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Food Security Research Project (FSRP) and
Division of Agricultural Statistics (DSA)

Ministry of Agriculture, Livestock and Forestry

MINAGRI

Research Report

Decaffeinated? Situation, Trends and Prospects for Smallholder Coffee Production in Rwanda

Analysis of a Rural Household Survey, 2002

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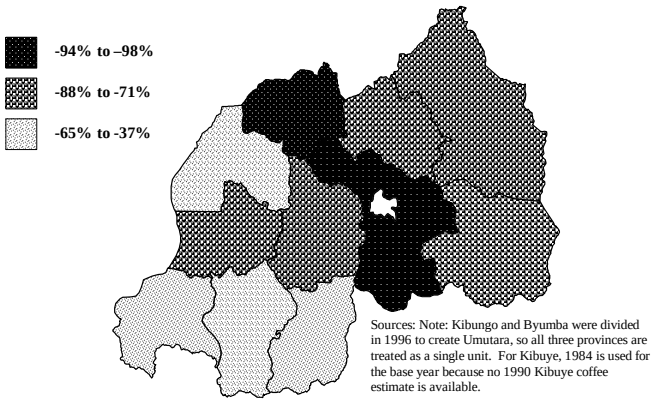
Introduction[1]

The world market for coffee is changing rapidly. Among the changes are an emphasis on improved quality and greater consideration of how coffee is grown and marketed (Ponte). Important new producers of bulk quality coffee (especially in Vietnam) have driven down world market prices (Gionvannucci, 2001). Rwanda's production and marketing system for coffee has not kept pace with changes in the global high quality market, so prices are down. Farmers have responded to the price declines, so recent Rwandan coffee exports are less than half what they had been in the 1980s (Loveridge et al., 2002). Figure 1 (drawn from Donovan, Mpyisi and Loveridge, 2002) shows the extent of the decline in coffee production by province.

Most Rwandan coffee is grown and processed in much the same way as it was a decade or longer ago. A major factor in the decline of Rwanda's world market position has almost certainly been the lack of political stability. The country was simply not in a position to attract international donor and private sector investment in systems to take full advantage of the natural agro-climatic conditions that seem to be favorable for production of the kind of high quality coffee that can attract premium prices in world markets. Recently, Rwanda has regained some measure of political stability so it is appropriate to assess on-the-ground conditions in the coffee sector as a way of informing public and private decision-making for future investments. Despite the challenges in coffee marketing and production, coffee remains one of Rwanda's most important official sources of foreign exchange. Because its goods must transit difficult overland routes through other countries to reach port, Rwanda does not have natural advantages for many forms of export. The fact that the coffee sector survives at all in the face of numerous unfavorable conditions is a weighty testament to its potential. This report shows that the sector appears to be at a turning point—significant numbers of farmers have moved away from coffee with more seemingly on the cusp of removing more trees, or "decaffeinating" their fields.

Figure 1. Change in Coffee Production by Province 1990 – 2001



Sources: Note: Kibungo and Byumba were divided in 1996 to create Umutara, so all three provinces are treated as a single unit. For Kibuye, 1984 is used for the base year because no 1990 Kibuye coffee estimate is available.

[1] Acknowledgements. Etienne Bihogo answered some key questions about conversion ratios early in the analysis presented here. Michael T. Weber and Valerie Kelly provided valuable comments on earlier versions of this document. Participants at a seminar on "Research for Agricultural and Rural Development" in Kigali, Rwanda on September 5, 2002 provided comments helpful in preparing the final version. We thank in particular our discussant at the seminar, Mr. Murekezi Anastase for his thorough and thoughtful review.

While the overall picture presented in this report is one of decline, there are also some encouraging changes. In the 1920s and 1930s as part of a program to expand coffee production in Rwanda and Burundi, the Belgian administration put in place aggressive policies. Output did increase (Miracle, 1967, p. 268), but the policies left a legacy of restrictive requirements: coffee fields had to be mono-cropped and mulched; once planted, coffee fields could not be taken out of production. Liberalization of coffee policies in the mid-1990s seems to have increased yields by taking the poorest fields out of production and intercropping may provide a means of stretching Rwanda's most limiting resource—land area.

This study complements ongoing effort at the National University of Rwanda and elsewhere to stimulate the coffee sector—those efforts are primarily in the area of improved marketing and production techniques. This study provides a national assessment of farmer attitudes towards coffee and identifies characteristics of small versus large producers. The word "large" must be used here with caution. The largest coffee plantations in our national sample are quite small on the international scale. The survey, fielded in the first months of 2002 and covering the 2001 coffee crop year, replicates many of the questions posed by Rwalinda et al. in 1991 (reported in 1992). At several points this document takes advantage of the 1991 study to provide the reader with precise information on how much the sector changed over the intervening decade.

The rest of this document is laid out as follows. First we briefly describe the survey method. Then characteristics of households growing coffee are compared with those who do not grow coffee along with a look at cropping activities that compete with coffee. Because grower attitudes and practices may vary according to whether the farmer has many or few trees, a system of categorizing growers by number of trees is established. A major section of the document then follows in which grower characteristics and attitudes are broken down by these "number of tree" categories to help identify how various types of farmers maintain their trees and how they are likely to behave in the future. A short section then looks at the relationship between grower categories and overall household consumption. The document concludes with implications for policy. Throughout the document, information supplemental to the household survey is included where relevant. In particular, comparisons to the 1992 study provide some sense of trends.

Survey Method

The survey questions were posed to rural Rwandan households in MINAGRI's Food Security Research Project sample. A small team of enumerators circulated among households drawn in a multi-stage sampling procedure designed with assistance from the U.S. Bureau of the Census. As a household-based survey, the data do not include activities from commercial enterprises. The lack of data on commercial agriculture is not a big impediment to analysis of coffee in Rwanda as nearly all of the coffee production is on small farms managed by households.

The sample design is used to develop weights so that each household represents the population and probability of selection in its region. Readers interested in further details of the sample design are referred to the Food Security Research Project's (2002) report on 2001 agricultural production, livestock and land use inventory.

The survey was fielded in January and February 2002[2]. The total number of useable survey responses was 1576 although naturally not all farmers answered all questions. In particular, farmers not engaged in coffee production were not asked many questions. The survey instrument is a modified version of the one used by Rwalinda et al. (1992) in 1991. The full survey instrument is available in its English form in Appendix 1. An important consideration in viewing the results below is that farmers have established trust relationships with the enumerators—by the time the survey was fielded the enumerators had been visiting these same households to collect other types of information for two years—thus the responses are likely more candid than would be the case in a more typical single-visit survey.

Coffee Growers and Non-Growers

Figure 1 in the introduction documents the extent of production change in Rwanda. Production, of course, is a function of yield and area. An examination of the reasons for the drop in production follows. Table 1 shows a large reduction in the proportion of farmers cultivating coffee fields—nationally 55% of smallholders grew coffee in 1991 versus only 30% in 2002. The number of agricultural households has grown since 1991, but not enough to offset the decline in the proportion of farmers growing coffee. In absolute terms, the number of farmers with coffee fields dropped from 678,375 in 1991 to 437,196 in 2002—in other words, roughly a quarter million fewer households engage in coffee production.

Of those households not currently growing coffee, 18% (177,026 households) expressed interest in growing coffee in the future. The last column in Table 1 provides information on the provincial distribution of households interested in taking up coffee production. The distribution is quite uneven across the country; efforts to help farmers get into coffee production are best be concentrated in zones where interest is high and agro-climatic conditions are favorable.

Nationally, 18% of those who do not currently grow coffee have grown it in the past. Of those non-growers with prior experience in coffee, the most frequently mentioned year for getting out of coffee production was 1994—the year of the genocide (Table 2). One can imagine the following scenario might be true in many cases: 1. Fields were not maintained in the genocide time and growers lacked labor needed to maintain trees after the genocide. 2. After the genocide, liberalization of coffee policy included allowing farmers to uproot coffee trees, and farmers with poorly maintained fields had less reason to stay in production.

Non-growers also reported their reasons for not growing coffee—irrespective of whether they were interested in coffee or not. The results are presented in Table 3. A result that might at first blush seem surprising--given the long downward trend in prices--is that only 1.9% of those not growing coffee listed low prices as the primary reason. However these are non-growers, most of whom have never tried to sell coffee; and as noted above most of those with prior experience with coffee haven't been growing for some years. Among non-growers, the principal reason for not growing coffee was that the region is not well adapted to coffee culture—over three quarters of non-growers in Gikongoro, Gisenyi, and Kibuye listed this as

[2] In some cases, the 1991 questions were modified to better reflect prevailing conditions in 2001. For example, in questions relating to price, 2001 prices were used as the benchmark instead of 1991 prices. Also, in 1991 it was against government policy to uproot coffee stands. The law has since been changed and the 2002 questions reflect the change. A number of questions asked in 1991were not repeated because Rwalinda et al. did not report results from those questions or the questions did not seem central to current policy issues.

the major inhibiting factor. After agro-climatic reasons, the lack of land was by far the greatest impediment to farmers not growing coffee. This is a hint that improving yields—either on coffee or other crops--might be key in the recovery of Rwanda's coffee sector. We return to the question of yield later in this study. A substantial minority (10%) of non-growers felt coffee was just not worth the effort—an indication that returns to labor may be better in other crops or other activities. It is perhaps telling that the greatest response in this "too demanding" category came from Kigali Rurale (nearly 30%), where proximity to the major city may create easier access to off- and non-farm work than elsewhere in Rwanda.

