PHILIPPE P. LEURQUIN*

AGRICULTURAL CHANGE IN RUANDA-URUNDI: 1945–1960†

The two new independent states of Rwanda and Burundi formed part of German East Africa from their occupation at the end of the last century until May 1916. After that date, and until they became independent on July 1, 1962, they were administered by Belgium, first under League of Nations mandate and then, after the Second World War, under the trusteeship regime of the United Nations.

The trusteeship territory of Ruanda-Urundi is situated between the first and the fourth degrees of south latitude, south of Uganda, northwest of Tanganyika, and east of the Congo (Map 1). It had a population in 1960 of 4,928,890 inhabitants, of whom 2,694,749 were in Rwanda and 2,234,141 in Burundi (Table 1). The population has increased by 43.5 per cent since 1945 and by 20 per cent since the census of 1952. Its total area is 54,172 sq. km., of which 26,338 are in Rwanda and 27,834 are in Burundi. The country is entirely landlocked: as the crow flies, it is about 1,200 km. from the Indian Ocean and 2,000 km. from the Atlantic; by rail and water, Dar es Salaam, the nearest port, is 1,455 km. away, and Matadi, by Kamina, is 3,239 km. away (7, p. 205).

The climate of Ruanda-Urundi has the same general characteristics in both countries: it is an equatorial climate tempered by altitude. The dominant influence is that of the monsoon zone of the Indian Ocean. Relief accounts for the rainfall and the river system, and for the area in which endemic diseases prevail, especially malaria and sleeping sickness. If account is taken, too, of the very variable quality of the soils and of the different types of human occupation, a great number of homogeneous regions can be distinguished within Ruanda-Urundi.

The territory is traversed from south to north by the Congo-Nile watershed, the most southerly source of the Nile being situated in Burundi. These moun-

* Translated by Richard J. Hammond.

The author is at present Research Associate, Food Research Institute. He was formerly attached to the Belgian *Institut pour la Recherche Scientifique en Afrique centrale* (IRSAC) at Astrida, Rwanda, and was afterwards a member of the 1960 Mission, financed by the European Economic Community, which enquired into the general development needs of Ruanda-Urundi.

† This is the second of a series of studies of agricultural achievement in the countries of tropical Africa during the fifteen years following the end of World War II. Grateful acknowledgment is made to the Carnegie Corporation of New York for a grant to the Food Research Institute of funds which made these studies possible. The Corporation is not, however, the publisher or proprietor of the publication and is not to be understood as approving by virtue of its grant any of the statements made or views expressed herein.

MAP 1

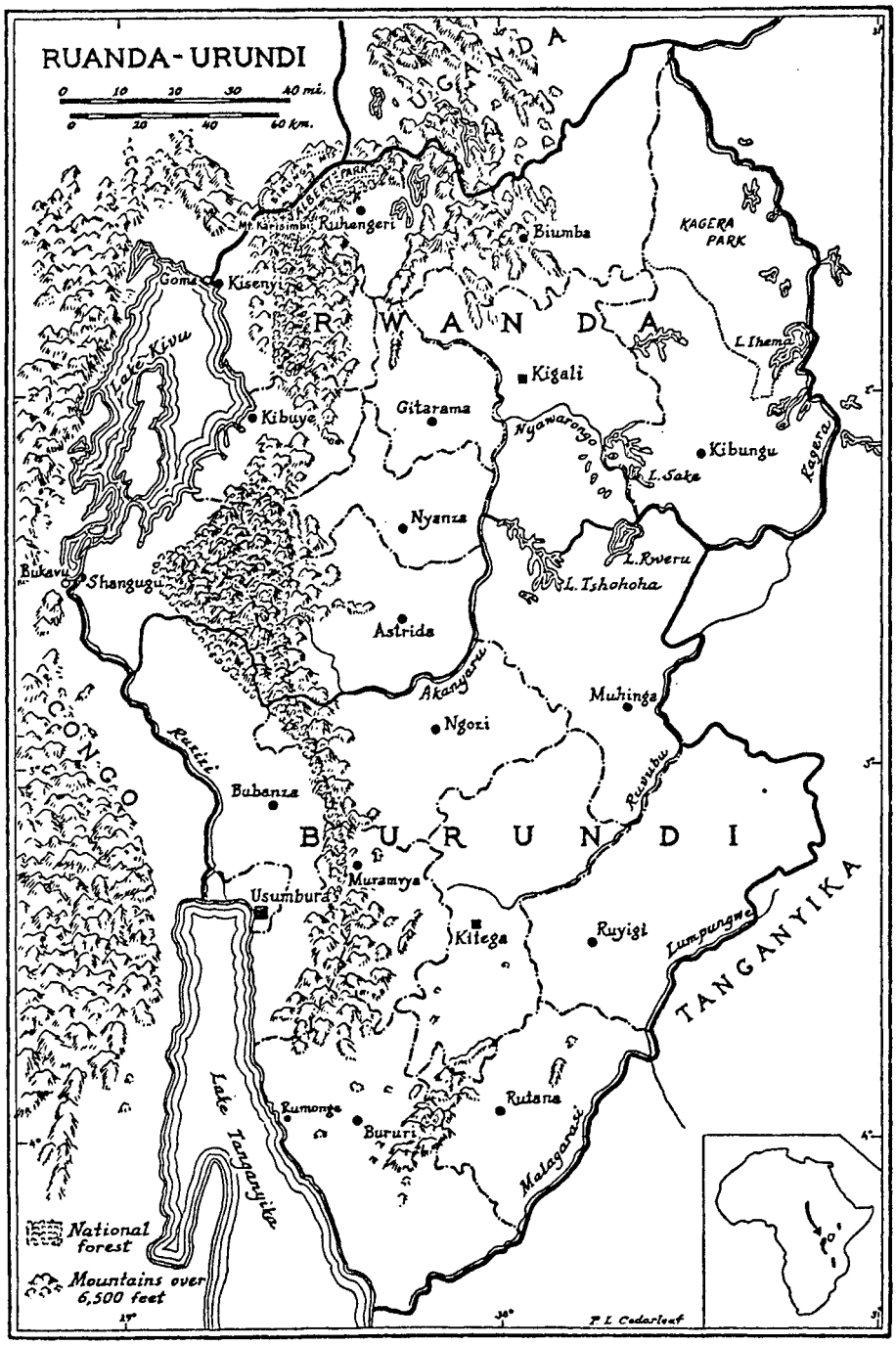

RUANDA-URUNDI
0 10 20 30 40 mi.
0 20 40 60 km.
UGANDA
Mt. Karisimbi
Ruhengeri
Biumba
KAGERA PARK
Goma
Kisenyi
RWANDA
Lake Kivu
L. Ihema
Kigali
Kibuye
Gitarama
Nyawarongo
Kibungu
L. Sake
Kagera
Nyanza
L. Rweru
L. Tshohoha
Bukavu
Shangugu
Astrida
Akanyaru
Muhinga
Ngori
CONGO
Ruzizi
Bubanza
Ruvubu
BURUNDI
Muramya
Usumbura
Kitega
Ruyigi
Lumpungwe
TANGANYIKA
Lake Tanganyika
Rumonge
Rutana
Bururi
Malagarasi
National forest
Mountains over 6,500 feet
29°
30°
F. L. Cedarleaf

TABLE 1.—AFRICAN POPULATION OF RUANDA-URUNDI, 1945–60*
(*Thousand people*)

Year	Total	Rural	Urban	Year	Total	Rural	Urban
1945	3,431	3,386	44	1953	4,144	4,072	72
1946	3,650	3,597	53	1954	4,262	4,187	75
1947	3,776	3,718	58	1955	4,362	4,297	65
1948	3,861	3,794	67	1956	4,485	4,416	69
1949	3,882	3,808	74	1957	4,630	4,560	70
1950	3,958	3,905	53	1958	4,689	4,626	63
1951	4,022	3,960	62	1959	4,848	4,785	63
1952	4,102	4,035	67	1960	4,929	...	...

