contract farmer" was the dependent variable. We used the variables identified above as the independent variables, which include: the Cost of Levy (US\$), Transportation Cost (US\$), Input Cost (US\$), Hours of Labour Used per Acre, Proportion of Income related to Tobacco Farming, Years of Experience Tobacco Farming, Years of Education of Household Head, Acre of Land Assigned for Tobacco Farming, Single, Female Household Head, Household Size while controlling for geographical district (with Bungoma as the baseline).

In Table 11, we present the results of the logistic regression for farmers' decision to contract. For the sake of space, only the variables that were statistically significant are displayed in the table (please see <http://www.cancer.org/research/acsresearchers/about-the-economic-health-policy-research-program> for the full regression results). The coefficient for years of experience is positive and significant suggesting that farmers who have been farming tobacco for many years are more likely to enter into contracts. Similarly, the coefficient of the acreage allocated to tobacco farming is positive and significant, suggesting that those growing tobacco on more land are more likely to contract farm. The coefficient for the dummy for single is negative and significant suggesting that single farmers are less likely to contract. The coefficient for the Migori county dummy is negative and significant suggesting that farmers in this area are less likely to contract. We note that Migori until recently was typically the territory of Alliance One.

Finally, cost issues appear to play a role in the decision – the coefficients of two of these variables (levy and transportation) were positive and significant. It is difficult, however, to interpret these coefficients because the data are at one snapshot in time. It is possible that the respondents became contract farmers because they had high input costs, or that contract farmers have higher input costs (or both).

**Table 11 – Decision to Enter into Contract with Leaf-buying Firm**

VARIABLES	Coef.	Std.Err
Cost of Levy (US\$)	0.0201***	0.006
Transportation Cost (US\$)	0.0434***	0.015
Years of Experience on Tobacco Farming	0.0722**	0.029
Land Assigned for Tobacco Farming (acres)	0.391*	0.216
Migori County	-1.573*	0.841
Single	-0.835*	0.468
Observations	451	

*Note: Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.*

To check the robustness of the theory- and field-driven model, we also utilized machine-learning methods, including Random Forest (RF). This technique aids in variable selection and subsequent model improvement. Because the survey had many questions, we wanted to be sure that we were not omitting key variables.

After running the RF new variables were identified, and we re-utilized the theoretical framework to consider the variables that we might have missed. The RF method is part of the decision tree family (Breiman 2001), which comprises many decision trees and outputs the class that is the mode of the classes output by individual trees (Liaw and Wiener 2002). The RF method complements regression analysis by handling many input variables without variable deletion and ranking explanatory variables by importance. The method's explores myriad different possible paths of variables, which potentially generates new perspectives (Biau 2012; Biau and Devroye 2008; Strobl, Malley and Tutz 2009). Highlights of these trees (paths) are available in <http://www.cancer.org/research/acsresearchers/about-the-economic-health-policy-research-program>.

The analysis was conducted in R version 3.2.2. We randomly selected 70 percent of the data and constructed 200 trees in order to fit the forest model. The random seed 123 was adopted for the process; 37 potentially meaningful variables were included in the analysis and RF results ranked the top 30. The machine-learning echoed much of the regression results, identifying the following variables as among the most influential in farmers' decisions to contract: input and production costs (transportation and levies); the proportion of income from tobacco farming; the years of experience farming tobacco, the land size of tobacco cultivation, and whether the farmer was married (See <http://www.cancer.org/research/acsresearchers/about-the-economic-health-policy-research-program>.)

# SATISFACTION WITH TOBACCO FARMING AND FUTURE

## Satisfaction with Leaf Classification

The survey results demonstrate that most respondents are not satisfied with the classification of tobacco leaf by the leaf buyers. The majority of the respondents believe that the government should monitor this exercise and that there is a need to revise the prices of some grades. Others believe that there is need for farmers to be involved in the classification of the leaf to ensure fairness in the exercise. Notably, a larger proportion of independent farmers were more likely to be satisfied with the classification ( $p < 0.05$ ). The levels of satisfaction of respondents are summarized below in Table 12.

