REPUBLIC OF RWANDA

MINISTRY OF AGRICULTURE AND ANIMAL RESOURCES

CROP ASSESSMENT – 2009B SEASON

FINAL REPORT

July 2009

1. Introduction

The Ministry of Agriculture and Animal Resources (MINAGRI), in collaboration with RADA, the National Institute of Statistics of Rwanda (NISR), FAO and WFP organizes, each agricultural season, a crop assessment survey. One of the objectives of this survey is to estimate the food balance and plan for food requirements within the next six months. Also, results from this exercise are used in the estimation of the gross domestic product (GDP) and the contribution of the sector in the national economy.

Data are collected by enumerators recruited by MINAGRI, under the supervision of staff from MINAGRI, RADA, NISR, FAO and WFP. Field activities began on May 25th, 2009 and were completed on June 20th, 2009. Given the reason that all districts don't harvest at the same time, data collection began in Eastern and Southern Provinces and Kigali City (May 25th – June 6th) followed by the Western and Northern Provinces (June 8th – 20th).

2. Sampling methodology.

The methodology used in the crop assessment exercise is the one used for the National Agriculture Survey (ENA 2008) organized by the National Institute of Statistics of Rwanda (NISR), in collaboration with the Ministry of Agriculture and Animal Resourses. The sample size for the crop assessment survey respresents 25% of the National Agriculture Survey. At the first stage, 210 primary sampling units (PSU) or enumeration areas (EA) have been selected using the simple random sampling methode and then 15 households (12 for interview and 3 households for replacement) per EA have been selected. In fact, the same housenols selected for the ENA have been covered by the crop assessment exercise, which represent 2,520 sample households.

The sampling frame of the ENA is described in Gashaka Jacques « Sampling frame and estimation procedures », Novembre 2007. The summary of the sampling methodology is presented in annex 1.

3. Data collection methodology.

3.1. Area measurement

The shape of cultivated areas is not always of the regular form (triangle, rectangle…), but most of the fields under cultivation have rectangular shape (square or rectangle), others are triangular (triangle). We encounter also fiels that have irregular shape, having 5 sides or abore. In one or other case, the area measurement has been done by triangulation method (splitting the plot in triangles or rectangle). Hence, the area of the plot is the total sum of the surface areas of the triangles (or rectangle, square) created in that plot.

3.2. Density estimation and crop areas.

It's a common in Rwanda to have intercropping practice. In one parcel, it can be planted beans, sweet potato and sorghum. The question that arises is to estimate the area allocated to each of these crops, i.e, which area is allocated to a particular crop planted in this parcel in the absence of intercropping (one single crop in the parcel)?

Dessity of each crop in the parcel are roughly estimated de visu and standardized by dividing density for particular crop by the sum of the densities of all crops (the standardized densities sum up to 100). The area for each crop is equal to the standardized density multiply by the area of the parcel. These densities are used to estimate the percentage of land allocated to each crop by district. These estimates are applied to the total area under cultivation by district to obtain the total land for each crop.

3.3. Estimation of Production.

Under each particular piece of land, the enumerator mesure the quantity harvested or asks the head of household what quantity of each crop present in that parcel, to be harvested during season 2009B. The expected production includes the quantity harvested before the interview and the quantity to be harvested until december 2009.

The production can be expressed in different units of measurement (Kg, bag, basket, bucket, …). It is asked to the enumerator to convert these units in Kg.

3.4. Data processing and analysis.

Data entry mask has been designed using CsPro (Census and Survey data Processing). Data editing included the checking of range, structure and a selected set of checks for internal consistency. All errors detected during the editing procedure were corrected. Statistical tables have been prepared using SPSS. These tables were transfered to Excel spreadsheet for further calculations.

All crop and animal products were converted to their equivalent Kcal, proteins and lipids using the appropriate weights of each commodity. The population was estimated at mid seasonal time, August 31st, 2009. Assuming a daily adult requirement of 2100 kcal/capital/day, 59 g of proteins and 40 g of lipids (source ENA/MINAGRI), the total Kcal was shared among the Rwandan population for six months (181 days) calculated at August 31st, 2009.

Losses through cooking and post-harvest handling were estimated at 15% since most of the produce in Rwanda is consumed almost immediately.

Comparisons were made between production in 2008B and 2009B for the different crops and products. The food balance sheet was then computed using the following formula:

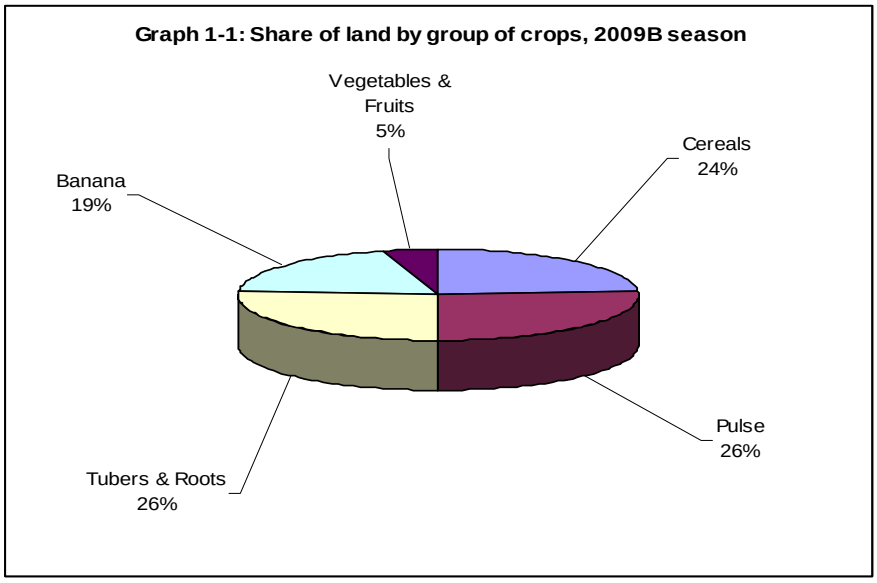
1. Available food for human consumption=2+3+4
2. Amount available in stock=0 (non estimated)
3. Production (x 1000 MT)=Energy (Kcal/Capital/day)/equivalent Kcal for maize (i.e. 3225.32 Kcal/Kg) x 1000
4. Losses = -0.15 x crop production
5. Needs = 6
6. Human consumption=2100x181daysxestimated population/3225.32/1000000
7. Balance/Deficit=1-5

4. Key Results.

4.1. Area under crop.

The land area measured in the crop assessment exercise consists of the land under cultivation and of which the planted crops will be harvested within the next six months following the end of the season.