* Data from Belgium, Chambre des Représentants, *Rapport sur l'Administration belge du Ruanda-Urundi pendant l'Année 1960.* (Présenté aux Chambres par M. le Ministre du Ruanda-Urundi, p. 297, and earlier issues presented by M. le Ministre des Affaires Africaines ou des Colonies) [briefly cited hereafter as *Rapport Annuel*]. Population "des chefferies" and population "non soumise au régime des chefferies" here roughly considered as rural and urban respectively.

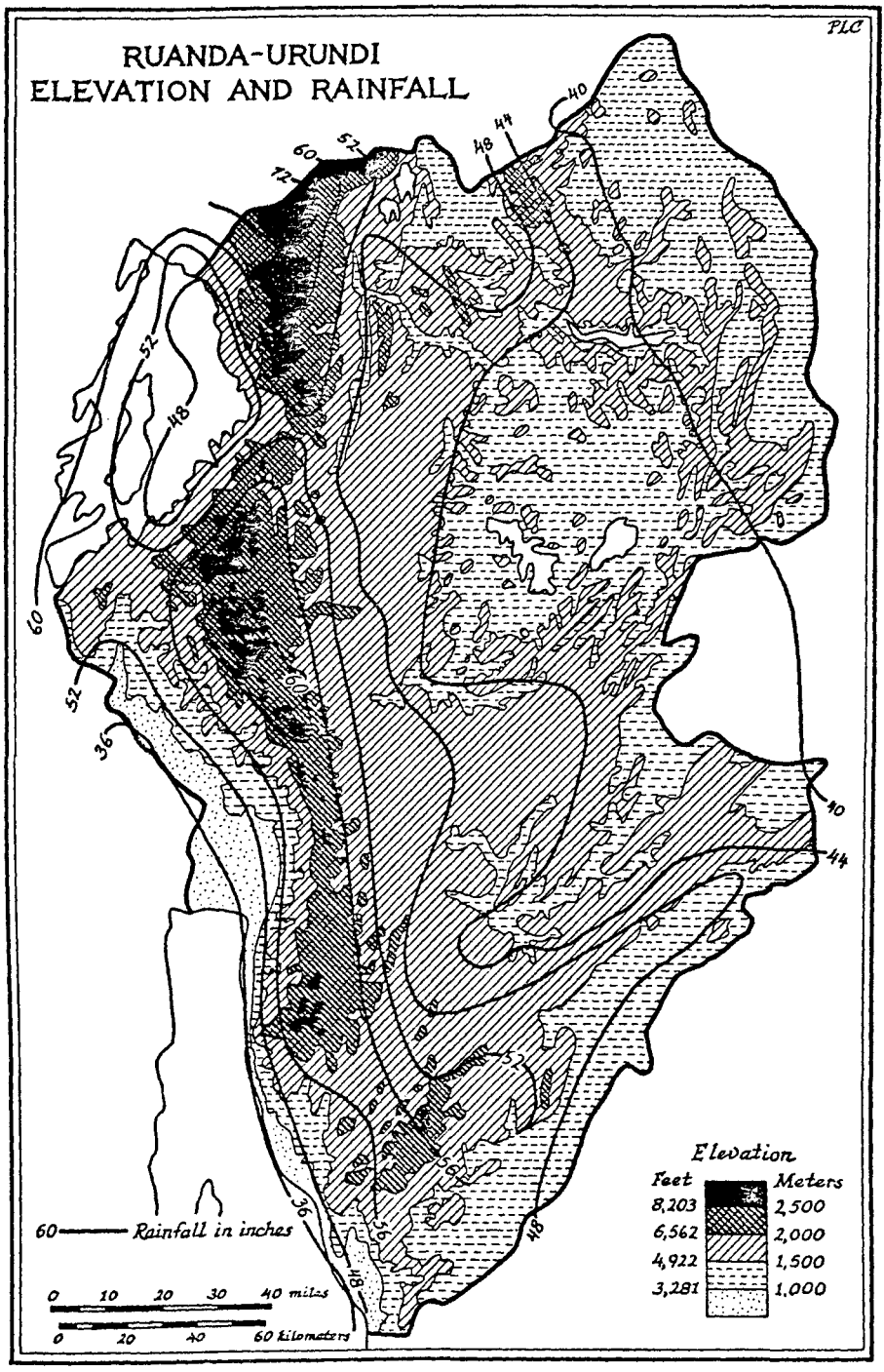
tains, relatively young—witness the river captures still taking place at the present day—fall abruptly into the Central Africa Rift Valley in the valley of the Ruzizi River. On the east, contrariwise, the plateaus slope gently toward Tanganyika, at the frontier of which country the mean altitude is around 1,400 meters. The Congo-Nile watershed extends from Bururi in the south to Ruhengeri in the north. The peaks reach 3,000 meters in height in the north, 2,600 meters in the south. The passes are not much lower than 2,000 meters; for instance, the great central road from Astrida to Shangugu has to cross a col at 2,550 meters. This chain is made up of a succession of massifs which extend over a width of from 20 to 50 km.; it is prolonged to the north by the Birunga volcanoes, of which the highest, Karisimbi, the highest point in the territory, 4,507 meters, is snow-covered each winter, and by the barren mountains of the north of the country, in the territory of Ruhengeri and of Biumba (Map 2).[1]

To the east of the massifs of the watershed, the forest disappears and the uplands fall gradually from 2,000 meters to 1,400 meters in a series of terraces intersected by streams; the shape of these ravines is narrow and deep toward the west, widening toward the east until they emerge in wide valleys. At the east and south frontiers of the country the plateaus end abruptly in imposing escarpments, at the foot of which, in the east of Rwanda, is the Kagera depression; in the south of Burundi, the trough of Malagarasi and its tributary, the Lumpungwe. Lastly, in the southeast of Rwanda and the northeast of Burundi, great papyrus marshes fill the valleys of the Akanyaru and the Nyawarongo, and the lakes Tshohoha, Rweru, Sake, and Ihema.