**Table 12 – Satisfaction with Leaf Classification**

Type of Farmer	Satisfied	Not Satisfied
Contract	138 (28.99%)	338 (71.01%)
Independent	39 (41.05%)	56 (58.95%)
All	177 (31.28%)	394 (68.72%)

## Satisfaction with Pricing of Leaf

The survey also asked farmers to reflect on their satisfaction with leaf pricing. Table 13 presents the proportions of farmers dissatisfied or satisfied with tobacco pricing. Again, contract farmers were more likely to be dissatisfied than independent farmers ( $p < 0.05$ ). In focus groups, many of those dissatisfied indicated that the low prices are due both to poor (unfair) leaf classification and underpayment (e.g., low price) by the leaf buyers. One farmer offered: “We have been growing this crop for many years and know the different grades. At the buying centre, you can see your leaf of high grade being grades as low grade. If you complain, you are asked to wait until other farmers without complaints are done with. Because you can even lose your sale opportunity, you just accept the grade given.” Similarly, a second tobacco farmer considered: “I think they have a target of how much to take to the companies. Good grades are given to those well known by the leaf buying officials, leaving the rest of us unknown to accept to sell our good grades as low grades “

**Table 13 – Satisfaction with Leaf Pricing**

	Satisfied	Not Satisfied
Contract	129 (27.10%)	347 (72.90%)
Independent	35 (36.84%)	60 (63.16%)
All	164 (29.06%)	407 (70.94%)

## Tobacco Leaf –Buying Center in Kuria, Migori County



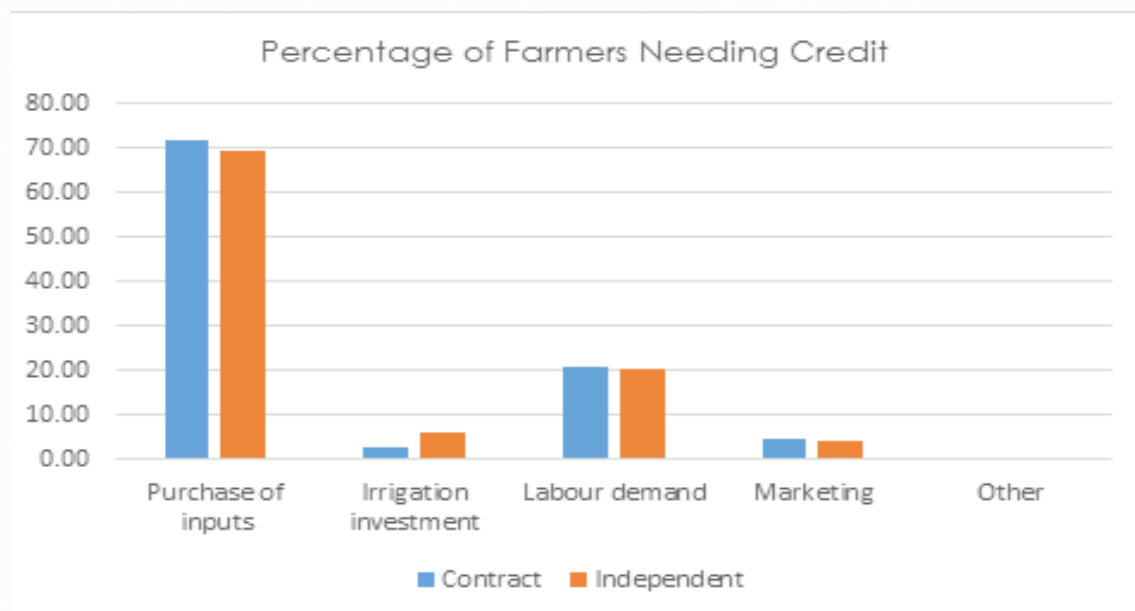
Source: Author (Magati)