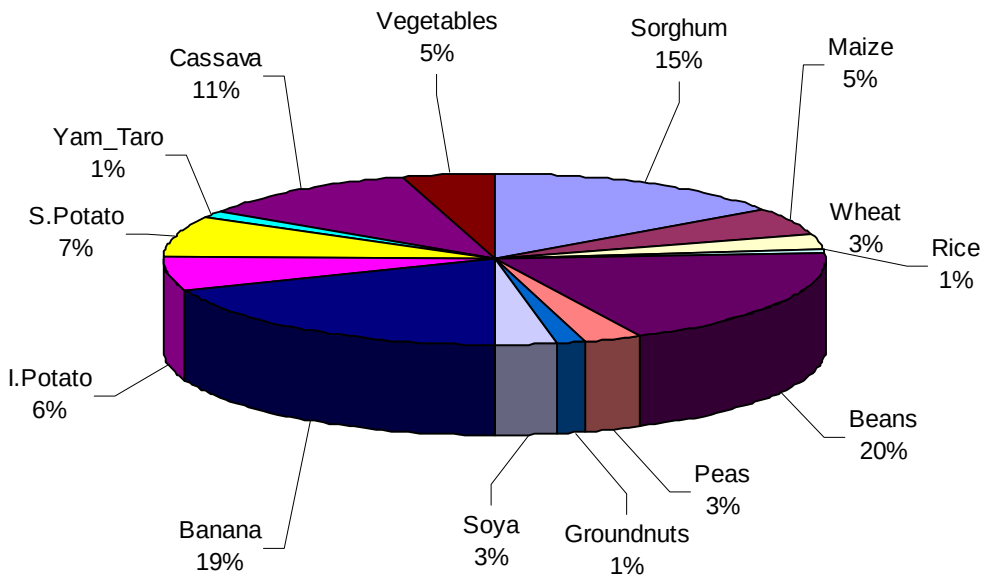
Graph 1-1 shows the share of land allocated to each category of crop in 2009B. The share of land allocated to pulses and tubers in 2009B stood at 26% each. This share was established in 2008B at 23% for pulses and 29% for tubers. The share of land under banana and cereals in 2009B did not change in 2009B; it represented 19% and 24% respectively.



The drop in area under banana may have been caused by the Banana wilt which attacked plantation in Eastern and Western provinces, thus compelling farmers to uproot attacked plants as a control measure.

At crop level, graph 1-2 shows the share of land allocated to each individual crop. The distribution of the share of land in 2009B for each individual crop is as follows: 20% for beans, 1% for rice, 3% for wheat, 5% for maize, 15% for sorghum, 11% for cassava, 7% for sweet potato, 6% for Irish potato and 19% for banana.

Graph 1-2: Share of land by crop, 2009B season



4.2. Agriculture production, 2009C.

This year, MINAGRI has put more emphasis on maize and vegetable production by distributing improving seeds and chemical fertilizers. The production of the season C occurs between July and the end of the year and therefore, it must be included in the food availability of the next six months (July – December).

There will be a major improvement of agricultural production of maize and vegetables in 2009C season. Efforts have been made in the distribution of improved seeds for vegetables and a new variety of maize will be planted.

During season 2009C, MINAGRI/Rhoda distributed 2,030 Kg of vegetable seeds to be planted on 788 Ha. Vegetable crops for which seeds have been distributed are African egg plants, brinjal, cabbage, carrot, cauliflower, concumber French beans, poivron and tomato. The great quantity of seed distributed is constituted of French beans which represent 54% of the total distributed seeds (Table 1-1).

Table 1-1: Vegetable seeds distribution in marchland, season 2009C

	Southern Province	Western Province	Northern Province	Eastern Province	Kigali City	Rwanda
African Egg Plant						
Qty of seeds/Kg	142.0	30.0	36.0	38.0	22.0	268
Area to be planted	56.8	12.0	14.4	15.2	8.8	107
Brinjal						
Qty of seeds/Kg	80.0	30.0	51.0	9.0	27.0	197
Area to be planted	22.9	8.6	14.6	2.6	7.7	56
Cabbage						
Qty of seeds/Kg	8.0	10.0	4.0	13.0	2.0	37
Area to be planted	26.7	33.3	13.3	43.3	6.7	123
Carotte						
Qty of seeds/Kg	74.5	71.0	25.0	10.5	0.0	181
Area to be planted	13.5	12.9	4.5	1.9	0.0	33
Cauliflower						
Qty of seeds/Kg	3.0	0.0	9.0	0.0	9.0	21
Area to be planted	6.0	0.0	3.6	0.0	18.0	28
Cucumber						
Qty of seeds/Kg	0.0	0.0	12.0	27.0	27.0	66
Area to be planted	0.0	0.0	4.8	10.8	10.8	26
French Beans						
Qty of seeds/Kg	0.0	50.0	225.0	475.0	350.0	1,100
Area to be planted	0.0	1.0	4.5	9.5	7.0	22
Poivron						
Qty of seeds/Kg	6.0	6.0	12.0	14.0	6.0	44
Area to be planted	6.0	6.0	12.0	14.0	3.8	42
Tomato						
Qty of seeds/Kg	46.5	16.5	0.0	37.5	15.5	116
Area to be planted	142.7	39.3	0.0	150.0	18.7	351
Total						
Qty of seeds/Kg	360.0	213.5	374.0	624.0	458.5	2,030
Area to be planted	274.5	113.1	71.8	247.3	81.4	788

Source: MINAGRI/Rhoda

Maize is also a focus for the CIP during season 2009C. Maize to be planted is a new variety called SC514 which can produce between 5 and 9 tons per hectare (According to MINAGRI/CIP). A total of 9,166 Ha is planned to be planted (Table 1-2).

Table 1-2: Area to be planted for maize, season 2009C

District	Area planned (Ha)
Bugesera	2,295
Ngoma	450
Rwamagana	120
Nyanza	600
Rulindo	50
Kayonza	350
Kamonyi	160
Ngororero	385
Gisagara	750
Ruhango	200
Nyamasheke	35
Nyaruguru	1,200
Nyabihu	1,771
Rutsiro	800
TOTAL	9,166

Source: CIP/MINAGRI

Expected yield for this variety of maize is at least 5 tons per hectare and yield for vegetables is estimated to be 11,071 Kg/ha. Thus, the expected production for season C is estimated at 45,830 Tons and 8,724 Tons respectively.

In summary, crop production in 2009C is presented in the following table.