On the other side of the Congo-Nile watershed, in the direction of the Congo, the mountains fall to the Central African Rift Valley, occupied in the north by Lake Kivu, 1,462 meters above sea level, and in the center by the valley of the Ruzizi; on the south by Lake Tanganyika, at 772 meters above sea level. All this area forms part of the Congo basin; the rest of the country, on the other

[1] The place names are to be found on Map 1; elevations and rainfall on Map 2; and the natural regions on Map 5, p. 62.

MAP 2


PLC
RUANDA-URUNDI
ELEVATION AND RAINFALL
60
52
48
44
40
36
Elevation
Feet
Meters
8,203
2,500
6,562
2,000
4,922
1,500
3,281
1,000
60 Rainfall in inches
0 10 20 30 40 miles
0 20 40 60 kilometers

hand, except for the basin of the Malagarasi, drains into Lake Victoria and so feeds the Nile.

The rains fall principally from March to May, during the great rainy season, but also from October to December. Local variations of rainfall are considerable on account of local factors such as the evaporation of the lakes, nearness to the forests, exposure, and altitude; furthermore, there are great differences in the rainfall between one year and another. The varying amounts of rainfall and its capricious character have caused much concern both to the African farmer and to the administration; in some years rains have been wanting at seed time; on other occasions, hail has destroyed the young maize plants, and on yet other occasions prolonged rains have caused the harvest to rot. This is the reason for many of the food crises that have occurred, against which both the traditional practices of the inhabitants and the administrative measures taken against famine have struggled, not always successfully.

Although irregular, the rainfall is by and large sufficient, particularly at the higher altitudes, and it feeds a dense network of rivers and streams; in more than half the country there are more than three-quarters of a kilometer of stream for every square kilometer, and in the greater part of the rest, more than half a kilometer; only the region of the Kagera National Park is wanting in watercourses.

The soils are of many types, as is normal in a country with broken relief. In the east, the underlying rock is generally of the pre-Cambrian epoch, that is to say, schists and quartzites; the higher regions are mainly composed of volcanic rocks, notably basalt, on which are established some of the most prosperous agricultural communities in Ruanda-Urundi. Granites occur in the center of Rwanda; alluvial soils are rare—they are found mostly in the basin of the Malagarasi; lastly, the recently drained valleys contain peaty soils.

THE NATURAL REGIONS

The diversity of soils, of temperature and of rainfall, the different types of human occupation, here agricultural, there pastoral, make it difficult to fix natural regions precisely. Going one better than the classification of Everaerts (*10*), the agricultural statistics of Ruanda-Urundi distinguish twenty-five. However, one may perhaps reclassify them in four great zones according to altitude: below 1,000 meters, from 1,000 to 1,500 meters, from 1,500 to 1,900 meters, and above 1,900 meters.

Below 1,000 meters the region of Imbo comprises the plain of the Ruzizi and the banks of Lake Tanganyika. Its mean altitude is 850 meters, its mean temperature 73° Fahrenheit; the annual rainfall varies from 30 to 40 inches. This savanna country of spurges, acacia, and other spiny plants used to be inhabited mainly by wild animals: elephants, buffaloes, antelopes, and water game. Since 1950, thanks to a determined war on malaria, the settlement of people from the highly populated uplands, and the systematic development of rice and cotton production, this area has become one of the most prosperous in the country and one of the principal sources of the provisioning of the town of Usumbura, nearby.

Usumbura and the plain of the Ruzizi are dominated by the Congo-Nile watershed. Some thirty kilometers from the town, the main road to the interior

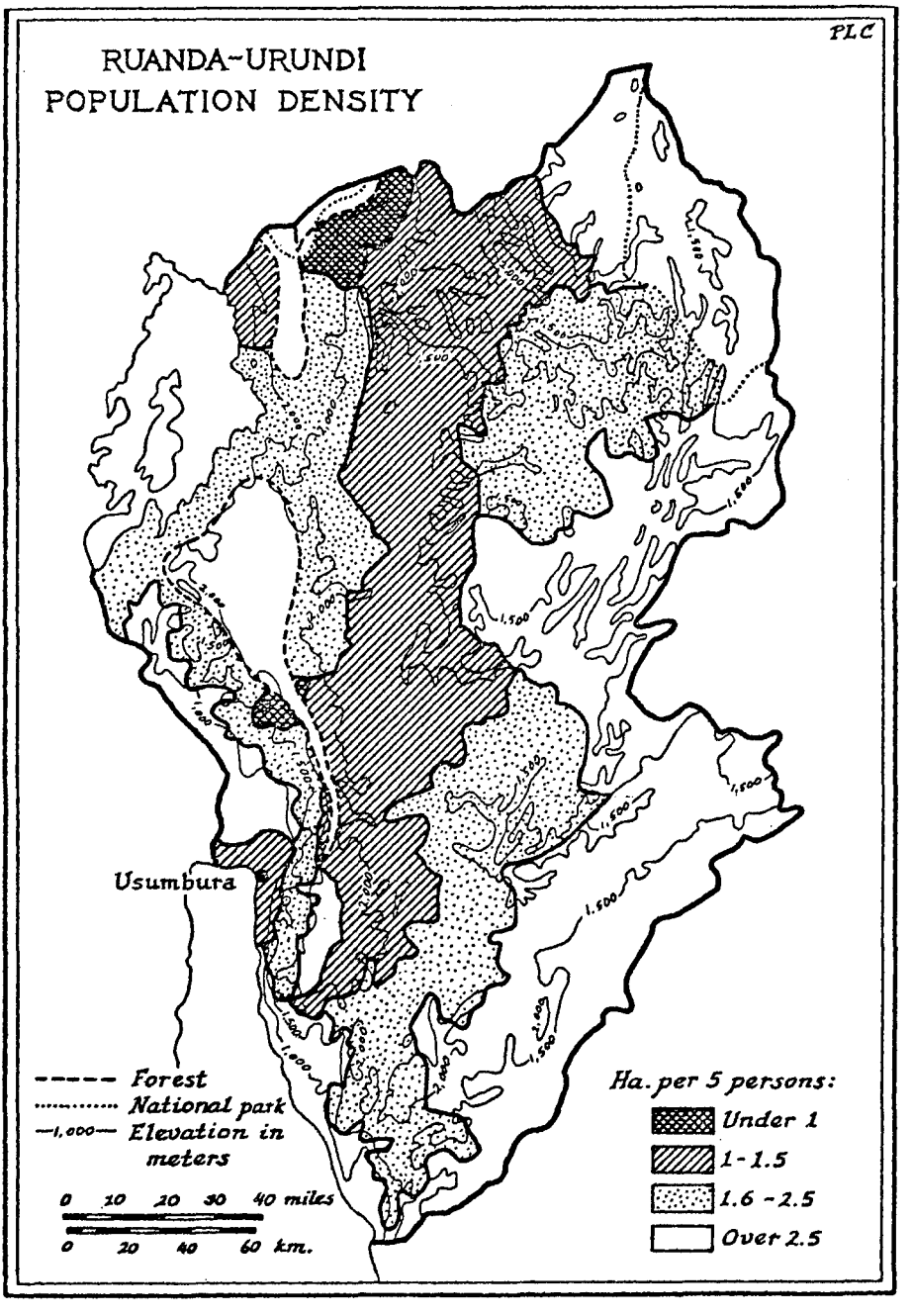
crosses a col at 2,300 meters. The zone between 1,000 and 1,500 meters is situated at the other end of the country along the Tanganyikan frontier: the Moso in the south is about 1,200 meters above sea level; on the east, the valley of the Kagera and its tributaries, the Akanyaru, Nyawarongo, and the Ruvubu, consists of savannas rarely more than 1,500 meters high; here the temperature varies from 20° to 23° C. (68° to 73° F.) and rainfall from 900 to 1,200 mm. (35 to 47 inches).