Table 1. Percent of Farms with Coffee Fields, 1991 and 2002 Number of Coffee Smallholders, 2002 Number of Non-growers Interested in Coffee, 2002

	2002	1991	Change	Number of Households with Coffee Fields, 2002	Non-growers Interested in Coffee, 2002
BUTARE	50%	83%	-33%	71,257	27,061
BYUMBA	30%	35%	See Eastern Zone	43,597	24,028
CYANGUGU	63%	76%	-13%	65,253	9,451
GIKONGORO	22%	51%	-29%	21,070	1,333
GISENYI	28%	40%	-12%	45,273	1,695
GITARAMA	54%	67%	-13%	86,085	8,044
KIBUNGO	19%	69%	See Eastern Zone	26,559	29,716
KIBUYE	22%	21%	-1%	20,463	1,333
KIGALI RURAL	27%	77%	-50%	46,297	22,128
RUHENGERI	1%	16%	-15%	1,450	34,222
UMUTARA	15%	N/A	See Eastern Zone	9,890	18,016
EASTERN ZONE	23%	49%	-26%		
RWANDA	30%	55%	-25%	437,196	177,026

Notes. The 1991 data are from Rwalinda et al. The borders of Byumba and Kibungo were redrawn in 1996 to form Umutara, so all three are combined here into the Eastern Zone for purposes of the change comparison.

Table 2. Non-Growers' Prior Experience with Coffee and Year They Quit Producing Coffee

		Year Respondent Stopped Growing Coffee	
	Non-Growers with Prior Coffee Experience	**Mean**	**Mode**
BUTARE	37.5%	1993	1994
BYUMBA	20.5%	1992	1994
CYANGUGU	35.3%	1997	2001
GIKONGORO	11.4%	1987	1995
GISENYI	0%	N/A	N/A
GITARAMA	36.7%	1993	1992
KIBUNGO	24.0%	1989	1994
KIBUYE	1.1%	1999	1999
KIGALI RURAL	27.1%	1993	1994
RUHENGERI	9.4%	1982	1990
UMUTARA	13.2%	1987	1994
RWANDA	18.0%	1991	1994

Table 3. Non-grower Reasons for Not Growing Coffee, 2002

	Low Income, Low Price	Low Productivity in This Region	Land Shortage	Too Complicated to grow, too demanding	Not Interested	Lack of Seedlings	Lack of Money to Invest in Coffee	Other
BUTARE	1.5%	2.5%	52.5%	16.1%	9.8%	3.0%		14.5%
BYUMBA	.7%	27.6%	33.3%	14.7%	10.1%	10.3%		3.3%
CYANGUGU	3.9%	8.0%	68.4%	11.3%	1.4%		1.1%	5.9%
GIKONGORO	.8%	74.5%	15.3%	2.2%	.9%	2.7%		3.6%
GISENYI		94.1%	3.0%			1.5%		1.5%
GITARAMA	6.0%	14.4%	53.1%	1.8%	6.8%			17.9%
KIBUNGO	2.4%	23.5%	28.9%	16.2%	.8%	8.9%	4.4%	14.7%
KIBUYE	4.9%	83.3%	9.2%	2.6%				
KIGALI RURAL	.7%	13.6%	41.6%	29.9%	2.8%	2.8%		8.6%
RUHENGERI	2.1%	36.7%	6.4%	1.3%	7.0%	.9%		45.6%
UMUTARA		8.7%	30.7%	24.2%	19.0%	15.1%	.8%	1.6%
RWANDA	1.9%	37.4%	26.8%	10.7%	5.0%	3.9%	.6%	13.7%

Tables 4 and 5 provide insights into coffee's competitor-crops. Using detailed monthly household 1990 income, purchase and sales data, Kangasniemi (1998) found that the beer banana is coffee's major competitor—a result confirmed by Rwalinda et al.'s 1991 data. In 2001, it is clear that the beer banana is still an important competitor with coffee as a cash crop, although down considerably from a decade earlier. In 1991, 40% of coffee-growing households listed banana beer as their most important cash crop, while in 2001 only 15% listed the beer banana as most important. The percentage of households mentioning coffee as their number one cash crop remained unchanged between 1991 and 2001 at 34%.

Table 4. Most Important Cash Crop (Percent of coffee-grower households mentioning)

	Beans	Peanuts	Sorghum	Cassava	Sweet Potato	Cooking Banana	Beer Banana	Coffee	Vege-tables
BUTARE	9.1%	19.4%		8.3%		1.7%	21.5%	26.2%	1.4%
BYUMBA	5.4%	1.8%	13.5%	11.0%	2.4%	3.5%	24.7%	30.8%	
CYANGUGU	12.0%	2.8%	2.3%	1.6%	5.7%	12.3%	12.3%	31.3%	1.6%
GIKONGORO					3.2%		3.2%	87.8%	
GISENYI				3.5%			20.0%	56.7%	16.1%
GITARAMA	5.3%	12.0%	2.1%	18.5%	5.9%		3.9%	26.3%	2.7%
KIBUNGO	24.5%	15.7%	2.8%			19.9%	4.8%	14.9%	4.2%
KIBUYE	10.4%			15.8%	2.6%		34.3%	28.8%	
KIGALI RURAL	15.5%	5.9%	1.3%	2.0%	1.3%	2.0%	21.4%	37.3%	5.2%
RUHENGERI			100.0%						
UMUTARA	26.2%		14.1%	3.5%		35.3%	16.6%		
RWANDA	9.1%	7.7%	3.0%	7.7%	2.7%	4.7%	15.3%	33.5%	3.5%

Note: crops mentioned by fewer than 2% of households nationally are dropped from this table for the sake of brevity.

Coffee also ranked high among mentions as second and third most important cash crops; 15% and 12% of coffee-growing households listed the crop in these categories. Adding responses for first, second and third together yields 60% of coffee-growing households characterizing coffee as an important cash crop. In terms of cropping for purposes of **consuming** the harvest within the household, beans, sweet potatoes, manioc, and cooking bananas ranked the highest among growers (Table 5).

Table 5. Most Important Consumption Crops (Percent of coffee-grower households mentioning; up to three crops per grower)

	Beans	Sweet Potatoes	Manioc	Cooking Bananas
BUTARE	98	91	67	5
BYUMBA	100	94	21	45
CYANGUGU	92	69	62	22
GIKONGORO	97	97	91	0
GISENYI	100	100	34	34
GITARAMA	98	96	89	1
KIBUNGO	88	64	66	54
KIBUYE	66	96	85	6
KIGALI RURAL	92	71	75	9
RUHENGERI	100	100	0	0
UMUTARA	96	60	21	80
RWANDA	95	86	64	19

Note: crops mentioned by fewer than 6% of households nationally are dropped from this table for the sake of brevity. See Table A2.5 in Appendix 2 for a full list of consumption crops by grower category.

Defining Categories of Large and Small Growers

An analysis that looks only at average behavior can miss important patterns. To facilitate comparisons of small and larger growers, a method of categorizing them by size is proposed here. One might think of categories based on land area, production, or sales, and these would be reasonable choices. The total number of coffee trees on the farm (including those not in production) was selected as the key category variable for size comparisons because it eliminates bias associated with price and yield variability. For example, a grower might produce a lot of coffee but receive a lower-than-average price due to location or quality considerations, so using a revenue measure might under-report productivity of some areas. Similarly, a grower might have a lot of trees but harvest few beans due to localized unfavorable weather, blight, or infestation. Land area under coffee has its own sources of bias, as measurement of area is difficult under Rwandan land tenure conditions and further complicated by intercropping. So total number of trees was selected as the best measure of farmer commitment of resources and overall capacity to produce coffee.

On average, coffee growers in Rwanda tend 155 trees, down only slightly from the 177 reported by Rwalinda et al. for 1991 (p. 11). The 2001 distribution of number of trees among the coffee-growing respondents ran from 5 to 1350. This distribution was broken down into four logical intervals, each with twenty to thirty percent of growers. Table 6 shows the distribution of the "number of trees" categories by Province and for the country as a whole, while Table 7 shows the proportion of each category located in a particular province[3]. So Table 6 tells us that 44.1% of Kibungo growers have 200 to 1350 trees, while Table 7 says that 8% of Rwanda's growers in the "200 to 1350" tree category live in Kibungo Province. In other words, Kibungo doesn't have many coffee growers, but many of its coffee growers are large by Rwandan standards. Tables 6 and 7 also show that except for Ruhengeri, every Province has at least a few growers in the "large" category.

[3] Table A2.2 in Appendix 2 shows that the mean number of trees by province in each category is roughly in the middle of the category, except in the 200 to 1350 category, where the mean number of trees is 331.