Crop	Area planned	Yield (Kg/Ha)	Production in Tons	Production in Kcal (10^6)	Production (in cereal-equivalent) in Tons
Maize	9,166	5,000	45,830	147.8	45,830
Vegetable	788	11,071	8,724	4.6	1,426

The overall agricultural production of the season 2009B went up by 6.5% in comparison with the same season in 2008B. Production of almost all crops has increased with the exception of sweet potato and vegetables/fruits.

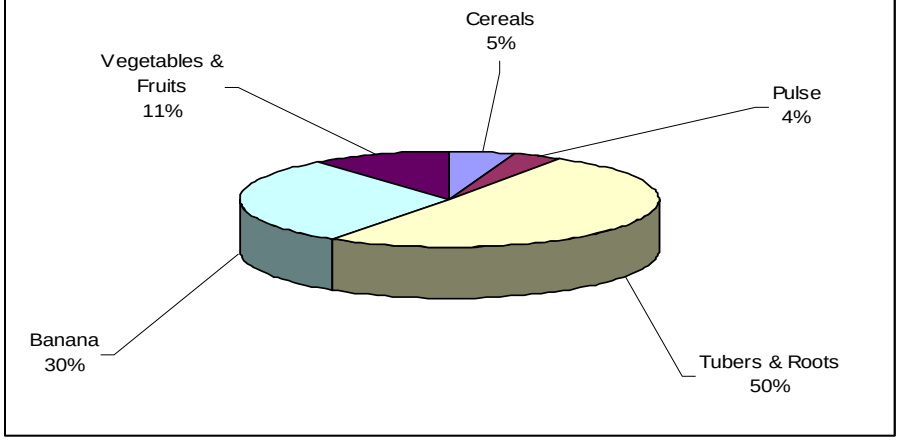
Sorghum, wheat and rice production increased by 17%, 14% and 38% respectively and most importantly, maize production has recorded an increase of 108%.

The production of beans increased by 11% in 2009B. Peas and groundnuts production increased by 82%, while soya production rose by 18% though it's yield declined by 1%, between 2008B and 2009B.

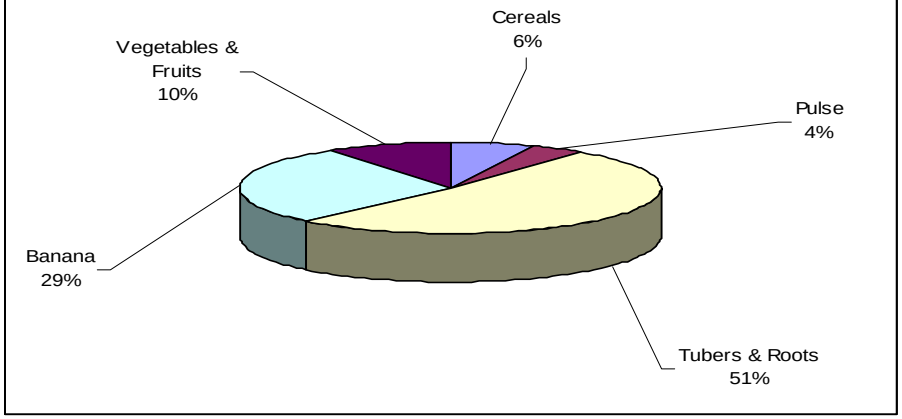
Within the category of tubers and roots, Irish potato, yam/taro and cassava production went up by 2%, 11% and 21% respectively; whereas sweet potato production decreased by 13%. Banana production registered a rise of 4%.

Graph 1-3 and 1-3 bis show that the share of tuber production represents at least the half of the total production in 2008b (50%) and 2009B (51%). The share of a crop is the ratio between the production (in quantity) of that particular crop and the total production The share of cereal production which represented 5% in 2008B went up and stand at 6% in 2009B; whereas the share of pulse remained unchanged. Went down from 30% in 2008B to 29% in 2009B.

Graph 1-3: Share of crop production, 2008B



Graph 1-3 bis: Share of crop production, 2009B



The main cause of the production increase in most of the cases is the improvement of the yield. The use of chemical fertilizers led to the increase of yield for cereals, i.e rice, wheat and maize. Moreover, the quality of maize seeds has been improved.

The wheat yield improved considerably, going from 961 Kg/ha to 1,371 Kg/Ha, with an increase of 43%. From 2008B to 2009B, the maize yield grew from 780 Kg/Ha (2008B) to 1,551 Kg/Ha (2009B), recording an rate of 99%. Yield for rice and sorghum went up by 28% and 17% respectively. The increase of sorghum yield can be explained by the fact that it has been cultivated in land previously occupied by another crop where fertilizers have been applied. Also, good weather contributed to the increase of the yield.

Yield for beans, peas and groundnuts grew by 2%, 39% and 49% respectively, while the yield for soya dropped by 1% between the two periods.

The yield for Irish potato and cassava increased by 4% and 5% respectively.

Similarily, yield for banana increased by 6%, which led to the increase of banana production though area under banana dropped by 1% as an impact of banana wilt. Table 1-3 below shows the evolution of the area under crop, yield and production between 2008B and 2009B. Detailed tables are presented in annex II.

Table 1-3: Area under cultivation, yield and production, 2008B and 2009B.