## CREDIT

In focus groups, tobacco farmers consistently identified credit as one of the central issues bearing on their ability to engage in agricultural practices. One focus group participant worried openly: "Everything is expensive in this country making it expensive and hard to engage in any agricultural production. With tobacco farming, all you need to worry about is giving it time, not look for money to buy fertilizers, pesticides and other inputs unlike other crops. They are given to you"

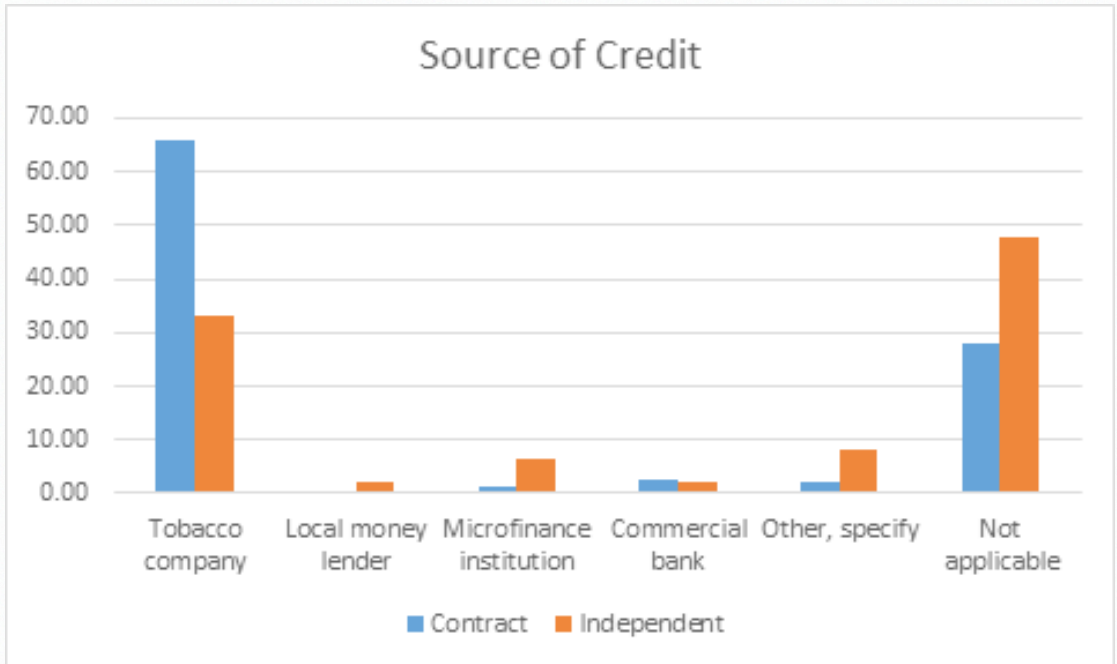
Among survey respondents, 66% indicated that they needed credit to undertake tobacco farming. Figure 10 demonstrates that most farmers – ~70% – are seeking credit to purchase inputs. While there are several other reasons that farmers seek credit, including to pay for non-household labour, non-labour inputs are the most important reason.