Table 6. Percent of Coffee Growers in Each "Number of Trees" Category 2002

	Number of Trees				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
BUTARE	28.1%	19.2%	22.5%	30.3%	100.0%
BYUMBA	20.0%	22.5%	32.9%	24.5%	100.0%
CYANGUGU	18.6%	28.7%	15.8%	36.9%	100.0%
GIKONGORO	17.1%	21.4%	18.0%	43.5%	100.0%
GISENYI	19.3%	30.1%	31.5%	19.1%	100.0%
GITARAMA	13.8%	20.7%	26.7%	38.8%	100.0%
KIBUNGO	12.9%	21.3%	21.7%	44.1%	100.0%
KIBUYE	N/A	13.3%	20.3%	66.5%	100.0%
KIGALI RURAL	18.8%	19.7%	38.9%	22.6%	100.0%
RUHENGERI	100.0%	N/A	N/A	N/A	100.0%
UMUTARA	43.2%	37.6%	12.8%	6.4%	100.0%
RWANDA	20.8%	22.9%	26.4%	29.9%	100.0%

Table 7. Distribution of Growers by Number of Trees Across Provinces 2002

	Grower Category (number of trees)				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
BUTARE	29.6%	18.4%	18.7%	22.2%	22.0%
BYUMBA	12.0%	12.3%	15.6%	10.2%	12.5%
CYANGUGU	7.9%	11.1%	5.3%	10.9%	8.9%
GIKONGORO	5.2%	5.9%	4.3%	9.2%	6.3%
GISENYI	12.9%	18.4%	16.6%	8.9%	13.9%
GITARAMA	8.8%	12.0%	13.4%	17.2%	13.2%
KIBUNGO	3.3%	5.0%	4.5%	8.0%	5.4%
KIBUYE		.8%	1.0%	2.9%	1.3%
KIGALI RURAL	11.7%	11.2%	19.1%	9.8%	13.0%
RUHENGERI	2.3%				.5%
UMUTARA	6.2%	4.9%	1.5%	.6%	3.0%
RWANDA	100.0%	100.0%	100.0%	100.0%	100.0%

Characteristics of Coffee Growers by Number of Trees; Potential for Crop Shifts

Table 8 provides insights as to the productivity of various categories of grower. Small growers (5 to 49 trees) account for roughly 21% of coffee farms, but only 5% of total national output. On the other end of the spectrum, roughly 30% of coffee farms are in the 200 to 1350 tree category and produce over 54% of the crop. Cyangugu stands out as a province with 15% of total national production coming from large producers in this region. Careful readers will note that the total national production reported here is substantially higher than the 9.7 thousand tons reported in FSRP's regular production statistics (FSRP/DSA publication No. 5F). Discussions with FSRP staff concluded with the consensus that the figures in Table 8 are more accurate. First, they more nearly match the figures coming from OCIR on coffee exports. Second, enumerator turnover in Gisenyi province occurred between the end of the 2001 B Season and the coffee survey—Gisenyi's coffee survey estimate was higher than the regular production survey coffee estimate. FSRP field supervisors felt that the work quality of the replacement enumerator was higher than that of the outgoing enumerator. Third, Table 8 is produced from a question near the end of a survey focused exclusively on coffee, while FSRP's regular survey covers all crops as well as a selection of other activities. It is quite likely that for the coffee survey, respondents self-selected for the person in the household most actively engaged in coffee production and marketing, and therefore able to produce more accurate responses.

Table 8. Production of Parchment Coffee by Grower Category and Province 2001

	Grower Category (number of trees)									
	5 to 49		50 to 97		100 to 198		200 to 1350		All	
	Kg	%	Kg	%	Kg	%	Kg	%	Kg	%
BUTARE	106281	1%	135085	2%	184172	2%	717284	8%	1193390	10%
BYUMBA	94492	1%	122450	1%	483556	5%	439064	5%	1197242	10%
CYANGUGU	92192	1%	104245	1%	155162	2%	1382137	15%	3598377	30%
GIKONGORO	15351	0%	29975	0%	1765	0%	559032	6%	611535	5%
GISENYI	102464	1%	773177	8%	1261725	14%	781992	8%	3017641	25%
GITARAMA	13208	0%	60633	1%	72865	1%	480255	5%	885857	7%
KIBUNGO	3626	0%	52185	1%	82831	1%	348180	4%	694318	6%
KIBUYE	.	.	0	0%	6443	0%	112627	1%	315662	3%
KIGALI RURAL	0	0%	40979	0%	139696	2%	131376	1%	396720	3%
RUHENGERI	8701	0%	.	.	.	.	.	.	8701	0%
UMUTARA	19088	0%	85686	1%	43758	1%	28764	0%	177295	2%
RWANDA	455404	5%	1404415	15%	2431973	26%	4980711	54%	12096738	100%

Note: "All" category includes those growers who were not able to estimate the number of trees on their farm. The totals in the "all" column are therefore greater than the sum of the preceding columns.

Table 9 shows the average productivity per tree by grower category. Smaller growers appear to produce more per tree, perhaps due to more labor availability per tree or more fertile soils. Overall productivity per tree is improved since the 1991 data were collected; Rwalinda et al. (p. 39) reported average output per tree at .27. Some of the improved productivity is very likely due to the liberalization of Rwanda's coffee policies—as farmers are allowed to uproot coffee it stands to reason that the least productive stands would be the first to be eliminated, thereby increasing the overall average production per tree. Nationally, Cyangugu and Gisenyi have the highest productivity per tree. Kigali's productivity is very low. The overall productivity per compares unfavorably with the yields typically experienced in the region. Using a regional[4] standard of 2.5 to 3.75 kg cherries per tree[5] and a conversion factor of .3081 kg dry parchment coffee per kg cherries (computed from Coste p. 206), yields should be on the order of .77 to 1.15 kg dry parchment coffee per tree. Table 9 shows that the average grower experiences yield per tree less than half the lower end of the range. Clearly there is still much room for yield improvement. The lower overall average productivity per tree in the larger grower categories may be partially explained by the fact that they may have more immature trees—Table 10 shows that more growers in the "large" category have planted trees in the past six years. Table 11 considers the average yield per tree by grower category when trees out of production due immaturity or other reasons are removed from the computation. The essential conclusion is the same—lower productivity per tree among the largest two categories of growers.

Another potential explanation for the variation in yields across grower-categories is that growers with more trees have a labor constraint and are not able to do as much pruning, mulching, composting and other yield-enhancing activities per tree as smaller growers. A third possibility is that smaller growers may have more very small stands of coffee, so that trees do not compete with each other as much. Finally, land with more fertile soil in Rwanda was settled earlier, so it has been divided through more family generations, resulting in smaller farms. Small growers may simply enjoy the benefits of more fertile soil.

[4] Burundi, Rwanda, Tanzania, and Uganda.
[5] Personal communication, Etienne Bihogo, July 29, 2002.

Table 9. Average Grower Production (Kg Dry Parchment) per Tree by Grower Category and Province,2001 (Farm-level average, all trees)

	Grower Category (number of trees)				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
BUTARE	.41	.39	.15	.18	.25
BYUMBA	.48	.28	.32	.26	.33
CYANGUGU	1.04	.39	.37	.44	.49
GIKONGORO	.26	.10	.02	.17	.16
GISENYI	.42	1.08	.71	.42	.71
GITARAMA	.28	.28	.17	.21	.22
KIBUNGO	.13	.33	.26	.15	.20
KIBUYE	.	.00	.08	.17	.11
KIGALI RURAL	.00	.23	.14	.13	.15
RUHENGERI	.33	.	.	.	.33
UMUTARA	.34	.55	.25	.25	.39
RWANDA	.42	.49	.33	.25	.35

Note: averages are "farm-level" averages—i.e., the yield experienced by the average farmer in each category. This is different than "tree-level" averages computed by dividing the national coffee production by the national number of trees. The same table using "tree-level" averages is produced in Appendix A.

Table 10. Percentage of Growers Planting New Trees in Past Six Years By Grower Category and Province 2001

	Grower Category (number of trees)				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
BUTARE	0	0	7	12	5
BYUMBA	12	14	18	33	20
CYANGUGU	47	9	18	55	35
GIKONGORO	0	0	0	17	7
GISENYI	0	13	14	21	12
GITARAMA	0	0	11	23	12
KIBUNGO	43	0	76	50	44
KIBUYE	n/a	0	0	50	33
KIGALI RURAL	0	0	0	17	4
RUHENGERI	0	N/a	N/a	n/a	0
UMUTARA	15	25	0	0	16
RWANDA	8	6	12	26	11

Table 11. Average Production (Kg Dry Parchment) per Tree by Grower Category and Province, 2001 (Tree-level average of trees "in production")

	Grower Category (Number of trees)				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
BUTARE	.44	.40	.20	.18	.21
BYUMBA	.42	.34	.50	.26	.36
CYANGUGU	1.00	.54	.00	.61	.65
GIKONGORO	.34	.12	.02	.24	.22
GISENYI	.65	1.31	.79	.38	.64
GITARAMA	.26	.29	.26	.24	.25
KIBUNGO	.56	.61	.66	.25	.32
KIBUYE	n/a	n/a	.08	.33	.19
KIGALI RURAL	n/a	.29	.15	.14	.18
RUHENGERI	.33	n/a	n/a	n/a	.33
UMUTARA	.37	.63	.38	.25	.43
RWANDA	.46	.61	.44	.29	.36

Tables 12 and 13 provide insights about grower access to land. Logically, growers with more trees also tend on average, to have access more land for their total farm operation (Table 12), and those with few (many) trees tend to fall disproportionately into low (high) quartiles of household land access (Table 13). The computed correlation[6] between land area and coffee production is relatively high at .61, but not statistically significant. The correlation[7] between land area and total number of trees is lower at .208, but statistically significant at the 1% level.

Table 12. Average Total Land Area (all uses) by Grower Category and Province 2001

	Grower Category (Number of Trees)			
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**
BUTARE	1.02	1.61	1.76	1.17
BYUMBA	1.18	.60	1.36	1.48
CYANGUGU	.33	1.38	.66	1.55
GIKONGORO	2.04	1.03	1.62	2.05
GISENYI	.21	.46	.82	.49
GITARAMA	.92	.63	.79	1.59
KIBUNGO	2.38	1.15	1.42	1.40
KIBUYE	n/a	.39	.65	1.74
KIGALI RURAL	.31	1.50	1.61	1.23
RUHENGERI	.60	n/a	n/a	n/a
UMUTARA	.48	.70	1.10	.18
RWANDA	.84	1.00	1.28	1.36

Note: Land area observations were missing for a few households in Season B 2001.
In these cases, Season A data were used as a proxy for Season B data.