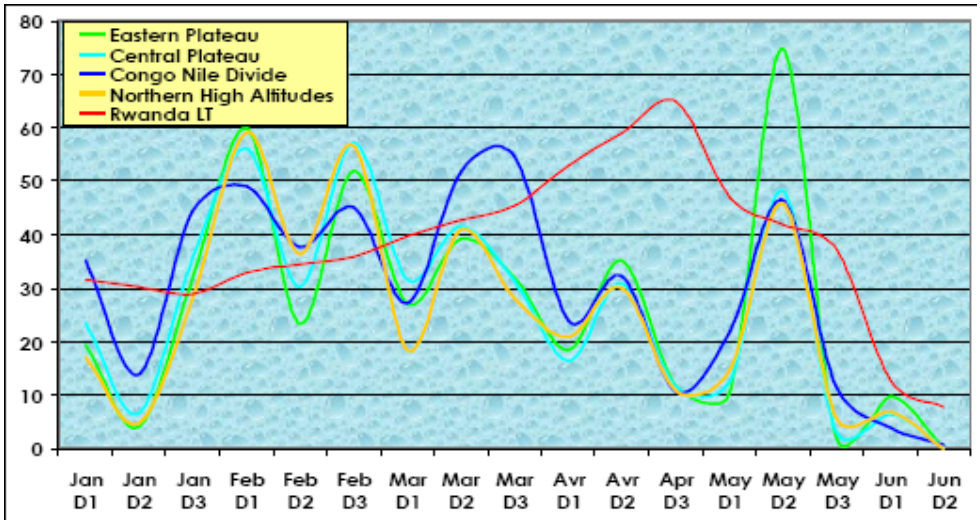
Crops	Area under crop(ha)		Share of land by crop		Yield (Kg/Ha)			Production (MT)		
	2008B	2009B	2008B	2009B	2008B	2009B	Change	2008B	2009B	Change
Sorghum	132,592	132,835	15%	15%	994	1,162	17%	131,800	154,376	17%
Maize	43,438	45,362	5%	5%	780	1,551	99%	33,863	70,344	108%
Wheat	31,172	24,923	4%	3%	961	1,371	43%	29,960	34,164	14%
Rice	7,327	7,868	1%	1%	4,636	5,942	28%	33,971	46,752	38%
Beans	154,024	167,040	17%	19%	827	843	2%	127,335	140,853	11%
Peas	17,723	23,245	2%	3%	548	762	39%	9,711	17,706	82%
Groundnuts	10,365	12,624	1%	1%	499	745	49%	5,172	9,404	82%
Soya	22,767	26,976	3%	3%	814	808	-1%	18,522	21,794	18%
Banana	171,045	168,659	19%	19%	7,574	7,960	5%	1,295,477	1,342,608	4%
I.Potato	58,380	57,100	7%	6%	10,091	10,537	4%	589,089	601,644	2%
S.Potato	96,761	65,989	11%	7%	5,567	7,139	28%	538,629	471,103	-13%
Yam_Taro	13,689	11,451	2%	1%	4,994	6,620	33%	68,367	75,809	11%
Cassava	84,164	97,358	10%	11%	11,809	12,345	5%	993,874	1,201,902	21%
Vegetables	21,237	19,959	2%	2%	11,475	11,071	-4%	243,690	220,964	-9%
Fruits	19,787	19,938	2%	2%	11,296	10,942	-3%	223,508	218,168	-2%

4.3. Rainfall situation, season 2009B.

The monthly bulletin produced by MINAGRI and FAO under the Operationalization of Harvest and Agricultural Markets Monitoring Project indicates that in general, rains came early and were favorable, allowing for the maturation of seasonal crops, in particular sorghum (the main cereal for this season) and maize, and allowed for the continuous development of sweet potato, cassava and banana.

However, rainfall was high during the second decade of May, causing production losses in some parts of the country, especially for beans and other water-sensitive pulses. Between the third decad of January and end of mach, rain was good enough. Beyond that period, the rain was low but went up in May as shown in the graph 1-4 below. Though there was high rain during the second decad of May, it took a very short time and no significan losses were registered.

Graph 1-4: Decadal rainfall estimates by natural region, season 2009B



Cumulative rainfall from January 1st to June 20th, 2009, came to a total of 454 mm, which represents 71% of the 638 mm long term average for the same period. The long-term average is calculated for the period 1920 – 1980.

4.4. Food Security

The production of the 2009B season led to the improvement of national food security. In the South and North Provinces, carolific needs are covered at a rate greater than 100%, except in Nyaruguru district where this rate stands at 98%. In the other Provinces, carolific needs are covered at a minimum rate of 100% (Table 1-4). High Kcal/person/day is found in Ruhango and in almost all the districts of the Eastern Province with a pick in Kirehe district. The main crops with high share in crop

production and potentiality in Kcal are maize, sorghum, cassava and banana which are grown in these districts.

Graph 1-5: Spatial distribution of the production in Kcal/per/day, season 2009B.

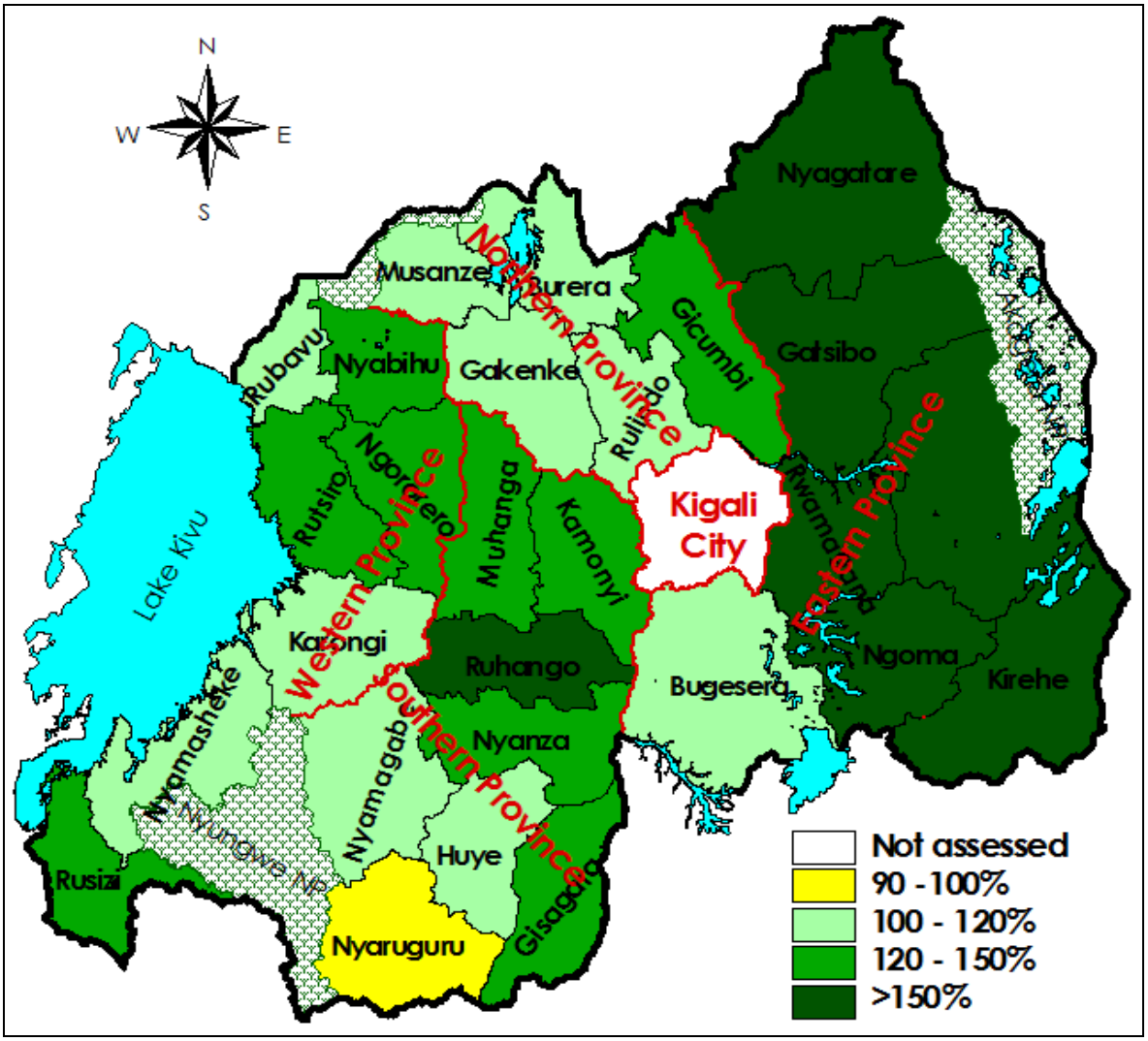


Table 1-4: Estimated energy availability in percent of the requirement (2100 kcal/person/day) from local food production in Rwanda by Province, Season 2009B