These regions are among the least peopled of Ruanda-Urundi. They seem better adapted to stock raising than to agriculture, for they are often wanting in streams and the fertile soils on the borders of the marshes and of the rivers and of the papyrus-choked lakes are often ravaged by wart hogs, antelopes, or hippopotami. This used to be stock raising country; but the cattle were driven out by sleeping sickness, from Moso around 1900, from Bugesera from 1955 onwards: the stock raisers with their remaining cattle departed for more healthy regions and were replaced in the more fertile spots by cultivators. This process of immigration was encouraged by the government, which created numerous *paysannats*[2] during the last ten years of the trusteeship.

The zone between 1,500 and 1,900 meters enjoys numerous natural advantages. Sleeping sickness is not found above 1,500 meters. With a temperature of 19° to 20° C. (66° to 68° F.) and a mean rainfall of 1,000 to 1,100 mm. (40 to 43 inches) the conditions on the hills between 1,400 and 1,800 meters are ideal for the coffee tree. The banana tree, whose fermented products are an essential part of the diet, flourishes up to 1,800 or 1,900 meters, according to the aspect. At 1,500 meters the flowers of certain kinds of banana trees yield fruit in four months; at 1,900 meters it takes nine months. This area holds more than half of the population of the country; it extends on both sides of the Congo-Nile watershed and is made up of agricultural and pastoral regions according to the type of terrain, the population density, and the respective numbers of the Tutsi and Hutu tribes. As in the rest of the country, no villages are to be found. Each family, a nuclear family in Rwanda, a patriarchal family in Burundi, lives in the midst of its compound surrounded by its banana grove which is fertilized by household refuse, the severed and broken stems, and the dried leaves. The countryside is dotted with kraals in the midst of pastures and fields of annual crops. Nowhere is apparent the astonishing density of the population, which in places attains 500 inhabitants to the square kilometer (Map 3). This great zone is divided into numerous subregions which it would be fussy to elaborate. A few general remarks will give an idea of them. In central Rwanda, from Kigali to Astrida, the herds are cheek by jowl with the fields of sorghum, beans, and sweet potatoes. The typical rotation follows sorghum sown in January with beans sown in September and harvested at the new year underneath the banana trees. Sweet potatoes are very popular. Nearing the frontier of Burundi, banana trees become more numerous and the population denser. Once in this country, maize takes the place of sweet potato and of sorghum, finger millet becomes more common, and the banana groves are more extensive. The Ngozi

[2] The *paysannats* were set up in the areas which hitherto had been little exploited. The immigrants were trained in modern cultural methods devised by the Institut National pour l'Étude Agronomique du Congo Belge (INEAC). Thanks to this precaution, many of them had incomes per head twice the national average (see p. 85 and p. 86).

MAP 3


PLC
RUANDA-URUNDI
POPULATION DENSITY
Usumbura
Forest
National park
1,000 Elevation in meters
0 10 20 30 40 miles
0 20 40 60 km.
Ha. per 5 persons:
Under 1
1-1.5
1.6-2.5
Over 2.5

territory at the extreme north of Burundi is one of the best areas for coffee, of which it produces one-quarter of the country's total output; by itself, it accounts for one-fifth of the population of Burundi. Further south, the climate becomes dry, the soil less fertile, and the population less dense.

On the other side of the Congo-Nile watershed, two very rich agricultural zones, with volcanic soil, north and south of Lake Kivu, are separated by a pastoral region with poor soil. To the north, near Kisenyi, the lava soils carry the finest banana groves and the best tobacco fields in the country. This region is well watered, thanks to the influence of the forests and Lake Kivu.

South of the lake, there are banana groves on the basalts. This region was not occupied by the armies of Rwanda until the eighteenth century; it has almost always escaped famine and hence has been peopled by immigrants coming both from the Congo and from Rwanda and Burundi; within a small area are to be found all the zones of altitude, from the 1,000 meters of Ruzizi, good for manioc, cotton, and sugar cane, up to the altitudes greater than 2,000 meters on the edges of the forest, where tea, peas, and wheat prosper. Further south, the country is more mountainous: the steeply sloping Mumirwa region is squeezed between the forest of the watershed and the malarial plain of the Imbo, so that colonization has been very recent and there is not yet any shortage of land. The valleys of the foothills are filled with groves of trees which harbor monkeys and wart hogs.

Above 1,800 or 2,000 meters, according to the district, the banana tree disappears. The malarial mosquito is unknown, the climate is cold and damp; temperature 17° C. (62° F.), mean rainfall 1,300 to 1,500 mm. (50–60 inches). Food crises are brought about by hail and by excessive rainfall and not by drought. In Rwanda, this is the dwelling place of a simple mountain people, the Kiga, the mountain Hutu, with unpolished manners and energetic habits. The Tutsi, who had been there since 1900, were expelled at the time of the 1959 uprising. In these regions, which produce barley, peas, finger millet (eleusine), and potatoes, a minor polygamy still exists.

By contrast, the watershed in south-central Burundi is completely deforested: in places, the cattle-raising Tutsi are more numerous than the Hutu, which is exceptional in Ruanda-Urundi. The soil is so poor that cattle manure is indispensable to the fertility of the fields; each family has a herd, whose droppings make rich the kitchen gardens of maize, peas, sweet potatoes, and beans, which surround the patriarchal enclosures. There is a long-standing export of cattle from this region to the Congo.

Upon this mosaic of natural conditions, the hand of man has left its mark in a very unequal fashion; some regions have been inhabited since prehistoric times, others for only a few generations. In some places the sweetness of the grass has caused the pastoral Tutsi to settle, as at Buganza, around the Rwanda hill which has given its name to the new state; elsewhere the primitive clearings of the Hutu have multiplied on the humid lands that adjoin the forest. Hence a brief account of human settlement in Ruanda-Urundi is not without interest if one is to understand the principal factors in agricultural development up to the last war and the changes that have taken place since.

AGRICULTURAL DEVELOPMENT IN THE PAST

Several hundred years ago, a revolt at the court of Bunyoro in Uganda provoked repercussions all around the Great Lakes; at this time the Tutsi led their herds into Rwanda and a little later they entered Burundi. By an artful policy of intrigue they subjugated the Hutu petty chiefs little by little and, despite famines, wars, and cattle plagues, established feudal "states" more centralized in Rwanda than in Burundi.