Table 13. Household Total Land Area Quartile by Grower Category 2001

Total Farm Land Area (Quartiles)	Grower Category (Number of Trees)				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	
Lowest	38.4%	17.2%	25.5%	19.0%	100.0%
Second	24.7%	33.5%	24.9%	17.0%	100.0%
Third	23.3%	25.7%	19.4%	31.7%	100.0%
Highest	10.6%	16.4%	32.7%	40.2%	100.0%
All	21.4%	22.4%	26.4%	29.8%	100.0%

Note: Land area observations were missing for a few households in Season B 2001.
In these cases, Season A data were used as a proxy for Season B data.

Table 14 provides information on how farmers intend to use land allocated to coffee trees if prices stay at current levels. Slightly over half of growers would maintain their coffee plantation at current prices; about one-third would make some kind of shift in cropping patterns—including 9.5% who would replace coffee completely. The predominant shift would be towards intercropping. Table 15 provides the same information as in Table 14, but broken down by province instead of grower category. Cyangugu, Gikongoro, and Gisenyi are the provinces likely to see the most radical shifts in cropping patterns if prices stay at early 2002 levels.

[6] Pearson correlation calculated on the unweighted sample.
[7] Pearson correlation calculated on the unweighted sample.

Table 14. Farmer's Predicted Use of the Land they Now Allocate to Coffee over the Next Year if Prices Stay at Current Levels By Grower Category

	Grower Category (number of trees)				
Likely Change in Farmer's Use of Land Under Coffee	**5 to 49**	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
Complete replacement	10.3%	7.3%	9.2%	11.0%	9.5%
Intercrop	34.2%	27.4%	21.1%	22.1%	25.6%
Reduce Area				2.5%	.7%
No change in Area	36.2%	60.2%	62.3%	56.7%	54.7%
Increase Area	4.5%			1.3%	1.3%
No response	8.0%	2.6%	5.0%	5.1%	5.1%
Other	6.9%	2.5%	2.4%	1.3%	3.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Table 15. Farmer's Predicted Use of the Land they Now Allocate to Coffee over the Next Year if Prices Stay at Current Levels By Province

	Complete Replacement	**Intercrop**	**Reduce area**	**No Change in Area**	**Increase Area**	**Other**	
BUTARE		25%		61%	3%	10%	100%
BYUMBA	10%	25%	2%	57%	2%	3%	100%
CYANGUGU	15%	63%	4%	17%		1%	100%
GIKONGORO		79%		18%		3%	100%
GISENYI	19%	42%		39%			100%
GITARAMA	17%	1%		81%		1%	100%
KIBUNGO	14%	11%		71%	4%		100%
KIBUYE	4%	42%	4%	50%			100%
KIGALI RURAL	11%	5%		84%			100%
RUHENGERI		100%					100%
UMUTARA	4%	29%		67%			100%

If farmers shift away from coffee, a natural next question is what they will shift towards. Tables 16 and 17 address this question. Bananas and beans are the clear preference for farmers taking out coffee fields, while beans are the predominant crop of choice for inter-cropping with coffee.

Table 16. Crop Choices Among Coffee Growers Intending to Replace Coffee (% of households—up to 3 responses per household)

	Grower Category (number of trees)				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
Beans	62.1	80.1	58.1	50.3	60.2
Soy	20.0			11.4	8.4
Sorghum	17.9			7.7	6.7
Maize		12.6			2.2
Cassava	25.3	10.5	25.8	18.1	20.4
Sweet Potato		10.5		22.4	9.6
Bananas	74.7	77.0	100.0	29.5	66.0
Coffee*				14.8	5.1
Others			16.0	25.6	12.9

*A few growers in Gitarama intended to switch a new variety of coffee

Table 17. Crop Choices for Inter-cropping with Coffee (% of households—up to 3 responses per household)

	Grower Category (number of trees)				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
Beans	81.6	84.9	59.6	72.0	75.1
Peas				3.8	1.0
Peanuts			11.4	6.6	4.2
Soy	12.8	11.8	4.2	18.5	12.2
Sorghum				3.3	.9
Maize				5.8	1.5
Cassava	12.9	2.8	6.9	2.1	6.3
Irish Potatoes		2.3	6.6	6.6	3.7
Sweet Potato	16.3	4.1	18.1	3.4	10.3
Colocase	29.8	9.5	16.9	21.9	20.0
Bananas	16.9	23.1	11.3	25.6	19.5
Vegetables	2.4		7.3		2.2
Others		3.1			.8

Table 18 shows that despite lower yields per tree, growers more heavily invested in trees are in general more likely to engage in various activities to increase yields. Overall pesticide use is down compared to 1991. Mulching is also down--as expected since Rwanda no longer requires farmers to mulch coffee. A slightly larger proportion of farmers attempt to improve soil fertility through organic or inorganic methods than was the case in 1991. A detailed report on coffee maintenance differences among growers is the subject of another report based on the same survey. The report is "Rwandan Smallholder Coffee Tree Maintenance and Cherry Processing Techniques" by Loveridge et al. (forthcoming).

Table 18. Maintenance of Trees by Grower Category in 2001 and Comparison to 1991

	Grower Category (number of trees)					
Type of Coffee Tree Care	**5 to 49**	**50 to 97**	**100 to 198**	**200 to 1350**	**All Growers in 2001**	**All Growers in 1991**
Weeding	80.4%	92.1%	85.5%	93.2%	88.3%	76%
Pruning	73.6%	80.3%	91.4%	95.3%	86.3%	92%
Mulching	46.7%	77.8%	72.4%	76.6%	69.5%	96%
Compost during planting	45.2%	43.9%	58.1%	70.0%	55.8%	*
Compost after planting	14.1%	9.8%	11.5%	15.4%	12.8%	10%
Chemical Fertilizer	6.9%	12.3%	9.7%	10.4%	9.9%	2%
Pesticide	38.5%	50.8%	60.1%	72.2%	57.1%	96%

*"Compost during planting" not reported by Rwalinda et al.

Growers seem less satisfied with the impact of pesticides on their production than they were in 1991. Table 19 shows how growers rated pesticides in 2002. In 1992, Rwalinda et al. reported that 74% of growers rated pesticides as "very good", so the 2002 data represent a substantial drop in the highest category of satisfaction. Although most of the movement was to the next highest category—"good", this is still an area that bears careful attention in the future. Roughly 38% of growers were interested in increasing their use of pesticides (Table A2.3) and despite official concerns about this issue, less than 8% of growers admitted using pesticides intended for coffee on other crops (Table A2.4). Possible reasons for decreased satisfaction with pesticides include: 1) under the liberalized coffee policy, farmers now have to pay for pesticide that was formerly distributed to growers free of charge; and 2) farmers

may be spreading too little pesticide on too many trees as a way of reducing their costs—and thereby fostering development of pesticide resistant strains.[8]

Table 19. Grower Assessment of Effectiveness of Pesticide Use By Grower Category and Comparison with 1991 Results

	Grower Category (Number of Trees)					
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All Growers in 2002**	**All Growers in 1991**
Very good	48.7%	31.6%	37.5%	33.4%	36.3%	74%
Good	21.5%	46.6%	48.3%	41.3%	41.5%	16%
Acceptable	11.5%	10.3%	7.3%	14.8%	11.4%	4%
Ineffective; insects are resistant	3.0%	3.8%	1.1%	1.9%	2.2%	6%*
Ineffective; poor method or timing of application	12.9%	4.9%	2.3%	5.7%	5.6%	
Other	2.5%	2.9%	3.4%	2.9%	3.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

*Reasons for lack of effectiveness were not reported by Rwalinda et al.

Average farm gate price for coffee sold by farmers in the 2001 season was 175 francs per kilo with considerable variation among provinces (Table 20). Coffee prices in a liberalized market should reflect variations in the costs of transport and assembly, as well as quality. Figure A2.1 in Appendix 2 illustrates how the price data fall into consistent geographic zones—the three southwestern provinces clearly enjoy a price premium over other parts of Rwanda.

Table 20. Average Coffee Grower Selling Price Per Kilo and Percent of Growers Who Thought Buyer Cheated on Weight By Province, 2001

	2001 Price	Unfair Weight?
BUTARE	190	41%
BYUMBA	186	40%
CYANGUGU	211	42%
GIKONGORO	272	0%
GISENYI	165	29%
GITARAMA	138	0%
KIBUNGO	162	41%
KIBUYE	239	10%
KIGALI RURAL	129	6%
RUHENGERI	167	0%
UMUTARA	131	15%
RWANDA	175	24%

Enumerators asked coffee growers a series of questions about future prices. They asked the price at which growers would uproot trees due to low prices, the price at which the grower would stop maintaining and harvesting the fields (i.e. temporarily abandon them), the price at

[8] The authors gratefully acknowledge Munyankusi Laurent for contributing the theories on reasons for lower satisfaction with pesticides.

which the compensation for the grower's effort would be fair, and the price at which the grower would be motivated to plant additional trees. Table 21 shows the responses by grower category while Table 19 breaks it down by Province. By comparing Table 20 with Table 22, we can see that three provinces—Gisenyi, Kibuye, and Umutara—were in 2001 within the range of the "abandon fields" threshold for producer prices. In no case was the average provincial 2001 price anywhere near the level that growers reported for "fair compensation" or the price that would lead them to increase the size of their coffee stands.