Province	Min	Max
South	98%	165%
West	100%	147%
North	102%	126%
East	109%	202%

The production in Kcal, proteins and lipids from livestock has also improved as indicated in table 1-5 below. The quantity of Kcal, proteins and lipids from livestock has increased by 16%, 17% and 15% respectively.

Table 1-5: Production in Kcal, proteins and lipids

	2007B	2008B	2009B	2008B/07B	2009B/08B
Kcal (1 000 000 000)	3,173.60	3,897.10	4,338.3	23%	11%
Proteins (1 000 T.)	72.5	81	92.2	12%	14%
Lipids (1 000 T.)	9.5	12.6	16.1	33%	27%
Kcal from animals (1 000 000 000)		235	271.4		16%
Proteins from animals (1 000 T.)		12.8	14.9		17%
Lipids from animals(1 000 T.)		17.3	19.9		15%
Energie (Kcal/Capital/day)	1,839.20	2,327.30	2,523	27%	8%
Protein (g/capital/day)	42	52	61	24%	18%
Lipids (g/capita/day)	5.5	16.7	21	204%	25%

N.B: Adult humans require 2100 kcal/capital/day, 59 g of protéins and 40 g of lipids (source ENA/MINAGRI)

Crops and animals contributed differentelly to the production of energy, protein and lipids. Table 1-6 indicates the contribution of individual crop in the production of energy: sorghum (10%), beans (9%), banana (11%), Irish potato (7%) and sweet potato (11%); whereas cassava contributes to nearly one third (27%) of the total energy produced. Maize contributes to 5% and the shares of the remaining crops are 3% maximum. Animal production contributes to 6% of the total energy produced in 2009B.

Regarding the production of protein, the shares of animal and sorghum stand at 14% and 10% respectively and beans production represents 26% of the total protein produced. The contribution of maize, peas, soya, banana, Irish potato, sweet potato and cassava contributes individually from 4% to 7%.

Lipid production is mainly attributable to animal production. Animal production alone contributes to 55% of the total production of protein. The share of the main individual crop production in lipid is distributed as follows: Maize (8%), beans (5%), groungnuts (7%), soya (9%) and cassava (5%). The remaining individual crops contribute for 3% maximum (Table 1-6).

Table 1-6: Contribution of crops and animal in energy, proteins and lipids (%)

	Energy	Protein	Lipids
Animal	6%	14%	55%
Sorghum	10%	10%	2%
Maize	5%	6%	8%
Wheat	2%	3%	1%
Rice	1%	1%	0%
Beans	9%	26%	5%
Peas	1%	4%	1%
Groundnuts	1%	1%	7%
Soya	2%	7%	9%
Banana	11%	5%	3%
Irish Potato	7%	7%	1%
Sweet Potato	11%	6%	2%
Yam & Taro	1%	1%	0%
Cassava	27%	6%	5%
Vegetables	3%	2%	0%
Fruits	2%	2%	0%

The national food balance sheet shows a surplus of 197 MT. Data on Imports, food aid and stock are not available and hence not included in this balance (Table 1-7). This shows the result of efforts made in agriculture sector and that the country is able to meet its food requirements and get surpluses. However there is still need to strengthen value addition and post harvest handling in order to minimise post harvest losses (which are estimated at 15%) as low as possible.

Table 1-7: Rwanda Food Balance for 6 months from July to December 2009

	(*1000 MT)
I. AVAILABILITY =1+ 2+3	**1387**
1. Crop production	1,532
2. Animal production	84
3. Losses (15%)	(230)
II. NEEDS = 4	**1,190**
4. Consumption	1,190
III. Balance/Deficit = I-II	**197**

5. Conclusion and recommendations.

Figures on production for the 2009B season show that there is a surplus of food in the country and food security is not threatened. Production has increased by 6.5% in 2009B from 2008B. The main cause of the increase of the production is the improvement of the yield, for the majority of the main crops.

Production in Kcal, proteins and lipids has also improved, both from crop production and animal production.

Recommendations:

- Conduct a cross border trade survey;
- Conduct a monitoring and evaluation of season C;
- Conduct a variety research on rice with the aim at selecting varieties that are suitable for different regions;
- Need specific study on banana commodity chain in Rwanda;
- Focus on storage at household and community level.

Annex I: Detailed tables

Cultivated area per District (Ha)

Crop	Huye	Gisagara	Nyamagabe	Nyaruguru	Ruhango	Nyanza	Kamonyi	Muhanga	Rusizi	Nyamasheke	Rutsiro	Karongi	Ngororero	Nyabihu	Rubavu
Sorghum	5,783	5,828	4,190	4,703	5,616	6,893	3,134	4,089	979	2,066	3,921	4,232	2,078	2,342	1,736
Maize	238	253	733	618	1,401	1,539	910	254	4,692	2,801	2,220	1,939	2,005	4,640	3,504
Wheat	0	0	921	1,322	0	0	0	0	0	0	2,624	2,306	3,148	1,893	1,497
Rice	614	1,416	0	0	170	618	564	42	1,474	73	0	0	0	0	0
Beans	5,630	6,109	4,014	3,203	6,493	5,743	5,878	7,293	9,287	7,618	4,710	3,924	11,412	9,060	5,954
Peas	1,563	445	2,053	2,121	817	351	518	294	0	1,080	728	1,594	731	926	86
Groundnuts	394	632	100	65	737	375	791	32	127	85	0	0	0	0	0
Soya	1,216	986	743	245	629	1,314	3,113	4,665	3,526	2,175	0	2,217	1,194	0	0
Banana	4,742	5,092	5,159	3,623	7,042	4,549	7,015	7,891	8,991	7,079	4,864	5,255	6,524	3,724	3,622
Irish Potato	693	609	1,522	1,956	1,117	1,019	796	1,506	419	17	3,035	3,518	1,498	5,881	4,854
Sweet Potato	2,607	2,089	4,807	3,136	1,304	931	2,055	2,625	1,683	3,682	4,323	2,837	5,803	1,055	4,691
Yam & Taro	148	42	392	389	255	257	136	608	431	621	846	780	431	287	218
Cassava	3,110	4,643	3,124	2,732	5,528	3,460	4,344	5,444	6,145	5,015	3,385	4,919	2,869	488	268
Vegetables	674	523	1,333	977	1,267	31	962	642	1,169	825	1,501	834	1,276	1,185	189
Fruits	522	745	850	326	694	704	1,035	919	1,391	303	845	787	881	480	358
Total cultivated area	**28,449**	**29,636**	**29,374**	**24,547**	**31,553**	**27,624**	**30,731**	**35,238**	**40,985**	**33,351**	**33,221**	**35,316**	**40,247**	**34,035**	**28,615**