These feudal kingdoms were dominated entirely by the graziers: the agricultural Hutu owed them labor services and food rents. There was no shortage of land: the right to pasture went with the cow, and the peasant could always clear the forest if he did not want to give allegiance to a Tutsi and so have a cow and a portion of pasturage given to him in exchange for his services.

Nevertheless famines were frequent, two or three a decade, according to the extreme caprice of the rainfall. The number of cultivated plants must at first have been limited, for the cult of first fruits only admitted four—sorghum, eleusine, gourds, and *isogi* (*Gynandropsis gynandra*). Long before the European occupation, novelties had appeared—bananas, peas, sweet potatoes, beans, and maize—some coming from Asia, others from the New World. However, the characteristics of the Tutsi feudal system, notably the right of public and violent dispossession (*kunyaga*), discouraged an accumulation of stocks against famine (*16*, p. 24). This led inevitably to crises in a country which had no organized transport. Hence, from the very occupation of the country in May 1916, the Belgian administration sought to improve supplies locally and to encourage exchanges between one district and another. The first road was built in 1922, the first automobile introduced in 1924.

So far as agriculture was concerned the administration followed a dual policy aimed at diversifying and increasing output. From 1921 onward, the agricultural station at Rumonge, on the shore of Lake Tanganyika, experimented with cotton, flax, and robusta coffee. In the following years the trials were extended to mulberry trees, rice, buckwheat, and sisal. Furthermore, the Catholic and Protestant missions, which had to live on the land, introduced wheat, potatoes, pigs, citrus fruits, and arabica coffee, of which the first cherries were harvested in 1921.

As a measure against famine, an ordinance of November 7, 1924 gave district officers the power of compelling African cultivators, only for their own profit, to plant food crops, do harvest work, and plant export crops. In spite of the resistance of the graziers, the extension services insisted that sweet potatoes be grown in the marshes, which had hitherto been reserved for cattle grazing in the dry season. It was estimated in 1925 that, thanks to this policy, the area planted with sweet potatoes had multiplied one-hundred-fold in a single year. This proved to be the salvation of the territories of Ngozi, Astrida, and Nyanza at the time of the great famine in 1928. In that year, following a succession of abnormally dry seasons, eastern Rwanda had one of the worst famines in its history: the rapid exhaustion of local reserves, the absence of wagon roads in the affected region, the migrations of those afflicted, who took to pillage in regions hitherto unaffected, all helped to make the catastrophe worse. In his speech of September 23, 1930, after the crisis was over, M. Voisin, the governor of

Ruanda-Urundi, drew the consequences of this hard lesson: besides measures of general policy, such as the rearrangement of African districts, the dispossession of African authorities who had shown themselves incapable, and the grant of mining concessions, he announced a huge agricultural program. This included, among other things, the growing by every African taxpayer of non-seasonal crops such as manioc and sweet potatoes, a reduction in surplus cattle, and systematic reforestation. It was at this time also that the massive extension of arabica coffee plantations began, encouraged by the discovery of a variety of wild coffee tree in the forest of the Congo-Nile watershed. This agricultural program was developed and amplified over the course of the years. Under the influence of M. Everaerts, who directed the territory's agricultural services from 1929 to 1954, the policy was maintained until the end of trusteeship, constantly supported by the activity of the agricultural research stations whose utility had quickly been made manifest. In spite of an acute shortage of technical staff, living conditions for the population had been already much improved at the end of the Second World War. The knowledge that had been acquired during the previous quarter of a century served as a basis for the Ten-Year Plan for the economic and social development of Ruanda-Urundi, which from 1950 onwards governed the establishment of infrastructures and recruitment of staff, and provided for financial aid from the metropolitan country.

Changes in Agriculture Between 1945 and 1960

After the Second World War, the re-staffed administration of the trusteeship territory set down a general plan within which the infrastructure and the administrative services were to develop between 1950 and 1960. This was the *Ten-Year Plan* established on the basis of the 1949 figures (*7*, and Table 2). Its financing was undertaken by Belgium. A grant of 2.791 million Congolese francs was envisaged for the administrative services alone.

By themselves transport, health services, and public buildings were to absorb two billion francs. In addition, the Ten-Year Plan provided for 2,075 millions in credits for the autonomous bodies under state control. Out of this total 2,014 millions had been spent at the end of 1959, distributed as follows (*3*, p. 381):

Autonomous body	Million Congolese francs
National Welfare Fund[8] (of which 407.1 was for supplying drinking water in rural areas)	641.2
Forces Electriques de l'Est (generating stations and transmission lines)	610.5
Regideso (water and electricity supply)	348.1
Office des Cités Africaines	322.6
Institut National pour l'Étude Agronomique au Congo (INEAC)	68.4
Institut pour la Recherche Scientifique en Afrique Centrale (IRSAC)	23.4

[8] By 1959 the National Welfare Fund had installed 19,285 drinking fountains which served 3 million inhabitants, as well as 152 kilometers of aqueducts to serve 115,000 people in the districts of the north on porous volcanic soil. Thus two-thirds of the population had access to pure water.

TABLE 2.—RUANDA-URUNDI TEN-YEAR PLAN INVESTMENTS BY THE ADMINISTRATIVE SERVICES: AS FORECAST, AND AS INCLUDED IN EXTRAORDINARY BUDGETS 1949–60*
(*Million Congo francs*[a])

Item	Forecast	Credits in extraordinary budgets (BE) BE 1949–50	BE 1959	BE 1960	Total
Road transport					
Original plans	1,023.0	392.6	28.7	38.0	459.3
Other	—	155.6	33.0	6.3	194.9
Water transport	61.8	192.3	16.8	14.3	222.6
Air transport	157.9	248.2	14.5	3.4	266.1
Building, housing, town planning	494.3	701.3	87.0	127.0	915.3
Warehouses	19.8	—	—	—	—
Cartography	61.4	7.8	6.0	4.4	18.2
Geology	.8				
Hydrography	77.3	53.5	17.0	17.7	88.2
Kagera National Park	9.7				
Meteorology	.6	—	—	—	—
Telecommunications	19.4	52.8	9.4	15.3	77.5
Agricultural training	206.9	371.5	40.5	42.0	454.0
Public health	422.5	138.8	19.9	5.1	163.8
Agriculture	56.8	84.0	53.2	6.6	143.8
Fishing, and fish raising	15.2	6.3	4.2	—	10.6
Stock raising	62.1	83.9	18.0	10.1	112.0
Forestry	38.4	21.7	5.9	1.0	28.6
Processing plants	4.8	24.0	6.2	—	30.2
Special agricultural programs	—	6.7	—	—	6.7
Information services	4.8	.5	—	—	.5
Total	2,791.2	2,541.5	359.6	291.2	3,192.3

* Public investment by the Administrative Services only, thus excluding investments by the autonomous bodies under state control. Investments are here understood to include only those that have concrete material results such as buildings, public works, etc., and to exclude expenditures for education covered elsewhere in the source cited.