Table 21. Grower Attitudes on Price by Grower Category

Average Hypothetical Coffee Price per Kilo to:	**Grower Category (Number of Trees)**				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
Uproot Trees	102	106	107	111	107
Abandon Coffee Fields	135	140	145	134	139
Receive Fair Compensation)	338	372	406	423	390
Plant More Coffee	391	427	435	438	425

Table 22. Grower Attitudes on Price by Province

Average Hypothetical Coffee Price per Kilo to:	**BUT**	**BYU**	**CYA**	**GIK**	**GIS**	**GIT**	**KGO**	**KBY**	**KIG RUR**	**RUH**	**UMU**	**RWA**
Uproot Trees	100	109	92	144	119	93	99	103	121	100	76	103
Abandon Coffee Fields	118	149	130	151	173	118	123	146	151	100	131	136
Receive Fair Compensation	352	355	376	342	432	419	385	419	421	250	237	386
Plant More Coffee	357	363	476	345	530	421	387	506	463	300	278	429

Overall, according to growers' responses to this series of questions, prices would have to increase by 245% to stimulate a planting response from the average farmer. Perhaps more important than the averages of grower responses to these various questions are the "tipping points" associated with each question. A "tipping point" is defined here as a price at which a substantially more than 10% of growers say they would change behavior as a result of a relatively small change in price levels. Tipping points are determined here from the cumulative distributions shown in Figures 2 through 5. A tipping point occurs where the slope of the lines in Figures 2 through 5 is steep. The cumulative distributions show the following tipping points. **Increased coffee tree plantings at:** 300, 400, and 500 frw/kg. **Uprooting of trees at:** 150 and 100 frw/kg. **Abandoning trees at:** 200, 150 and 100 frw/kg.

Figure 2. Cumulative Distribution of "Fair" Price as Reported by Coffee Growers

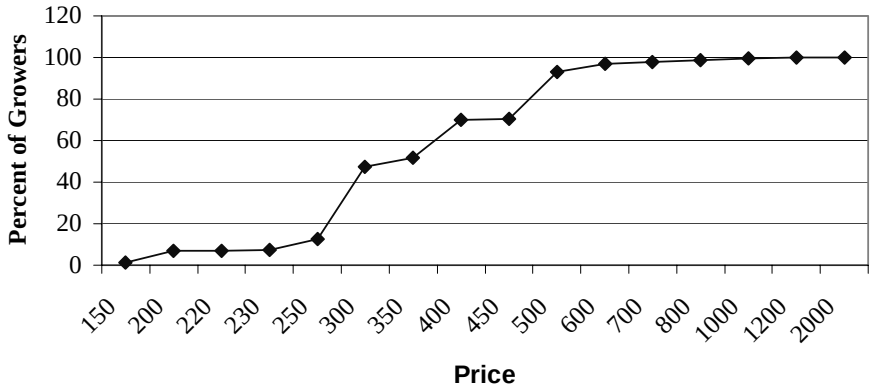


Figure 3. Cumulative Distribution of Price at which Growers Report they Would Uproot Coffee Trees

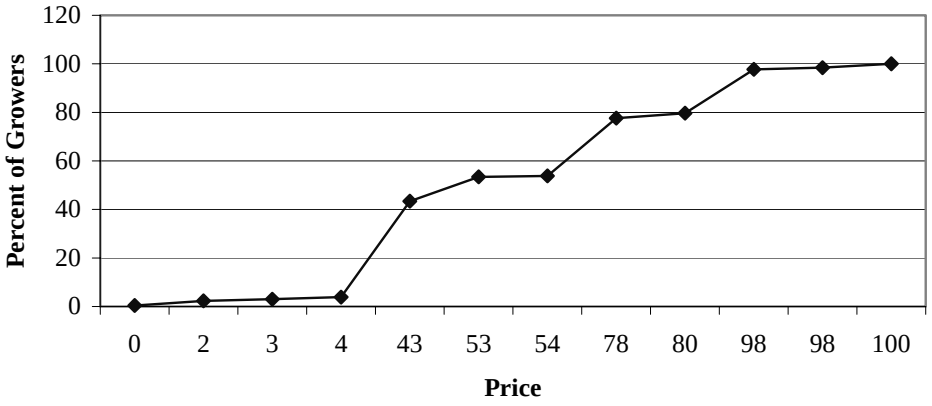


Figure 4. Cumulative Distribution of Price at Which Growers Report they would Abandon Coffee Fields

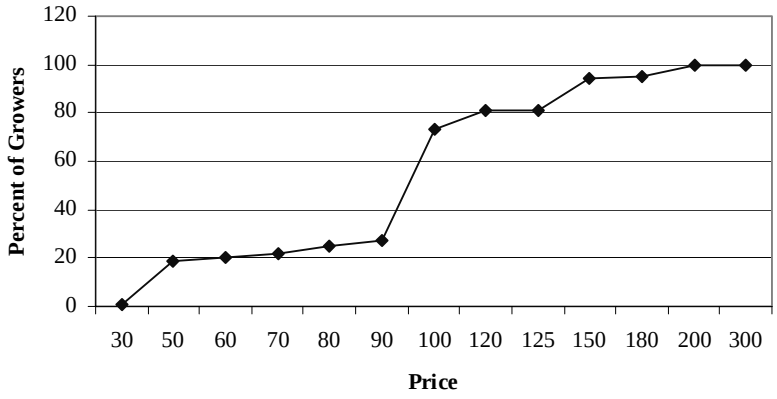
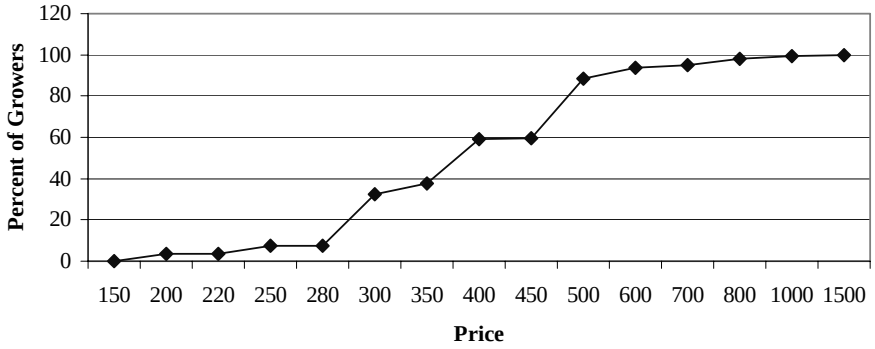


Figure 5. Cumulative Distribution of Price at which Growers Report they would Plant More Trees



It should be noted that under marketing conditions, farmers typically receive a price for average quality coffee; there is no system for providing higher prices for higher quality coffee. If higher prices are offered for high quality coffee without concurrent systems to help farmers raise overall quality, then a likely scenario is sorting of coffee into different grades without raising the overall average prices much.

A final question on the survey asked growers to say what they suggested for improving Rwanda's coffee sector. It is important to consider the fact that this was the final question, including many responses not tabulated in this document[9]. Therefore, grower responses may have been influenced by the questions preceding the final question. The results are tabulated in Table 23, which shows the percent of growers mentioning the suggestion. Since each grower could mention up to four suggestions, the total percentages add to more than 100. Compare the suggestion on prices to that reported earlier in this document: only 1.9% of non-growers listed price as a primary reason for not growing coffee—as stated earlier, these farmers for the most part have not experienced prices—at least not recently. Clearly the percentage of non-growers who mention this in the future will rise if steps are not put in place to improve the profitability of growing coffee—we are not suggesting here a return to government-imposed price controls; measures to improve marketing, yields or quality, or to reduce costs are needed.

Table 23. Grower Suggestions for Ways to Improve Coffee in Rwanda (Percent of growers. Multiple response--up to four suggestions per grower.)

Grower Suggestions	Grower Category (Number of Trees)				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
Stop Price Declines/Increase Prices	82.1	66.3	75.4	81.9	76.7
Provide/Improve Pesticides	49.6	51.7	49.6	54.8	51.7
Provide Fertilizer	30.9	30.0	38.3	26.1	31.2
Provide Tools for Pruning	18.6	32.9	21.5	23.6	24.2
Better Control Over Trader Pricing	15.2	14.3	17.1	27.4	19.2
Provide Tools for Pesticide Application	20.6	17.6	15.3	21.6	18.8
Provide Washing Stations	13.3	15.8	22.4	17.1	17.4
Provide Drying Mats	2.7	20.0	8.5	18.6	13.0
Improve Extension Agents	13.4	7.6	10.9	16.2	12.3
Replace Costly Mulching Material	5.6	2.8	5.3	4.2	4.5
Improve OCIR Quality/Period of Pesticide Treatment	4.4	7.4	2.7	3.3	4.3
Establish Grades	2.3	4.9	3.2	4.1	3.7
Provide Sprays	2.6	3.8	4.7	2.2	3.3
Provide Stores to Buy Coffee Inputs	2.8	.6	5.4	3.4	3.2
Resolve Disease Problems	4.1	1.2	3.3	1.2	2.3
Better Evaluate Whether it is Necessary To Keep Coffee	2.1		1.6	1.4	1.3
Replace Mulching Material that Attracts Pests		1.3			.3
Other	25.8	25.4	26.9	16.5	23.2
	100.0	100.0	100.0	100.0	100.0

Coffee Growers, Non-Growers, and Indications of Consumption

The coffee survey sample is the same as that used by the Food Security Research Project. The FSRP team coordinated samples with a group conducting a national living standards

[9] Many of the untabulated questions are discussed in Loveridge et al. (forthcoming).

survey. Through cooperation of MINIFINECO, we are able to insert their living standards survey results into the coffee data. The living standards analysis included computation of a household consumption variable. Household consumption includes the value of products grown and eaten on the farm as well as purchased goods and services. The household total consumption is adjusted for number of people in the household and age of members of the household. Households are ranked by consumption per adult equivalent and then the sample is divided into five equal-sized categories to establish the consumption quintiles. The consumption quintile is judged the best overall indicator of household income available from the living conditions survey. Here we cross-tabulate quintiles of household consumption with key responses from the coffee survey. Tables 24 and 25 show a weak positive relationship between level of consumption and level of involvement with coffee. Kangasniemi reported a strong relationship between coffee growing and household income in his analysis of 1990 data. The relationship here may be fairly weak as a result of the declining world market price for the type of coffee Rwanda produces.