Cultivated area per District (Ha) (Cont'd)

Crop	Gakenke	Musanze	Gicumbi	Burera	Rulindo	Bugesera	Rwamagana	Kayonza	Ngoma	Kirehe	Gatsibo	Nyagatare	Kigali City	Total
Sorghum	4,504	4,425	4,363	5,001	5,317	7,841	5,211	6,342	6,977	8,409	7,717	6,849	2,291	132,835
Maize	1,596	1,445	1,610	1,914	277	1,779	1,056	978	1,328	1,169	2,287	1,498	678	45,362
Wheat	2,413	751	4,348	1,829	1,176	0	0	0	0	0	695	0	0	24,923
Rice	0	0	0	0	0	375	264	77	253	483	553	757	134	7,868
Beans	6,543	5,943	6,453	6,756	4,741	4,732	3,475	4,661	5,946	8,021	5,125	5,895	2,420	167,040
Peas	597	1,863	2,165	1,489	1,502	358	119	316	62	198	968	42	260	23,245
Groundnuts	777	0	102	0	0	2,263	1,282	715	741	883	717	1,549	256	12,624
Soya	1,112	0	218	0	886	525	821	0	0	0	1,039	125	224	26,976
Banana	6,663	3,009	5,284	3,281	6,337	7,169	8,819	8,727	8,565	9,885	10,518	3,415	1,813	168,659
Irish Potato	2,284	6,101	6,496	6,015	981	907	570	830	761	704	1,471	1,029	509	57,100
Sweet Potato	3,327	1,129	4,227	3,108	1,695	1,172	1,272	1,607	1,746	508	988	1,034	548	65,989
Yam & Taro	658	701	900	409	370	349	204	278	293	510	485	454	0	11,451
Cassava	4,677	1,227	1,853	887	2,809	4,259	3,769	4,178	3,541	4,770	4,089	4,849	975	97,358
Vegetables	527	852	182	79	1,105	28	1,062	777	528	112	286	607	427	19,959
Fruits	1,272	659	996	765	1,111	240	398	615	673	663	425	933	348	19,938
Total cultivated area	**35,952**	**28,889**	**40,166**	**33,653**	**26,936**	**28,963**	**25,696**	**29,087**	**30,219**	**35,191**	**36,447**	**30,449**	**11,036**	**881,327**

Yield per District (kg/ha)

Crop	Huye	Gisagara	Nyamagabe	Nyaruguru	Ruhango	Nyanza	Kamonyi	Muhanga	Rusizi	Nyamasheke	Rutsiro	Karongi	Ngororero	Nyabihu	Rubavu
Sorghum	911	1,068	917	688	803	1,712	1,492	1,350	674	1,035	1,194	652			1,071
Maize	2,436	776	1,512	1,497	1,232	1,714	1,348	2,998	1,550	2,190	1,169	1,363	2,154	1,700	1,352
Wheat			2,287								1,011	1,039	1,642	2,510	1,063
Rice	5,400	5,400	2,857	2,857	5,380	5,400	7,000	5,714	6,500	6,800			6,000		
Beans	700	700	650	650	950	900	800	850	900	850	700	700	850	1,000	1,000
Peas	390	1,426	773	799	800		844	537	476	367	762	703	1,417	1,183	1,438
Groundnuts	1,093	745			683	539	1,119	769		313	1,495				
Soya	975	850	850	875	850	775	850	675	925	925	900	775	875	800	750
Banana	4,000	4,000	3,500	3,500	4,716	4,610	6,500	7,000	11,238	11,388	3,809	4,500	5,994	7,320	11,038
Irish Potato	4,000	4,000	8,750	7,750	5,000	4,000	5,000	6,000	5,800	6,000	8,000	6,000	11,000	15,000	14,500
Sweet Potato	6,678	6,748	5,354	4,123	14,513	9,943	7,707	9,215	11,015	7,646	7,955	6,883	8,834	7,184	4,788
Yam & Taro	2,070	8,918	12,165	8,278	12,085	16,459	2,820	7,611	12,734	3,321	3,509	10,857	7,710	13,246	6,782
Cassava	15,000	15,000	10,000	10,000	15,000	15,000	15,000	12,000	10,000	10,000	8,000	8,500	8,500	5,000	5,000
Vegetables	10,000	10,000	12,000	12,000	10,000	10,000	10,000	10,000	12,000	12,000	10,000	10,000	9,500	16,000	16,000
Fruits	12,000	12,000	10,000	10,000	10,000	10,000	10,000	10,000	12,000	12,000	9,500	9,000	9,500	16,000	16,000

Yield per District (kg/ha) (Cont'd)