Data are from Association Européenne de Sociétés d'Études pour le Développement, *Étude Globale de développement du Ruanda et du Burundi* (Brussels, 1961), p. 379–80 [briefly cited hereafter as *Étude Globale*].

[a] The Congo franc, freely convertible to Belgian francs until March 1960, was quoted at U.S. $.02 from 1949 to 1960.

Agriculture, forestry, stock raising, and fisheries, which require staff rather than materials, obtained large sums from the ordinary budget and from their own resources (Table 3).

In the realm of agriculture, the plan envisaged, over ten years, an increase of 104,200 hectares, or 8 per cent, in food crops for local consumption, and an increase of 30,500 hectares, or 99 per cent, in coffee and cotton grown for export. In forestry, the aim was to plant 20,000 hectares of native woodland and 2,500 hectares of government woodland. In stock raising, the plan foresaw the elimination of 444,567 cattle considered surplus out of a total of 973,658. The number of animal dispensaries was to be raised from 28 to 60; 160 dipping tanks were to be set up; cattle markets and abattoirs were to be organized. Research, particularly into agriculture, was to be increased in scale; stations were to be multiplied and employ a growing number of technicians. The plan set forth the requirements

TABLE 3.—ORDINARY BUDGETS OF RUANDA-URUNDI, SPECIFIED YEARS, 1945–1960*
(*Million Congo francs*)

Year	Receipts	Expenditures		
		Total	Agricultural Service	Veterinary Service
1945	120	110	11	
1950	386	335	92	12
1955	681	694	136	24
1960 (forecast)	990	1,468	157	39

* Data from *Rapport Annuel, 1960* pp. 347–48, 403, and earlier issues (see *6* for complete reference).

in personnel, material, and budgetary grants year by year. The objectives thus laid down served as a guide to the trusteeship authority until the end of the trusteeship period. The great majority of them were attained, so far as infrastructure was concerned, as also for export crops; coffee indeed increased far beyond expectation. On the other hand, the program of livestock reductions had to be completely abandoned.

CHANGES IN PRODUCTION

On account of its poverty Ruanda-Urundi has always been administered by a tiny staff. As of December 30, 1945, 3.5 million Africans were ruled by 205 Europeans; the agricultural staff was only 28. The district officers numbered 65, and there was only one commissioner of police for the whole country. Hence the statistical data for this period are approximate, especially for subsistence crops.

Cultivation by Africans is on a small scale, almost like gardening; crops are taken from the same fields several times during the year. There are no villages; the population is scattered over the countryside, on the more fertile pieces of land. The family kraals are surrounded by banana groves and the fields are dispersed in a multiplicity of strips, on the hillsides, in the marshes, in shade, and in open sun. Most families have less than one hectare, though often in ten or fifteen separate strips. The boundaries of these strips are not rectilinear; the crops are intermixed and vary from district to district according to the soil and the altitude. Most crops are harvested as occasion requires; banana bunches are cut all year around, sweet potatoes can be eaten four months after the tubers are planted, but attain their full development only after eight months. There are three growing seasons for beans, so that no matter what the time of year one can harvest them anywhere in Ruanda-Urundi. The growing seasons, the mixtures of crops, and the varieties change according to relief and altitude. Hence the difficulty that has already been mentioned of establishing precise agricultural statistics. On the other hand, crops that are processed and so passed through commercial channels are not retained at all by producers for their own consumption and hence the statistics are exact.

In spite of these difficulties and shortage of staff, the administration made a great effort in 1949 at the time of the World Food Survey of the Food and Agriculture Organization of the United Nations (FAO) and the preparation of the Ten-Year Plan. Each agronomist made a study in the field, estimating the

area under bananas, marking out rocky, marshy, and grazing areas, and tracing the areas of open field and those still bush. The whole of this information was set down on maps on the scale of 1 to 100,000. The effort involved will be appreciated if we recall that in this year there were, in all, sixteen agricultural engineers and twenty-six assistant technicians. The estimates of 1949 served as a basis for the published figures for subsequent years. These were modified in accordance with inquiries incidental to administrative controls and in accordance with the views of the chiefs and sub-chiefs in discussion with the European staff. After 1959, following the political troubles in Rwanda, the statistics lost much of their usefulness (Table 4).

The statistics do not indicate whether or not the total cultivated area includes land sown successively to two crops in one season. It appears from the stated yields that double counting has not been eliminated, so that one is forced to estimate the areas actually sown. For instance, the 136,000 hectares of sorghum are almost exclusively sown in the second cropping season, at the end of January and harvested in July; in the first cropping period after the dry season from September to December, these same soils are often sown with beans.

The apparent stability of the areas under cultivation results from the application of a variety of corrective coefficients to the different crops. The population has increased by one quarter in ten years, levels of food consumption do not appear to have changed very much, and imports of food for African consumption have remained insignificant. Moreover, one has only to travel along the roads to see meadows converted to tillage, marshes that have been drained, and valleys recently brought under cultivation. Internal colonization has been taking place on the edges of the Moso in Burundi, in the savannas near the Akanyaru in Rwanda, and on the grassland of every hill.

With few exceptions, the direction of the changes, crop by crop, that the statistics reveal appears more plausible than the amount of change. Barley was introduced as a cash crop by the administration to provide purchasing power for the planters in the north of Rwanda. Unfortunately the price was set too low to interest the growers, even though it was higher than the c.i.f. price of imported barley. So barley has all but disappeared. Soy beans proved unacceptable to African cooks, in spite of publicity in their favor. The Ten-Year Plan looked to a trebling of production, but in 1959 only 460 hectares were counted compared with 6,900 forecast. The system of cultivation for eleusine (*écobuage*)[4] leads to soil erosion and was systematically discouraged by the administration; hence the sowings of eleusine have declined. Peanuts are considered a luxury and demand a high price on the market, but the prices do not compensate for very low yields so that production has not doubled as was forecast. For many years peas have suffered heavily from attacks by aphis and their cultivation has been more and more limited to the high humid areas.

On the other hand sorghum and bananas have spread. Sorghum is well adapted to the drier soils to the east of Rwanda and has followed the shift of population in that direction.

[4] *Écobuage* is the name applied to the customary manner of growing cereals on poor pasture land. So as to increase the yield, the African cuts the grass and heaps it into little piles, which are then burned. The whole field is then prepared and sown. At harvest time the treated areas bear vigorous clumps of grain, while the rest of the field has a poverty-stricken aspect.