**Figure 10 – Need for Credit**



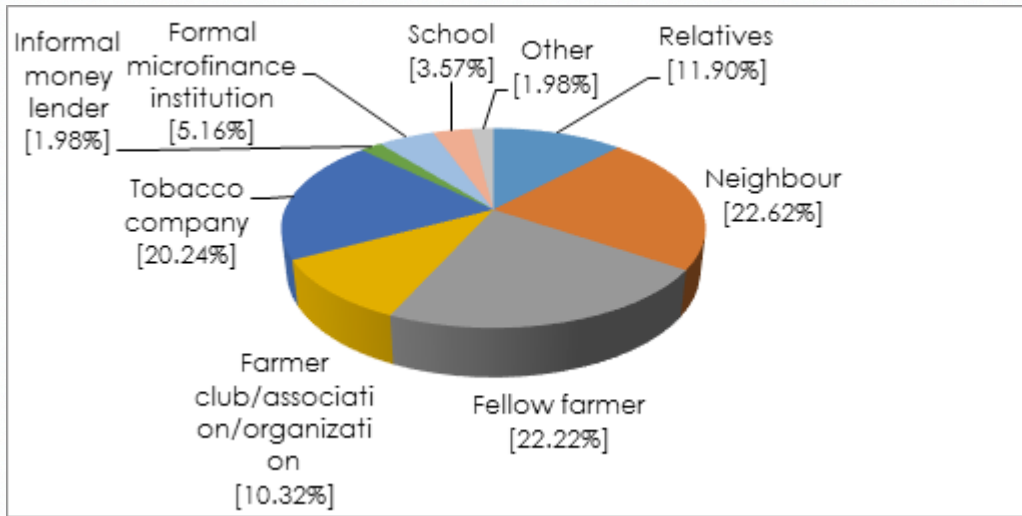
The results in Figure 11 demonstrate that the most common type of lender to tobacco farmers is a leaf-buying company. Of contract farmers, roughly two-thirds who answered this question (65.68%) borrowed money from leaf-buying firms. Notably, nine independent farmers also reported borrowing from leaf-buying firms. Although it is unusual for independent farmers to owe these firms, we speculate that these could be farmers who were on contract in the previous season and had yet to repay their loan(s) fully. Other common lenders included microfinance institutions, commercial banks and local money lenders.

**Figure 11 – Credit Sources**



More than half of the respondents (58.8%) indicated that after the sale of their tobacco they do not owe anyone money from tobacco farming. The other 41.2% of respondents who indicated that they have outstanding debt reported a variety of people or institutions to whom/which they owed money. As shown in Figure 12, of the respondents with outstanding debt, 20.3% stated that they owed tobacco firms, 22.3% owed fellow farmers, 22.7% farmer associations while 12.4% owed relatives. Farmers indicate that they sometimes borrow from other credit sources, usually farmer associations and fellow farmers with whom they are grouped with by the leaf companies in order to prevent forceful acquisition and auction of their livestock and chattels by the tobacco firms in the event of non-payment of the debt from the sale of tobacco leaves as provided for in contracts signed.

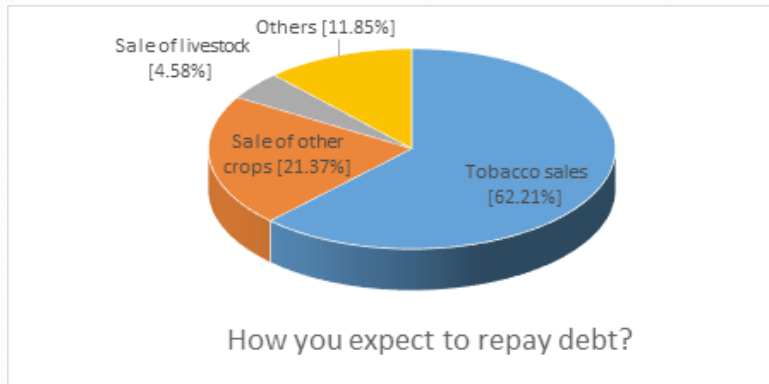
**Figure 12 – Credit Entities that Tobacco Farmers Owe**



Note: Data generated from a multiple response question allowing the frequency to vary beyond 100%

Because some farmers had multiple livelihoods (most commonly in Migori), the survey examined how the farmers pay back their loans. The majority of farmers that owed money to creditors reported planning to pay from sales of tobacco leaf as well as sales from other crops as seen below in Figure 13.

**Figure 13 – Farmer credit payment plan**



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## Switching to Alternatives

With poor economic performance being fairly typical among tobacco farmers in Kenya, and access to credit and debt issues on-going challenges, the government might encounter genuine opportunities to follow through on commitments to WHO FCTC Article 17, the alternative livelihoods provision. Accordingly, we analysed the survey results to better understand the farmers' interest in switching.