Table 24 Household Consumption and Grower-Non-Grower Status

Consumption Quintile	% of Households Growing Coffee
1st	28.2%
2nd	29.1%
3rd	30.3%
4th	35.5%
5th	30.6%
All	30.9%

Note: data on consumption quintiles supplied by the EICV study.

Table 25. Household Consumption and Grower Category

Consumption Quintile	**Grower Category (Number of Trees)**				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	
1st	29.1%	25.5%	28.3%	17.1%	100.0%
2nd	22.4%	20.4%	29.4%	27.8%	100.0%
3rd	20.8%	20.6%	28.5%	30.2%	100.0%
4th	22.6%	14.9%	26.2%	36.2%	100.0%
5th	10.9%	33.6%	20.2%	35.3%	100.0%
All	20.9%	22.2%	26.6%	30.3%	100.0%

Note: data on consumption quintiles supplied by the EICV study.

Conclusions

The coffee sector in Rwanda appears to be at a turning point. Substantial percentages of producers have stopped growing coffee in recent years. More are considering changes that will place emphasis on alternative crops, notably beans and bananas. Further price decreases (25 Frw, or 14%) from 2001 prices will bring even more coffee growers to the “tipping point” where they uproot their coffee. The Government of Rwanda must take these potential changes into consideration not only as it considers how to improve the coffee sector, but also in terms of its macro-economic and balance of trade planning. If overall production continues to decline, systems current in place to support production will also inevitably begin

to fail—traders will move to other crops, merchants will stop selling inputs, and community investments in processing equipment will not be replaced as the equipment ages.

Coffee yields, while better than in 1991, are still well below the standards established in nearby countries. Quality is also well below that achieved by nearby countries. So it is logical to focus on ways to improve the yields and quality of the area currently under crop. Improving the yield alone may help improve the quality by increasing the size of the average bean, but this is likely not enough.

The survey results suggest two areas of recommended future agronomic research that could contribute to increases in coffee production. **First**, many farmers are clearly interested in intercropping coffee and other crops. Principal among these crops is beans. Agronomic research into how best to harmonize intercropped beans and coffee could help reduce coffee-grower costs by effectively reducing the land area required by coffee and perhaps economizing on fertilizers. If beans can be grown without much negative effect on coffee yields, food availability and income might both be enhanced. It is important to establish research to determine where food and coffee can be intercropped in sustainable ways that make economic sense at prevailing prices. One could even conceive of a flexible system in which growers respond to variable world prices—when prices are high, putting more labor into improving coffee quality and dropping beans; when prices are low, putting labor into intercropping beans and coffee. If beans compete with coffee in a way that is economically unsustainable, then efforts to teach farmers about the fertility and yield consequences of this practice are needed soon.

The second area of agronomic research priority is the further investigation of farmer experiences with pesticides. The comparison with the 1991 survey results on pesticide effectiveness is worrying if the trend continues. It would be worthwhile to find out more about situations in which existing treatments are less effective than a decade ago and to begin researching economic alternatives. If resistance to existing treatments is truly growing, the threat to Rwanda's coffee output is real. On the other hand, growers may be applying the pesticides inappropriately. In that case, increased efforts to help them learn appropriate application rates and techniques are needed. If labor is not a constraint for certain growers, increased visual inspection and spot application may help reduce the overall quantities required, thereby increasing the ratio of benefits to cash outlays.

The results of this study highlight Cyangugu as a province deserving of special attention in future coffee production and marketing enhancement efforts. The reasons for a focus on Cyangugu are the following. 1. A high concentration of larger growers; these smallholders are in general more apt to use inputs. Larger growers may also be easier to work with in establishing processing facilities to improve coffee quality. 2. High yield per tree relative to other areas of the country. 3. Many Cyangugu growers are considering altering the use of fields now dedicated to coffee. 4. For non-growers, the modal year of leaving coffee production (2001) was more recent than other provinces, so it may be easier to bring some of these growers back to coffee. 5. Given that high quality coffee must be washed within eight hours of picking, washing stations may be more profitably located close to areas with highly concentrated production. Washing stations in these areas are more likely to attract significant volumes of high quality coffee within the eight hour radius needed for technical reasons.

The Butare washing station established by the UNR/PEARL project is a bold experiment in assessing the technical feasibility of bringing high quality coffee to the international market. Efforts to improve processing and marketing of coffee must be complemented with research

and extension work geared towards improving the quality of the average bean harvested from Rwandan trees. The Extension work must go hand in glove with establishment of washing stations. If overall quality is not improved, the effect of better processing for the high quality market on farmers incomes may be less than desired. Beans may simply be sorted and priced by grade, with too little effect on average prices to motivate farmers to make productivity enhancing investments and changes in cropping methods.

Efforts to complement the Butare washing station experience are also needed. The Butare work will help establish costs and benefits for a station with a certain tonnage of processing capacity. It is important to explore costs and benefits of various scales of washing stations. In some countries, growers all wash their own coffee on their own plantations with mini-washing stations. This eliminates a major bottleneck with larger scale systems—the need to get the coffee washed within eight hours of picking the cherries. But do Rwanda's small-scale growers—even those in the larger categories—grow enough coffee to make these mini-stations work?

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APPENDIX 1: COFFEE SURVEY INSTRUMENT

ID: |_____| Household: |_____|	
Name of head of hh:_____	Verification by:_____
Name of enumerator:_____	Date of verification:_____
Date of interview:_____	Data entry by:_____
Commune:_____	Date of data entry:_____

1. A. Do you grow coffee? _____[q1a]

1- Yes (go to sub-questions i. and ii. then to Q3)-------->> i. Number of years farming |____| [q1ai]

ii. Number of years growing coffee |___| [q1aii]

2- No

B. Would you like to grow coffee? _____[q1b]

1- Yes
2- No

C. What is the main reason stopping you from growing coffee ? _____[q1c]
(circle only one code)

1- Low income, low price
2- Low productivity in this region
3- Shortage of land
4- Too complicated to grow, too demanding
5- Not interested (reason:_
6- Lack of seedlings
7- Lack of technical advise
8- Lack of money to invest in coffee
98- Other:

D. Have you ever grown coffee in the past?_____ [q1d]

1- Yes
2- No (**End of survey**)

E. What is the last year that you planted coffee? 19 _____ [q1e]
(999 - Do not know)

(End of Survey)

2. What is your age? (age of person in charge of the coffee, estimate if necessary_____ [q2]

3. List, in order of importance, three crops that are most important for income and also for consumption.

1- Beans	14- Igname		
2- Peas	21- Bananas, cooking	Income	1st _____ [q3a1]
3- Peanuts	22- Bananas, beer		
4- Soya	23- Bananas, dessert		2nd _____ [q3a2]
5- Sorghum	30- Coffee		
6- Maize	32- Tea		
7- Wheat	60- Vegetables		3rd _____ [q3a3]
8- Millet	85- Fodder crops	Consumption	
9- Rice	98- Other:		1st _____[q3b1]
10- Cassava	_____		
11- Irish potatoes	___		2nd _____[q3b2]
12- Sweet potatoes			
13- Colocase			
			3rd _____[q3b3]

4. What is the number and age of your coffee trees (begin with the oldest trees).

A. Age of trees (years)	**B.** Number	**C.** In Production? 1= Yes 2 = No
_____ [q4a1]	_____ [q4b1]	_____ [q4c1]
_____ [q4a2]	_____ [q4b2]	_____ [q4c2]
_____ [q4a3]	_____ [q4b3]	_____ [q4c3]
_____ [q4a4]	_____ [q4b4]	_____ [q4c4]

Total number of trees _____ [q4b]

(9999 - Do not know number)

D. What variety of coffee do you grow? _____ [q4d]

1- Arabica only
2- Robusta only
3- Both arabica and robusta
4- Do not know
98- Other _____

5. A. Have you planted any new coffee trees in the past six years? [q5a]

1- Yes
2- No (**go to Q6**)

B. Where did you get the seedlings (the majority of the seedlings) ____ [q5b]
(circle only one code)

1- Nursery of OCIR, MINAGRI, commune, sector, project

2- Nursery of cooperative
3- Grew them by myself
4- Collected them from the field (wild)
98- Other:_____

C. What is the spacing in your coffee plantation?
(Use the spacing of the most recent planting)

999 - Do not know _____ [q5c1] meters by _____ [q5c2] meters

6. A. Do you prune your coffee (gukata) (inclure la taille d'entretien)? _____ [q6a]

1- Yes **(go to Q6c)**
2- No

B. Are there any reasons that don't allow you to prune? _____ [q6b]
(circle only one code)

1- Shortage of labour
2- Loss of income due to loss of cherries
3- No particular reason
4- Trees are still too young
98- Other:_____

(Go to Q7)

C. How often do you prune the same tree?

Number of times per year	i. Pruning (gukata) _____ [q6ci] ii. Egourmandage _____ [q6cii]

95- Less than one month per year
96- Whenever I pass through the plantation

7. **A.** Do you weed your coffee (weeding whole plantation)? _____[q7a]

1- Yes
2- Non **(go to Q8)**

B. How many times per year do you weed your coffee (weeding whole plantation)?
999 - Do not know _____ [q7b]

8. Do you use mulch in your coffee plantation? _____ [q8]
1- Yes
2- No **(go to Q12)**

9. In order of importance, which types of products do you use for mulching and where do you get them?

Products:

1- Banana leaves or stems
2- Sorghum or maize stalks
3- Pennisetum grass/urukangaga
4- Papyrus reeds? Ishinge (Eragrotis)
5- Leaves/products from the forest
6- Grass grown specifically for mulching
98- Other:_____