Crop	Gakenke	Musanze	Gicumbi	Burera	Rulindo	Bugesera	Rwamagana	Kayonza	Ngoma	Kirehe	Gatsibo	Nyagatare	Kigali City	Moyenne
Sorghum	222	1,000	1,226	1,708	1,426	860	1,401	1,302	1,424	1,935	1,417	1,167	1,255	1,162
Maize	1,396	1,104	1,791	1,490	2,192	1,324	1,769	1,255	1,354	1,925	1,099	1,434	1,861	1,551
Wheat		2,771	2,068	1,760							1,737			1,371
Rice						6,000	6,000	6,000	5,000	6,300	6,000	6,000	6,000	5,942
Beans	700	1,000	950	850	850	800	750	725	850	750	900	900	1,210	843
Peas	978	700	645	729	876	1,101	679	860	1,052	876	659	1,595	884	762
Groundnuts	260	475	736			951	435	615	1,166	776	1,018	653	566	745
Soya	750	750	575	600	675	675	700	725	700	750	750	725	808	808
Banana	6,207	5,743	7,500	7,500	6,649	3,867	9,856	9,850	14,999	12,131	12,000	9,945	7,257	7,960
Irish Potato	12,000	17,000	14,500	10,000	5,750	4,000	4,000	4,000	4,000	4,000	6,750	4,000	4,000	10,537
Sweet Potato	6,205	10,834	6,296	6,669	5,029	8,936	12,439	4,331	6,864	7,443	4,974	5,829	3,856	7,139
Yam & Taro	18,028	9,480		1,404	2,673	5,768	465	820	6,161	5,080		962	2,392	6,620
Cassava	10000	6,000	10,000	6,500	12,000	12,500	15,000	15,000	15,000	15,000	15,000	15,000	10,000	12,345
Vegetables	12,000	15,000	15,000	15,000	5,650	10,000	11,000	10,000	10,000	11,000	11,000	11,000	13,000	11,071
Fruits	12,000	12,000	15,000	15,000	11,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	10,942

Production per District (MT)

Crop	Huye	Gisagara	Nyamagabe	Nyaruguru	Ruhango	Nyanza	Kamonyi	Muhanga	Rusizi	Nyamasheke	Rutsiro	Karongi	Ngororero	Nyabihu	Rubavu
Sorghum	5,267	6,225	3,842	3,237	4,509	11,798	4,676	5,520	659	2,139	4,683	2,760	0	0	1,859
Maize	581	196	1,108	925	1,725	2,639	1,226	762	7,272	6,136	2,596	2,643	4,319	7,889	4,739
Wheat	0	0	2,106	0	0	0	0	0	0	0	2,654	2,396	5,170	4,751	1,592
Rice	3,317	7,644	0	0	916	3,339	3,946	238	9,584	497	0	0	0	0	0
Beans	3,941	4,276	2,609	2,082	6,168	5,169	4,702	6,199	8,358	6,475	3,297	2,747	9,700	9,060	5,954
Peas	610	634	1,587	1,695	654	0	438	158	0	397	554	1,120	1,035	1,095	124
Groundnuts	430	470	0	0	503	202	885	25	0	27	0	0	0	0	0
Soya	1,186	838	632	214	535	1,019	2,646	3,149	3,261	2,012	0	1,718	1,045	0	0
Banana	18,966	20,368	18,057	12,680	33,212	20,974	45,595	55,239	101,047	80,618	18,529	23,648	39,105	27,261	39,981
Irish Potato	2,772	2,436	13,322	15,162	5,584	4,076	3,981	9,037	2,430	100	24,284	21,109	16,482	88,210	70,383
Sweet Potato	17,409	14,097	25,738	12,930	18,922	9,261	15,839	24,191	18,535	28,153	34,393	19,530	51,262	7,577	22,459
Yam & Taro	306	372	4,765	3,223	3,086	4,225	385	4,626	5,483	2,063	2,970	8,467	3,322	3,801	1,478
Cassava	46,657	69,652	31,236	27,318	82,924	51,904	65,166	65,332	61,451	50,152	27,077	41,815	24,385	2,439	1,339
Vegetables	6,736	5,229	15,990	11,722	12,669	314	9,617	6,421	14,025	9,904	15,015	8,341	12,123	18,963	3,030
Fruits	6,266	8,939	8,496	3,256	6,939	7,036	10,350	9,189	16,689	3,639	8,029	7,079	8,369	7,680	5,735

Production per District (MT)

Crop	Gakenke	Musanze	Gicumbi	Burera	Rulindo	Bugesera	Rwamagana	Kayonza	Ngoma	Kirehe	Gatsibo	Nyagatare	Kigali City	Total
Sorghum	999	4,425	5,348	8,540	7,580	6,745	7,301	8,260	9,932	16,268	10,937	7,991	2,875	154,376
Maize	2,228	1,595	2,884	2,850	608	2,354	1,869	1,227	1,798	2,250	2,514	2,148	1,261	70,344
Wheat	0	2,081	8,989	3,218	0	0	0	0	0	0	1,208	0	0	34,164
Rice	0	0	0	0	0	2,253	1,586	459	1,267	3,045	3,316	4,541	805	46,752
Beans	4,580	5,943	6,130	5,743	4,030	3,786	2,606	3,379	5,054	6,016	4,613	5,306	2,929	140,853
Peas	584	1,304	1,396	1,086	1,316	394	81	272	65	173	638	66	230	17,706
Groundnuts	202	0	75	0	0	2,151	557	440	864	685	730	1,012	145	9,404
Soya	834	0	125	0	598	355	575	0	0	0	779	91	181	21,794
Banana	41,363	17,282	39,630	24,608	42,136	27,720	86,925	85,961	128,458	119,912	126,219	33,957	13,157	1,342,608
Irish Potato	27,408	103,714	94,189	60,151	5,642	3,627	2,282	3,320	3,045	2,815	9,932	4,117	2,035	601,644
Sweet Potato	20,643	12,228	26,616	20,729	8,526	10,475	15,817	6,959	11,982	3,777	4,912	6,028	2,114	471,103
Yam & Taro	11,865	6,641	0	574	990	2,011	95	228	1,806	2,591	0	436	0	75,809
Cassava	46,767	7,362	18,531	5,769	33,712	53,242	56,534	62,668	53,109	71,545	61,336	72,729	9,753	1,201,902
Vegetables	6,318	12,782	2,734	1,192	6,242	276	11,681	7,770	5,277	1,227	3,148	6,672	5,547	220,964
Fruits	15,269	7,902	14,945	11,475	12,226	2,162	3,582	5,537	6,055	5,969	3,826	8,397	3,130	218,168