TABLE 4.—AREA UNDER SPECIFIED CROPS IN RUANDA-URUNDI, 1945, 1949, AND 1960*
(*Thousand hectares*)

Crop	1945 African	1949 African	1960 African	1960 European	1960 Total
Food crops					
Grains					
Sorghum	107.6	135.7	161.6	...	...
Maize	82.5	120.8	126.3	...	...
Eleusine	45.0	54.2	31.0	...	...
Wheat, barley	n.l.	21.0	5.0	...	...
Rice	n.l.	.4	.8	...	...
Legumes					
Beans	263.2	320.6	348.1	...	...
Peas	106.0	137.0	87.1	...	...
Pigeon peas	n.l.	4.6	n.l.	...	...
Peanuts	n.l.	10.6	8.9	...	...
Soybeans	n.l.	2.3	.5	...	...
Starchy roots					
Sweet potatoes	150.0	170.0	141.4	...	...
Manioc	87.8	130.1	169.9[a]	...	...
White potatoes	3.0	10.5	17.0	...	...
Other roots	n.l.	17.7	10.5	...	...
Bananas	n.l.	151.5	192.3	...	...
Home gardens	n.l.	n.l.	2.2	...	...
Total food crops	...	1,287.0	1,302.6	.8	1,303.4
Industrial crops					
Coffee					
Arabica	18.0	19.0	43.8[b]	.6[b]	44.4[b]
Robusta	...	...	.3[b]	.6[b]	.9[b]
Cotton	4.6	6.7	10.1	n.l.	10.1
Oil palms	...[c]	...[c]	7.4	.1	7.5
Castor beans	...	...	6.4	n.l.	6.4
Pyrethrum	.2	.2	.3	.9	1.2
Cinchona	.1	.2	.2	.2	.4
Tea	...	...	n.l.	.4	.4
Pimento	...	...	...	n.l.	...
Other	...	...	2.1	.5	2.6
Total industrial crops	...	26.1[d]	70.4	3.3	73.7
All crops	...	1,313.1[d]	1,373.0	4.1	1,377.1

* Data for 1945 from Belgium, Ministère des Colonies, *Plan décennal pour le développement économique et social du Ruanda-Urundi* (Edition de Visscher, 1951), pp. 348, 350 [briefly cited hereafter as *Plan Décennal*]. Data for 1949 and 1960 from *Rapport Annuel*, 1949, pp. 333–34, and *ibid. 1960*, p. 440 (see *6* for complete reference). In view of the disrupted condition of the country it is the present author's belief that the figures for food crops in the latter report are more nearly representative for 1959 than for 1960. The letters n.l. indicate that the specified crop is not listed in the source cited.

[a] Including 48.2 not harvested.

[b] Including areas that do not report production; African arabica 9.7, robusta .2, and European arabica and robusta .1 each.

[c] There were 462 thousand trees in 1945, and 571 in 1949.

[d] Excluding crops for which no figures are shown.

The banana tree is a traditional and well established means of fertilizing the soil. It is an exacting crop and the establishment of a banana grove is a lengthy process. On poor soils banana trees are grown near the huts and are fertilized by refuse. The huts themselves, which are made of dried grass, are burnt every four or five years when the grass rots or is invaded by parasites. Thereafter, the site, rich in ash and organic material, is planted with banana trees. After a bunch of bananas has been harvested, the trunk bearing it is cut into pieces, so providing humus for the soil; the shade of the leaves prevents the earth from being dried out by the sun. The crops thus fertilized, grown underneath the trees, give better yields than those in open fields. In Rwanda potatoes have recovered some of the ground lost through mildew in 1943, but they are still attacked by blight.

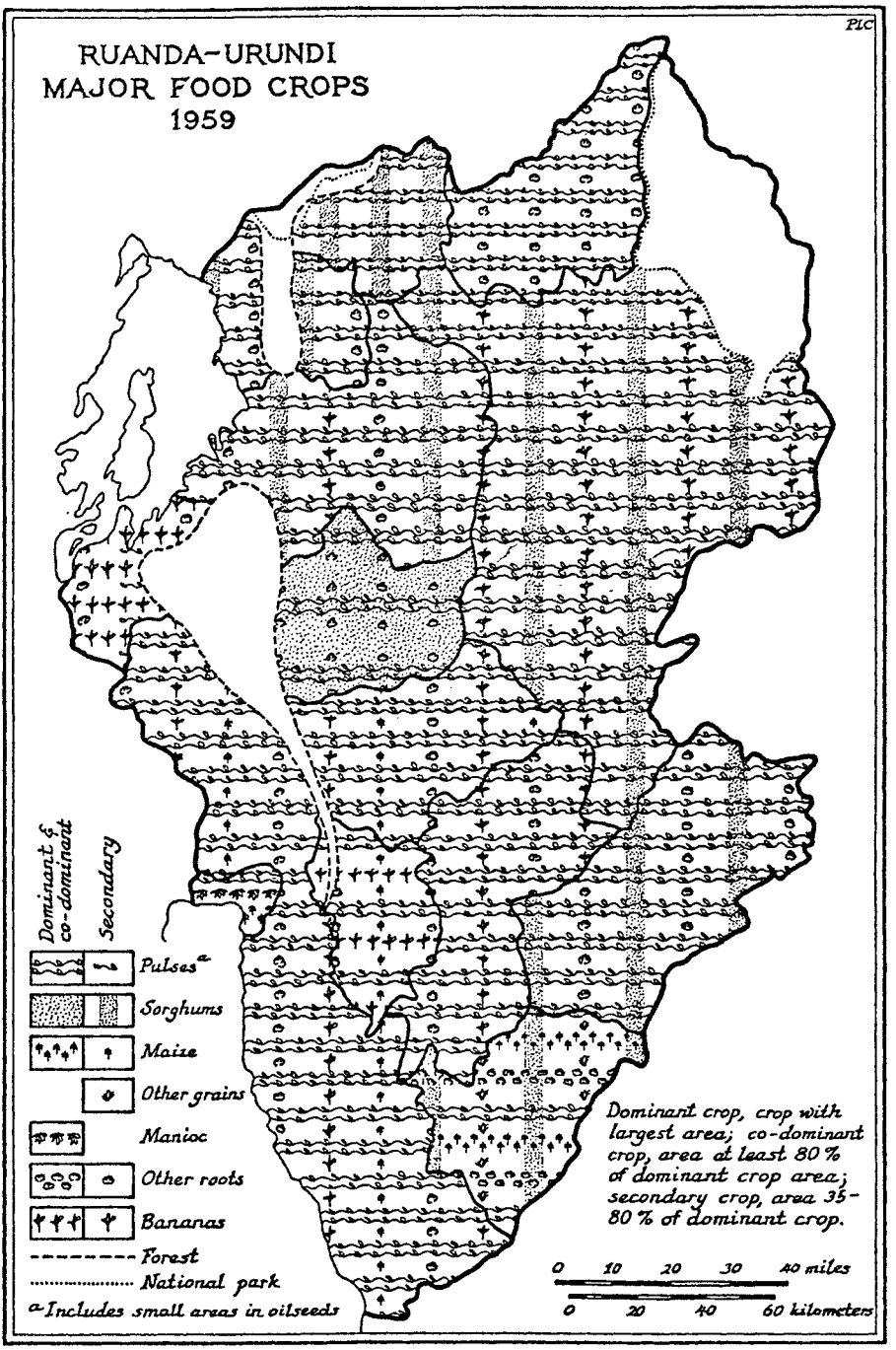
Some other changes indicated in the statistics appear less explicable. It is hard to believe that the cultivation of beans and sweet potatoes has not been extended with the growth of population and the bringing into use of new marshes that are especially suited to the culture of sweet potatoes. The cultivation of manioc on the other hand was made obligatory as an anti-famine measure; the local authorities, both European and native, were responsible for carrying out administrative orders. In general, therefore, the areas declared as having been cultivated are greater than those actually cultivated. Once the controls were relaxed, the Africans' discontent with them quickly made itself felt by a fall in the area under cultivation. For instance, at the end of 1959 in Rwanda, it was reckoned that 43,235 hectares of manioc had been planted in 1956, 40,709 in 1957, 29,005 in 1958, and 9,710 in 1959. For rice, which is cultivated in paddies close to Usumbura, and for export industrial crops the production figures are known accurately; moreover, this is the sector of the economy in which the action of the administration has been most effective.