The results suggest that almost half of tobacco farmers-49.23% (297 out of 585)-are considering a switch from tobacco to another crop. This proportion was highest in Migori, where 57.97% of respondents indicated willingness to shift and lowest in Bungoma where only 29.03% indicated willingness to shift to other livelihoods. In Meru the proportion willing to shift was 46.63% while for Busia County, the proportion was 44.89%. Results also suggest that contracted farmers are more likely to be open to switching, with 51.05% indicating a willingness to shift as opposed to independent farmers where only 41.05% indicated a willingness to shift. For those farmers who indicated willingness to switch, the average income from tobacco farming was US\$1270.78 compared to those who did not want to switch of US\$1400.07. They also drew 68.68% of their income from tobacco farming compared to those who did not express desire to switch who drew 73.91% of income from tobacco farming. The input costs of the farmers open to switching were US\$474.54 on average, compared to US\$533.22 for those indicating not wanting to switch, and the difference is statistically significant. The farmers open to switching spent 586.42 hours per acre on tobacco farming on average, while those who did not want to switch spent an average of 425.77 hours per acre and is not statistically significant. The food the farmers open to switching produced lasted them 10.14 months on average, compared to 9.27 months for those farmers who did not want to switch. Of the households open to switching, 20.63% of them have female household head, compared to 26.48% for those who did not want to switch, and the difference is statistically significant.

Because policymakers likely want or need to know which farmers to target first for switching to alternative livelihoods and how to approach this task, we also explored farmers' interest in switching using multivariate analysis. We used the limited theoretical and empirical literature on this topic (e.g., Altman et al; Kibwage et al 2009; Leppan 2014) and feedback from farmers in the FGDs to identify key independent variables. We also used the machine-learning methods described above as a complementary way to explore the key variables driving this dynamic. Among others, the three different methods consistently identified the following variables as important: years of experience tobacco farming, income from tobacco farming, the input costs, the labour intensity, and the proportion of the farmers' income from tobacco.



In Table 14, we present the results of a logistic regression examining the variables that predict farmers' willingness to switch from tobacco. The coefficient for the Migori County dummy is positive and statistically significant, suggesting that farmers in Migori are more likely to be open to switching than the farmers in the other tobacco-growing counties in the survey sample. Though it is not possible with the data to say definitively why Migori appears to be distinct, we speculate that because many Migori farmers already have additional livelihoods beyond tobacco growing, it is likely that there are more economic opportunities to pursue alternatives and a greater likelihood that farmers have experience with some of these other viable livelihoods. The coefficient for female-led household is negative and significant, suggesting that farming households led by women may be less likely to be open to switching to an alternative. This result may indicate that women – especially those with lower level of education – have fewer economic opportunities available to them.

Finally, the coefficient for food security is positive and significant, suggesting that food secure households are more likely to be open to switching. This result may reflect that farms with better agricultural land are more likely to be food secure and have more opportunity to grow crops beyond tobacco.

**Table 14 – Determinants of Willingness to Switch to Alternative Crops**

VARIABLES	Coef.	Std.Err
Input Cost (US\$)	-0.000515*	0.0002
Migori	0.700**	0.308
Female Househead	-0.546**	0.254
Food Secure	0.0834**	0.032
Observations	397	

Note: Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## Child Labour

There is general concern that tobacco-growing households are more likely to use child labour in Kenya than other agricultural pursuits. Kibwage et al (2007) demonstrated that use of child labour among tobacco-growing household is due to the labour intensity of tobacco farming. Child labour is observed in at least 17.27% of the surveyed households with the dominant activity being banding, nursery preparation and planting, as shown in Table 15 and pictured in Figure 14. Other than a single case during nursery watering and three cases during banding, there were no reports of children working during school hours. While self-reporting is not completely reliable as school-going children are supposed to be attending school during the mandatory hours, government surveillance and the stigma attached to keeping children from school appears to be affecting these results in a positive manner.