Products:

1st _____ [q9a1]
2nd _____ [q9a2]
3rd _____ [q9a3]

Source:

1- Collected from own farm
2- Collected elsewhere without buying
3- Collected from own farm and elsewhere without paying
4- Bought all
5- Collected some without buying and bought others
98- Other:_____

Source:

1st _____ [q9b1]
2nd _____ [q9b2]
3rd _____ [q9b3]

10. Did you use dung or compost on your coffee trees: —>

1 - Yes —> A. During planting _____ [q10a]
2 - No —> B. On trees in place (if yes **go to Q12**) _____ [q10b]

11. Is there a specific reason why you did not use dung or compost on trees already in place? (circle only one code)

1- I don't have animals / dung
2-
3- The soil is fertile enough
4- The mulch is enough and acts as compost
5- The dung or compost .....
6- I didn't know ...
7-The dung favors pests ....
98- Other:_____

12. Did you use chemical fertilizers on your coffee trees?:—> _____ [q12]

1- Yes (go to Q14)
2- No

13. Is there a specific reason why you did not use chemical fertilizers in your plantation? (circle only one code)? _____ [q13]

1- Fertilizers are not available in this region
2- Lack of money/cash to buy fertilizers
3- The soil is fertile enough
4- The mulch is enough and acts as fertilizer
5- Not profitable on coffee
6- I don't know about chemical fertilizers
7- Makes the crop vegetate too much resulting in losses??
98- Other:_____

14. Do you use pesticides on your coffee trees? _____[q14]

1- Yes **(go to Q16)**
2- No

15. Is there a specific reason why you don't use pesticides? _____[q15]

1- I don't have information on their use/don't know them
2- Not available in this region
3- No money/cash
98- Other:_____

(Go to Q21)

16 What distance do you have to travel to obtain the pesticides?
Minutes of walking (one way only) Minutes _____ [q16]

17. Are the pesticides then available:–>
1- Yes ----> When needed ? _____ [q17a]
2- No, never ----> Available in sufficient quantities ? _____[q17c]
3- No, not always
999 - Do not know

18. How do you normally treat your coffee for pesticides (The two most important ways)

1- With a cloth containing pesticides 2- With a sack that has a hole 3- With a personal machine for applying pesticides (powder form) 4- With a communal machine for applying pesticides (powder form) 5- With a sprayer 6- By vehicle/equipment of OCIR 7- By hand 98- Other:_____	1st _____ 2nd _____

19 A. How many times per year do you treat your coffee trees and during which months? (For a tree)?

Number of treatments per year _____ [q19]
Month of treatment _____ **[q19a1]** _____**[q19a2]** _____**[q19a3]** _____**[q19a4]** _____ **[q19a5]**
999 - Do not know

B. In your opinion what is the effect of the pesticide? (circle only one code) _____[q19b]

1- Very good
2- Good in general
3- OK
4- Not effective due to the resistance of insects
5- Not effective due to the method or timing of application
98- Other:_____

C. Would you like to treat or use pesticides on your coffee trees? _____ [q19c]

1- Yes
2- No **(go to Q20)**
3- No, but we have to improve current methods
(Go to Q20)

D. Are you ready to pay if the price for treatment is 2 francs/tree,
Meaning Frw _____ for all your trees?---->

1- Yes ---> i. Pay cash? _____ [q19d1]
2- No (**If yes go to Q20**)
3- To consider ---> ii. On coffee credit whatever the amount _____ [q19d2]

20. Last year did you use coffee pesticides on other crops? _____ [q20]

1- Yes
2- No

*** (N.B. If the farmer has coffee trees that are less than 3 years old **go to Q37)**

21. How much time passes between picking the berries and depulping/washing them? _____ [q21]

1- The same day
2- The next day
3- Part of it is done the same day and the other part the following day
4- Part of it the next day and the other part two days after
98- Other:_____

22. What method do you use to depulp most of your coffee after harvesting? _____ [q22]
(circle only one code)?

1- Depulp using a stone **(go to Q26)**
2- Sell the cherries to a washing station of OCIR (Nkore et Masaka), **(go to Q25 and then Q28)**
3- Sell cherries elsewhere **(go to Q25 then Q28)**
4- Depulp using my own depulping machine at home
5- Depulp using machines of other people who move around from house to house
6- Depulp at a depulping centre of OCIR, MINAGRI, commune
7- Depulp with a depulping machine elsewhere
98- Other:_____

23. What type of depulping machine do you use for most of your coffee? _____[q23]
(circle only one code)?

1- Locally made machine
2- Industrially made machine
98-Other:_____

24. How much do you pay for depulping?

A. Amount paid in Frw per sack of cherries Frw _____ [q24a]

B. Amount paid communally for the maintenance of the depulping machine or other equipment Frw _____ [q24b]

(**N.B.** if he pays in kind calculate the value in Frw)

25. What is the distance of the depulping machine from your home?

Minutes of walking (one way only) Minutes _____ [q25]

26. What do you do with the parchment coffee immediately after depulping? _____ [q26]

1- Dry it **(go to Q28)**

2- Leave it for some time in a container:----> --------> rusty _____[q26a]

1- Yes 2- No --------> with water _____[q26b]

3- Leave in a basket or sack

98- Other:_____

27. How long do you leave it in that state? _____ [q27]

1- For only one night

2- For 24 hours

98- Other:_____

28. How do you dry your coffee?

A. Time under the sun (circle only one code): _____ [q28a]

1- Leave it under the sun intermittently in the beginning

2- Leave it under the sun intermittently after one day or more

3- Leave it under the sun until it dries

98- Other:_____

B. Drying surface/material (by order of importance):

1- Drying net/mesh

2- Concrete surface

3- Ikidasesa or coffee drying mat

4- Other ikidasesa or mat 1st _____ [q28b1]

5- Iron sheet

6- On the ground 2nd _____[q28b2]

7- On a sack

98- Other:_____

C. Height of drying surface (Circle only one code, the most important): _____[q28c]

1- Raised

2- On the ground

3- We use both methods

29. A. Have you pruned your trees for regeneration (Gusazura)? _____ [q29]

1- Yes

2- No

30. A. What did you do with the coffee harvested in the off-season (2001) (circle only one code)? _____ [q30a]

1- Stored it until the official selling season
2- No harvest in the off-season
3- Sold it to traders at the price of _____ Frw/kilo _____[q30a1]
98- Other:_____

B. Quantity sold in kilos _____ _____[q30b]

31. How much coffee did you produce, including the small quantities sold?
(In kilos of cherries or parchment coffee)

A. Year	**B. Trees**	**C. Coffee**	**D. Coffee**	**E. Coffee**
	in production	**cherries**	**parchment**	**discarded**
		Production	**Production**	**(Not sold)**
	(Number)	(Kg.)	(Kg.)	(Kg.)
2002(forecast)	_____[q31b02]	_____[q31c02]	_____[q31d02]	_____[q31e02]
2001	_____[q31b01]	_____[q31c01]	_____[q31d01]	_____[q31e01]
2000	_____[q31b00]	_____[q31c00]	_____[q31d00]	_____[q31e00]

9999 - Do not know

Note: <u>If the production does not correspond with the number of trees for a given year ask questions to clarify/correct the anomaly.</u>

32. How much money did you make from coffee last year (2000)?

999999 - do not know Total amount received _____ [q32]

33. If the amount does not correspond to kgs. produced 2001 x 200, ask why, the principal reason? (circle only one code) _____ [q33]

1- The weight of the sack was not exactly 50 kilos
2- He sold too early while the price was below 200 Frw
3- The trader penalised him on the price because of the low quality of coffee
4- The trader cheated him on the price
5- The trader told him that the price in Kigali is down
6- The trader cheated him on the weight
7- The farmer got mixed up in answering the questions
8- He has not yet sold all his coffee
98- Other: _____

34. A. Did the trader cheat you on kilos? _____ [q34a]

1- Yes
2- No (go to Q35)

(If yes, verify that the kg which were reduced are the ones reported in Q31)

B. How many kilos did he cheat you out of?

999 - Do not know Total kilos reduced _____ [q34b]

C. What was his reason? _____[q34c]

1- Low quality - true
2- Bad quality - not true
3- Took advantage of limited market opportunities
4- To repay a debt
5- He did not give a reason
98- Other:_____

35. A. Have you ever taken credit (money or goods) to be repaid back by coffee?

1- Yes _____ [q35a]
2- No (go to Q36)

B. When was the last time you did this? Year |_____| [q35b]

C. Did he give you the official price for the correct quantity when you sold him the coffee?

_____[q35c]

1- Yes
2- No, he penalised me _____ Frw per kilo because of the credit [q35c2]
3- No, he reduced _____ kilos of coffee because of the credit [q35c3]
4- No, he penalised me on the price and the quantity because of the credit (fill in no. 2 and 3).
5- No, but not due to the credit.
98- Other:_____

36. A. Whom did you sell your coffee to last year (2001)?

1- Licensed roving trader
2- Licensed trader with a fixed store
3- Un-licensed trader roving trader
4- Un-licenced trader with fixed store
5- Rwandex
6- To a cooperative
7- To an OCIR washing station (cherries)
98- Other:_____

Buyer	Kilos sold	I owed them money? (1=yes 2=No)	Price Received per Kilo
_[q36a1]	[q36b1]	_[q36c1]_	[q36d1]_
_[q36a2]	[q36b2]	_[q36c2]_	[q36d2]_
_[q36c3]	[q36c3]	_[q36c3]_	[q36d3]_

37. If there was a system to control the quality where the price reduced if the quality was low, would you be willing to control the quality of your coffee if the price of good quality coffee was 200 Frw/kilo as opposed to 200 Frw/kilo for medium quality coffee?