Production in Kcal, protéins and lipids

	Huye	Gisagara	Nyamagabe	Nyaruguru	Ruhango	Nyanza	Kamonyi	Muhanga	Rusizi	Nyamasheke	Rutsiro	Karongi	Ngororero	Nyabihu	Rubavu
Kcal (1 000 000 000)	124.6	153.4	127.1	91.1	178.8	149.9	166.2	181.9	220.5	177.1	141.8	141.4	182.6	158.0	131.0
Proteins (1 000 T.)	2.6	2.8	2.6	1.9	3.2	3.2	3.5	3.9	4.9	3.8	2.8	3.0	4.7	4.7	3.3
Lipids (1 000 T.)	0.5	0.5	0.4	0.2	0.6	0.5	0.9	0.8	1.1	0.8	0.4	0.6	0.7	0.6	0.4
Kcal_animals (1 000 000 000)	6.9	4.5	10.8	17.5	12.6	7.0	12.0	10.5	9.2	5.2	10.7	6.1	10.6	7.6	7.6
Proteins_animals (1 000 T.)	0.4	0.2	0.5	0.9	0.7	0.4	0.6	0.6	0.5	0.3	0.6	0.4	0.6	0.4	0.4
Lipids_animals(1 000 T.)	0.5	0.4	0.9	1.2	0.9	0.5	0.9	0.8	0.7	0.4	0.7	0.5	0.8	0.5	0.5
Energie (Kcal/Capital/day)	**2,203**	**2,708**	**2,190**	**2,064**	**3,463**	**3,100**	**3,033**	**2,980**	**3,079**	**2,496**	**2,568**	**2,352**	**3,046**	**2,745**	**2,106**
Protein (g/capital/day)	49	52	51	52	70	71	70	69	73	56	58	54	83	84	56
Lipids (g/capita/day)	17	15	20	28	27	21	31	25	24	17	19	17	24	19	15

Production in Kcal, protéins and lipids (Cont'd)

	Gakenke	Musanze	Gicumbi	Burera	Rulindo	Bugesera	Rwamagana	Kayonza	Ngoma	Kirehe	Gatsibo	Nyagatare	Kigali City	Rwanda
Kcal (1 000 000 000)	152.1	149.3	199.8	144.1	117.2	132.8	160.3	156.1	182.0	213.0	196.6	161.9	47.7	4,338.3
Proteins (1 000 T.)	2.9	3.9	4.9	3.8	2.5	2.6	2.5	2.4	3.1	3.8	3.6	2.9	1.3	92.2
Lipids (1 000 T.)	0.5	0.3	0.6	0.4	0.3	0.8	0.5	0.4	0.6	0.6	0.7	0.6	0.2	16.1
Kcal from animals (1 000 000 000)	10.7	7.2	14.4	11.0	7.3	4.8	20.6	9.5	5.1	6.0	13.0	22.1	1.2	271.4
Proteins from animals (1 000 T.)	0.6	0.4	0.8	0.6	0.4	0.3	1.1	0.6	0.3	0.4	0.7	1.3	0.1	14.9
Lipids from animals(1 000 T.)	0.8	0.5	1.0	0.8	0.5	0.3	1.4	0.7	0.4	0.4	0.9	1.6	0.1	19.9
Energie (Kcal/Capital/day)	**2,250**	**2,269**	**2,649**	**2,150**	**2,204**	**2,295**	**3,652**	**3,512**	**3,539**	**4,246**	**3,290**	**3,210**	**284**	**2,523**
Protein (g/capital/day)	49	62	70	60	52	47	72	63	65	81	69	73	8	61
Lipids (g/capita/day)	18	12	20	16	15	20	39	23	18	20	26	38	2	21

N.B. : Adult humans require 2100 kcal/capital/day, 59 g of protéins and 40 g of lipids (source ENA/MINAGRI)

Annex II: Methodology.

1.1. Sampling methodology

1.1.1. Target population

The target population for the crop assessment survey is commposed of all rural and urban households where there exist strong agricultural activities.

1.1.2. Stratification

A stratified two-stage sample design has been used for the ENA. The sampling frame was stratified by Province (City of Kigali), urban and rural. The urban strata consisted of Kigali-City and other urban, while the rural part of each province was treated as a separate stratum. Data are representative at District level.

1.1.3. Sample selection procedure.

Within each stratum, the sample enumeration areas were selected systematically with probability proportional to size (PPS), where the measure of size for each enumeration area was based on the number of households from the sampling frame. Within each enumeration area, 12 households have been selected with simple random sampling, meaning that all households had the same probability to be selected.

1.1.4. Estimation procedure

In order for the sample estimates from a particular survey to be representative of the population, it is necessary to multiply the data by a sampling weight, or expansion factor. The basic weight for each sample household would be equal to the inverse of its probability of selection (calculated by multiplying the probabilities at each sampling stage).

1.2. Estimation of area under cultivation.

1.2.1. Area measurement

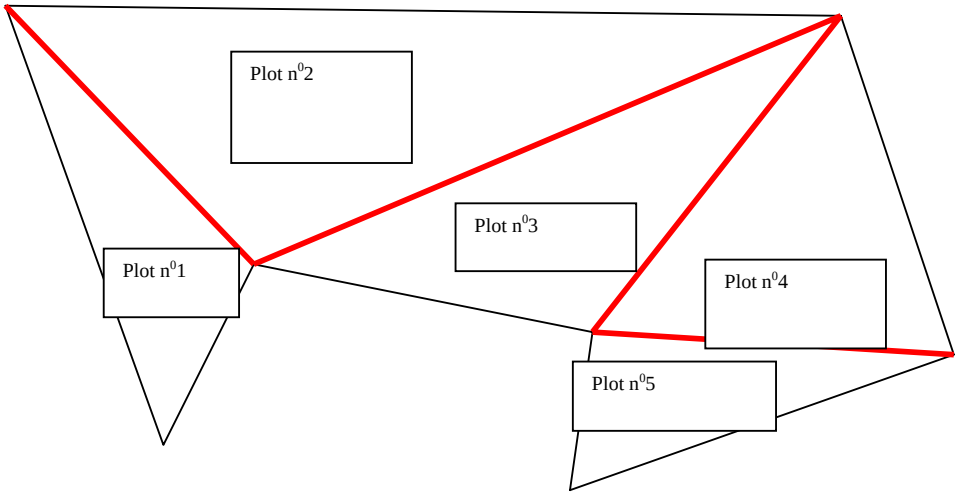
The shape of cultivated areas is not always of the regular form (triangle, rectangle…), but most of the fields under cultivation have rectangular shape (square or rectangle), others are triangular (triangle). We encounter also fiels that have irregular shape, having 5 sides or abore. In one or other case, the area measurement has been simplified as follows:

a) **Field of rectangular shape**: area is obtained by multiplying the length and the width.

b) **Triangular fields.** The enumerator measures the length of the base side and that of the height, and the area is equal to the base multiply by the height divide by 2.

c) **Fields of irregular shape.** In this case, a field of such shape has been divided into several plots of regular shape, in order to facilitate the calculation of the area of the entire field, as shown in the following figure.

Example: A field of irregular shape with 7 sides.



The perimeter of the above fiel is shown by the thin black lines. The field is not a rectangle, nor a triangle, neither of a known geometric form. In this case, area measurement has been done using procedure described in b, since the fiel dis composed of triangle. The total area of the fiels is the sum of the areas of the triangles that constitute the field. One or more plots were randomly selected for the purpose of estimating the yield.