**Table 15 – Child Labour in Tobacco Cultivation**

Tasks Related to Tobacco Cultivation	# total cases – help of children	# total cases – during school hours
Nursery Preparation	49	0
Nursery Sowing	28	0
Fertiliser Application-Nursery	23	0
Chemical Application	21	0
Watering of Nursery	40	1
Land Preparation	34	0
Planting	50	0
Fertilizer application 1	35	0
Weeding	40	0
Drying shed preparation	18	0
Fertilizer application 2	32	0
Banding	101	3
Chemical application	16	0
Harvesting	38	0
Drying/curing	17	0
Grading	35	0
Baling/Packaging	31	0

**Figure 14 – Children Taking Part in Tobacco Farming**



Source: Author (Magati)

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## Food Security

Both the government and farmers have considered the intersection of tobacco farming and food security for several decades. For example, the Ministry of Agriculture sought to control the adverse effects of tobacco cultivation on food security through the publication of the tobacco farming rules of 1991 that among other things gives a schedule of tobacco-growing months to ensure that farmers are also involved in growing food crops. In this schedule, tobacco growing should not take place from the period 1st August to 14th November in Nyanza and Western regions while in Eastern and Central region, the closed period is from 1st June to 14th July. Farmers in the FGDs in this research indicated that they plant other crops during the closed period in order to produce food for their households. But tobacco farming is land intensive including considerable intense cultivation of seedlings next to water sources, typically also the best places to grow food crops. The deforestation to expand land for tobacco crops and for wood for processing tobacco leaf (barns and curing of certain tobacco types) also contributes to soil erosion with further negative effects on farmers growing sufficient food. As a result, the tobacco-growing regions, especially in Nyanza and Western, continue to face food shortages because farmers continue to spend most of their time and land on tobacco farming at the expense of food crops. According to farmers, they often eventually buy food from surrounding districts at very high prices. One focus group farmer reflected: "Our lands are bare and no longer produce enough food as before. The rivers are dry, the trees are few and livestock no longer sustainable. We now have to buy trees from Masai land and food from far areas such as neighbouring, Luo Nyanza, Tanzania and even Kisii".

The Kenyan government now categorizes districts such as Kuria, which in the past produced adequate maize to feed the local population, as areas requiring relief food every year. While it is important to note that other variables are likely playing roles in affecting food production such as changing weather patterns (e.g., less rain in general; more particularly violent rains; and higher temperatures) as a result of climate change, it is nevertheless worth noting that tobacco production continues at the same or higher rates while food production decreases.

Most tobacco farmers' staple food crop is maize – 97.95% of the respondents reported it so. Of the survey respondents, 93.49% reported that the maize consumed by their household was from their own production. As one way to gauge their food security, the respondents were asked if the food they produce lasts the whole year: 59.83% of the respondents indicated that it lasts the whole year while 40.17% indicated that it did not. Of the farmers that indicated that they feel food insecure, 83.76% indicate that food lasts less than 9 months while 16.24% up to 12 months as reported in Table 16 below.

**Table 16 – How Long Does Own Grown Food Last?**

	No	Percent
=< 4 months	52	22.22
4-6 months	77	32.91
7-9 months	67	28.63
9-12 months	38	16.24
Total	234	100

The respondents were also asked to indicate who they felt were food secure between tobacco farmers and non-tobacco farmers in their areas. Table 17 indicates that 32.53% felt non-tobacco farmers were food secure while 25.86% felt that it is the tobacco farmers that were food secure. Roughly 40% on the other hand felt that both sets of farmers were food secure.