_____ [q37]

1- Yes
2- No

38. What price of coffee would correctly compensate your input on coffee activities?

Frw/kilo _____ [q38]

39. A. If you had the choice to do whatever you wanted to do with your coffee trees what coffee price would make you abandon your coffee?

Frw/kilo _____ [q39a]

995 - I would wait for the price to raise (therefore, no low price)
997 - Fears the authorities to say anything (doesn't say anything)
999 - Do not know

B. What coffee price will make you uproot your coffee trees? Frw/kilo _____[q39b]

995 - No price
997 - Fears the authorities to say anything (doesn't say anything)
999 - Do not know

40. What price will make you increase the number of trees?

Frw/kilo _____ [q40]

995 - No high price (impossible or doesn't want to increase)
998 - Does not want to say
999 - Do not know

41. What do you plan to do with your coffee in the near future (from now to 2003)? (Circle only one code)?

1- Replace it with another crop such as (by order of importance) _____ [q4111] _____[q4112]
2- Maintain the same area under coffee but practice mixed cropping with other crops such as (in order of importance) _____ [q4121] _____[q4122]
3- Reduce the area under coffee at the expense of crops such as (in order of importance), _____ [q4131] _____[q4132]
4- Maintain the same area under coffee **(go to Q43)**
5- Increase the number of trees, 200 Frw per Kg is good for me
98- Other:_____

Crop Codes

1- Beans	6- Maize	12- Sweet potatoes
2- Peas	7- Wheat	13- Colocase
3- Peanuts	8- Rice	20- Bananas
4- Soya	10- Cassava	30- Coffee
5- Sorghum	11- Irish potatoes	32- Tea
60- Vegetables	85- Fodder crops	98- Other:_____

42. Is there a specific reason for these intentions (circle only one code)? _____[q42]

1- Coffee does not give enough income, price too low
2- No, no particular reason
3- Coffee is not productive in this region
4- There isn't enough land for coffee / it's reserved for the food crops
5- Growing coffee is too demanding/complicated
6- Growing coffee is not interesting (Reason:_____)
9- Shortage of labour for coffee growing
10- Coffee gives more income when it's grown by itself (pure stand)
11- Mixed cropping gives more income
13- Shortage of food

14- Fear of authorities
15- Too old to do otherwise
98- Other:_____
(To ask only if they have coffee trees over 30 years old)

43. After all these questions what are your recommendations for improving coffee?

1- Standardise the quality of coffee by traders
2- Control better the activities of traders with respect to price
3- Provide fertilizers
4- Provide / improve pesticides
5- Provide tools for applying pesticides
6- Provide tools for pruning
7- Provide washing stations or place them nearer
8- Provide drying mats
9- Provide spraying pesticides
10- Replace mulching material that is currently very expensive
11- Replace mulching material that brings pests for coffee
12- Avoid price drops / increase the price 1st _____ [q431]
13- Improve the quality / period of pesticide treatment of OCIR
14- Improve the quality / provide serious extension agents
15- Provide stores for buying inputs and selling coffee 2nd _____ [q432]
16- Evaluate better whether it's necessary to keep the coffee 3rd _____ [q433]
17- Resolve the disease problem
18- _____ 4th _____ [q434]

Special notes: (Indicate the number of the question)

Appendix 2—Additional 2002 Coffee Survey Results Tabulated

Table A2.1. Percent of Farmers Currently Not Growing Coffee Who Are Interested in Coffee Growing

BUTARE	38.4%
BYUMBA	23.4%
CYANGUGU	24.9%
GIKONGORO	1.8%
GISENYI	1.5%
GITARAMA	11.1%
KIBUNGO	26.8%
KIBUYE	1.9%
KIGALI RURAL	17.3%
RUHENGERI	20.3%
UMUTARA	33.0%
RWANDA	17.6%

Table A2.2. Average Number of Trees within Tree Size Categories by Province

	Number of Trees				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**Mean**
BUTARE	29	65	129	304	141
BYUMBA	35	68	132	340	149
CYANGUGU	34	64	139	368	183
GIKONGORO	21	71	126	353	195
GISENYI	29	70	142	267	123
GITARAMA	33	61	125	316	173
KIBUNGO	21	55	135	454	244
KIBUYE	.	50	100	605	429
KIGALI RURAL	35	64	125	227	119
RUHENGERI	18	.	.	.	18
UMUTARA	24	67	155	200	68
RWANDA	30	65	131	331	155

Table A2.3. Yield per Tree by Grower Category and Province, 2001

	Grower Category (Number of Trees)				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
BUTARE	0.20	0.16	0.10	0.12	0.12
BYUMBA	0.36	0.21	0.30	0.14	0.20
CYANGUGU	0.55	0.21	0.26	0.38	0.36
GIKONGORO	0.23	0.10	0.00	0.19	0.16
GISENYI	0.43	0.88	0.67	0.37	0.57
GITARAMA	0.07	0.12	0.05	0.10	0.09
KIBUNGO	0.08	0.27	0.17	0.11	0.12
KIBUYE		0.00	0.08	0.07	0.07
KIGALI RURAL	0.00	0.08	0.07	0.07	0.07
RUHENGERI	0.33				0.33
UMUTARA	0.21	0.38	0.24	0.25	0.29
RWANDA	0.24	0.31	0.23	0.17	0.20

Table A2.4. Pesticide User Interest in Increasing Pesticide Use or Treatments By Grower Category

	Grower Category (Number of Trees)				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
Yes	32.9%	40.8%	32.0%	41.8%	37.7%
No	38.3%	45.7%	47.1%	37.0%	41.7%
No, but need to improve current methods	28.8%	13.5%	20.9%	21.2%	20.6%
	100.0%	100.0%	100.0%	100.0%	100.0%

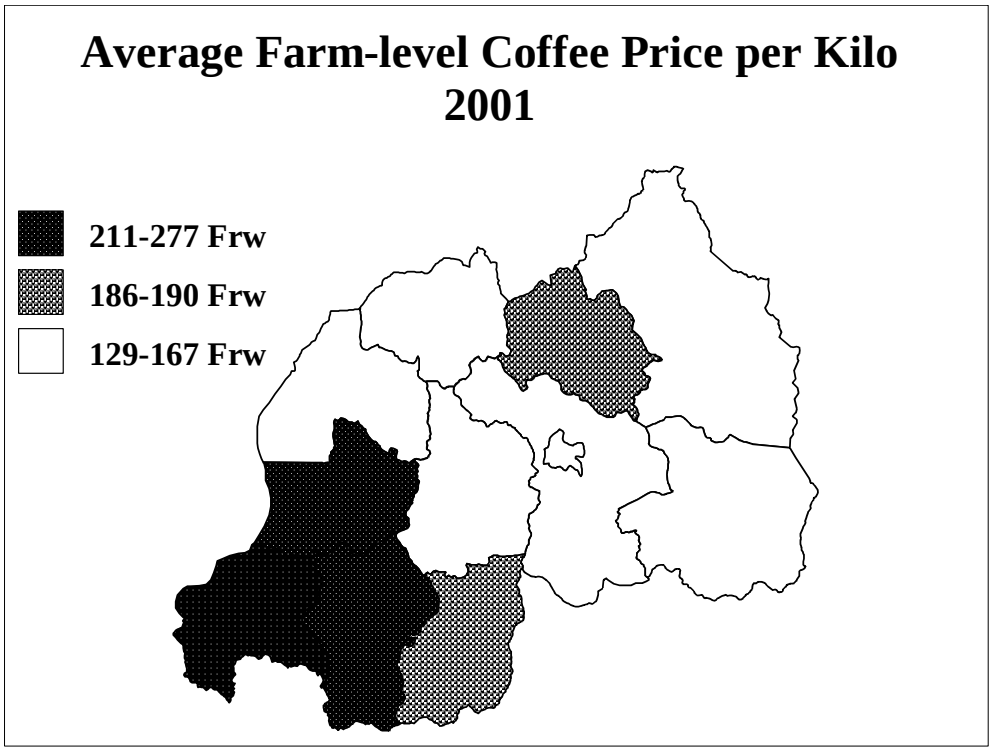
Table A2.4. Use of Pesticides on Other Crops

	Grower Category (Number of Trees)				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
Yes	5.1%	11.9%	4.7%	8.3%	7.6%
No	94.9%	88.1%	95.3%	91.7%	92.4%
	100.0%	100.0%	100.0%	100.0%	100.0%

Table A2.5a. Most Important Consumption Crops (Percent of coffee-grower households mentioning—up to three crops per grower)

	Number of Trees				
	5 to 49	**50 to 97**	**100 to 198**	**200 to 1350**	**All**
Beans	95.1	97.7	94.8	97.1	96.2
Sweet Potatoes	86.8	90.5	83.1	91.4	88.1
Cassava	56.3	51.2	67.2	62.6	59.9
Cooking Bananas	17.2	22.8	26.0	18.7	21.3
Colocase	7.5	4.1	6.5	3.8	5.4
Irish Potatoes	3.5	6.4	3.2	3.5	4.1
Peanuts	3.6	4.2	1.1	3.1	2.9
Soy Beans	6.7	1.7		2.7	2.6
Sorghum	5.5	2.8		2.7	2.6
Vegetables	2.0	4.8		2.5	2.3
Maize	2.5	2.7	2.1	1.1	2.0
Rice	2.2	1.0		2.4	1.4
Beer Bananas	1.4	.5	2.9		1.2
Peas			1.1		.3
Other		1.6	2.1	1.3	1.3

Figure A2.1.


Average Farm-level Coffee Price per Kilo
2001
211-277 Frw
186-190 Frw
129-167 Frw