**Table 17 – Who is more likely to be Food Secure?**

	No	Percent
Tobacco farmers	151	25.86
Non-tobacco farmers	190	32.53
They are both food secure	234	40.07
They are both food insecure	8	1.37
I don't know.	1	0.17
Total	584	100.00

In order to explore the food security dynamic within tobacco farming more deeply, we also employed multivariate techniques. We first used the existing literature on food security and tobacco farming to identify key explanatory variables (Benfica et al 2005; Eriksen et al 2015; Khisa 2011; Peters et al 1994), which we augmented with input from the tobacco farmers in the FGDs. We also used machine methods (described above) to confirm and complement the key variables identified by the first two methods. The main independent variables included: district dummies (for Migori and Meru); level of education; income from tobacco farming; costs of inputs, labour intensity; cost of hired labour and the farmers' proportion of income that is from tobacco farming.

In the regression results, presented in Table 18, two variables were statistically significant. First, the coefficient for labour intensity is negative and significant, suggesting that farmers whose operations are more labour-intensive are less likely to be food secure. This finding is logical in that farmers on more marginal land typically work more to farm tobacco successfully and this land is also more likely to be not well suited for the cultivation of food crops (also their tobacco is more likely to be of a lower quality thereby fetching a lower price). The dummy variable for Meru Country was negative and statistically significant, suggesting that farmers from Meru were less likely to be food secure.

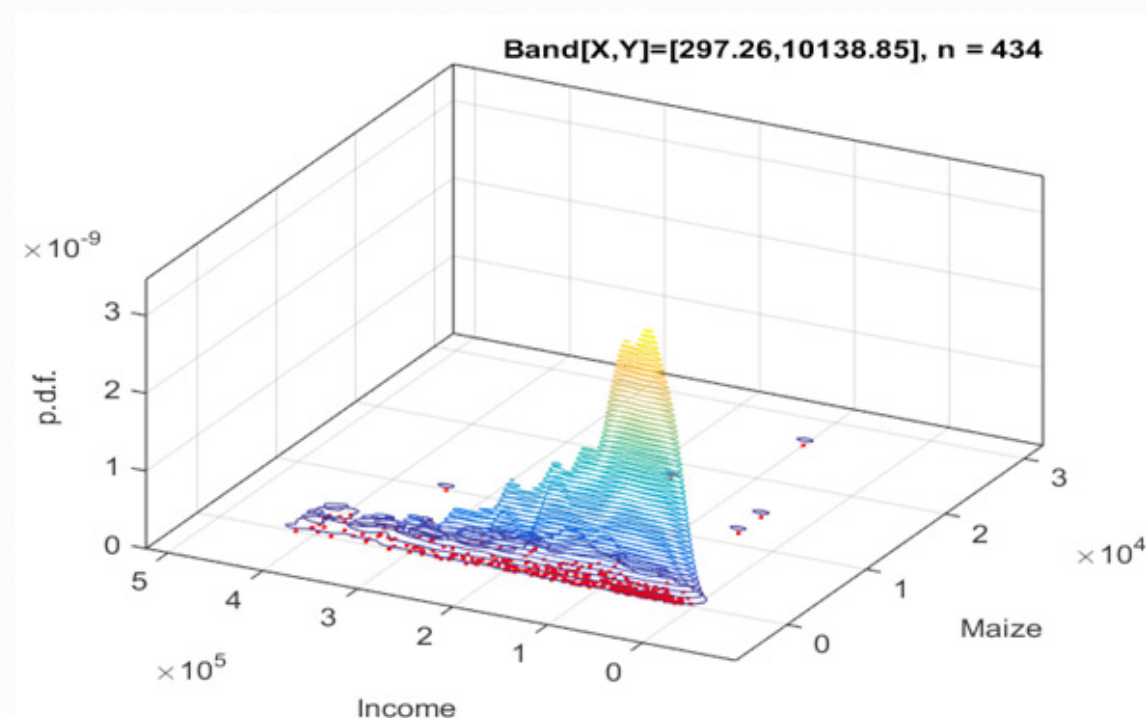
**Table 18 – Determinants of Food Security**

VARIABLES	Coef.	Std. Err
Hours of Labor Used per Acre	-0.000624**	0.0003
Meru	-1.345***	0.445
Observations	455	

Note: Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Finally, Figure 15 plots household income against the amount of maize grown using a bivariate probability function, and the shape of the function demonstrates that most farmers are growing approximately the same amount of maize regardless of their income. In other words, farmers with larger incomes are not necessarily growing more maize, but instead are allocating proportionally more of their land and resources to cultivating tobacco leaf, the cash crop. Results from the focus groups suggest that almost all farmers grow some maize for overall food security in case their cash crop does not perform adequately, but larger land owners appear to purposely grow a smaller proportion maize necessary thereby increasing the proportion of land for the cash crop.

**Figure 15 – Total household income against actual maize grown (bivariate pdf).**



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There is no doubt that the food security issue amongst tobacco farmers is a complex one. For some farmers with more successful tobacco-growing enterprises, as the figure above illustrates, they reported purposely growing less food and more tobacco because it made significantly more financial sense to generate a surplus and buy maize and other food at the market using part of the cash proceeds from selling their tobacco. There is a related larger dynamic, too, about food production on a societal level. Without doubt, more land allocated to tobacco cultivation means less land allocated to food production, but this research focuses more on the individual level wherein farmers typically make their cropping decisions based on their household finances not on the broad society's food needs. These results are important, but preliminary, and more research on both crop selection decisions and household calorie intake as it relates to these decisions is necessary to explore this dynamic better (for example, how much does calorie intake vary with the amount of land owned/cultivated for tobacco and food crops, and/or income).

## CONCLUSION

This research demonstrates strongly that **tobacco farming is not a particularly lucrative enterprise for most smallholder tobacco farmers in Kenya**. In fact, once most farmers incorporate even a conservative estimate of the value of their labour, their actual profits diminish to next to nothing, or even worse, in a number of cases, they are facing indebtedness. Whether entering into contracts with leaf-buying companies is good economically for farmers is unclear and appears to depend considerably on which contracting firm and where the farmer is cultivating leaf (among other factors). However, the results do demonstrate that contract farmers are disproportionately dissatisfied with how their crop is evaluated and priced.

The results also demonstrate that a **lack of access to credit continues to drive many farmers toward growing tobacco**. In many ways, it is perceived as the “easiest” path to earning a living, which is somewhat ironic when the high labour intensity of this endeavour is factored into the calculation of the financial reward (or lack thereof). In a related finding, **market access challenges for alternative agricultural goods presents a major barrier to switching to alternative livelihoods**.

It is clear from these results that tobacco farming should not be any part of Kenya's broader economic development strategy. **Tobacco farming is likely hindering, not helping, economic development in the tobacco growing regions in Kenya**. Considering the enormous industriousness of Kenyan tobacco farmers – the results demonstrate unequivocally that these individuals work incredibly hard – it makes considerable economic sense for the government to aggressively seek viable alternative livelihoods that would help them.

If Kenya's government is serious about fulfilling its commitment to WHO FCTC Article 17 and helping tobacco farmers explore new viable livelihoods – an idea to which many farmers indicate openness – it will be necessary to consider the challenges around access to credit. On a related note, because farmers have enormous demonstrable concerns about the quality of the markets for many alternative goods, the government will need to consider how it might play a role helping to improve them. A part of the market dynamic almost certainly includes supply chains – alternative crops typically need value chains that function better and will permit farmers to sell their goods for a price that generates consistent and reasonable profit for them. To complicate things, in many ways, the tobacco industry has been a model of successful supply chains – but the problem has been that it has disproportionately benefitted the buyers and not the farmers.



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For most farmers, the living from tobacco growing is certainly not better than from other crops. Furthermore, it is usually at the expense of the farmer's health and land since tobacco growing can cause green tobacco sickness among other ills (Arcury and Quandt, 2006) and the cultivation of tobacco is very input-intensive (fertilizer, pesticide and herbicide) putting enormous burden on the land and surrounding environment (Eriksen et al, 2015).

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