The estimates of the areas under cultivation were made separately for each section of a natural region which was represented in any particular district. Accordingly they form a much better base for ascertaining the geographical distribution of crops than for changes in the respective areas under cultivation.

Map 4 indicates by homogeneous areas dominant crops, co-dominant crops, and secondary crops, classified according to the method employed by Bruce Johnston (*14*, pp. 57–59). Co-dominant crops are defined as those which cover an area equal to four-fifths or more of the area covered by the dominant crops; secondary crops as those covering an area equal to at least 35 per cent of that covered by the dominant crop.

With the single exception of Usumbura, each district includes a variety of zones of altitude, with food economies varying according to the soils and the exposure. The Shangugu district, for instance, with an area of 2,226 square kilometers, half of which is covered by the mountain forest, contains a multitude of microclimates. It is possible to pick out one zone which specializes in cultivation of banana trees, another which produces chiefly manioc and sugar cane, a cotton growing zone, another that grows peanuts, another sorghum; there are soils that specialize in peas and in coffee and a zone of tea plantation. The inhabitants of the Usumbura district live on the manioc grown in the Ruzizi plain, and on fish from the lake and palm oil imported from the Congo (*4*).

MAP 4


PLC
RUANDA-URUNDI
MAJOR FOOD CROPS
1959
Dominant & co-dominant
Secondary
Pulses[a]
Sorghums
Maize
Other grains
Manioc
Other roots
Bananas
Forest
National park
[a] Includes small areas in oilseeds
Dominant crop, crop with largest area; co-dominant crop, area at least 80% of dominant crop area; secondary crop, area 35-80% of dominant crop.
0 10 20 30 40 miles
0 20 40 60 kilometers

In all the other regions is found the characteristic diet of Ruanda-Urundi. This combines a pulse, preferably beans or peas, boiled over a slow fire, and a starchy staple, which in Rwanda and even more in Burundi is principally sweet potato (*8*). Three-quarters of the banana crop and almost all the sorghum are used for home-made fermented drinks.

Agricultural Techniques

At the time of the census of 1950 the total area of Ruanda-Urundi was estimated at 5,400,000 hectares, of which 1,350,000 were useless for agricultural purposes; of the remainder, 2,200,000 were suitable for agriculture, 1,550,000 for pasture, and 300,000 for forests. Almost the whole area is cultivated by traditional methods, which are undergoing but gradual alteration. High value crops for processing which in 1959 provided about one-tenth of the total national income take up only 74,000 hectares. Less than 10,000 hectares, more than half of it reforested land, is occupied by non-Africans (Table 5).

TABLE 5.—AREA OF CROPS AND REFORESTATION 1960, IN RUANDA-URUNDI*
(*Thousand hectares, except as otherwise indicated*)

Category	African	Non-African	Total	Per cent
Food crops	1,302.6	.8	1,303.4	90.2
Industrial crops	70.4	3.3	73.7	5.1
Reforested area	61.9	5.6	67.5	4.7
Total	1,434.9	9.7	1,444.6	100.0
Per cent	99.3	.7	100.0	

* Data from *Rapport Annuel, 1960*, pp. 440, 447 (see 6 for complete reference). See Table 11 for additional data on reforestation.

The holdings are dispersed on the hillside and are exceedingly small (Table 6). A breakdown of the figures comprised in the agricultural census of 1959, according to the natural regions comprised in each district, shows that 39 per cent of the cultivable territory has a density of occupation corresponding to one

TABLE 6.—"GEOGRAPHICAL SUBDIVISIONS OF TERRITORIES" ACCORDING TO AVERAGE AREA AVAILABLE PER POLL-TAX PAYER, RUANDA-URUNDI, 1959*

Average area available per poll-tax payer (hectares)	Number
Less than 1	3
1.0–1.49	17
1.5–1.99	12
2.0–2.99	16
3.0–4.99	8
5.0–9.99	6
10.0 and over	3

* Data from *Étude Globale*, p. 143 (see *3* for complete reference). Ruanda-Urundi consists of 19 Territories; it has also been subdivided into 25 natural regions which cross the territorial boundaries. Counting separately the parts of Territories that fall in different natural regions gives the 65 subdivisions represented above.

poll-tax payer for less than 2.2 hectares. In two-thirds of the regions each poll-tax payer has less than three hectares at his disposal.

Even so, the area effectively under cultivation is very much smaller; it is estimated at 1,444,600 out of a total of 2,200,000 hectares suitable for cultivation, that is to say, less than two-thirds; this figure is, however, too high by reason of double croppings. Many of these small cultivators have one or two cows together with a few sheep and goats. The family unit is self-sufficing.[5] Agricultural production is organized so as to provide the total food needs of the family, notwithstanding diverse natural obstacles and limitations in technique and environment (*16*, p. 15).

Multiple rotation of crops, of fields, and above all of sowings of different varieties of crop at intervals of a few days assure constant flow of provisions. Such methods are exploited very knowingly and in a manner resembling horticulture rather than agriculture. Manioc tubers are lifted from plants one by one without disturbing the roots, and beans are harvested pod by pod as they develop. Rotations vary from natural zone to natural zone, from hill to hill. On some hillsides close to the swamps, root crops like sweet potatoes and manioc are not grown, for they are the favorite dish of the wart-hog. Under the banana trees the rotation is different from that in open fields.

A single example will make far clearer than could any long dissertation the complexity and stability of the traditional system of provisioning. Table 7 shows the food consumption of a Hutu family on the outskirts of Astrida from 1955 to 1962 according to the daily record of foods ready to be cooked. The father and mother were married in 1954; they have four children and no monetary income. The holding comprises a dozen strips totaling about half a hectare. One parcel of banana trees is planted on the very fertile soils 1,500 meters to the west; two strips of reclaimed marsh are in the valley 1,500 meters to the northeast, and the remaining fields are grouped either around the hut, or on the stony slopes a few hundred meters away.

Here follows the annual agricultural routine in this area:

September:	Sowing of beans and gourds. Cultivation of the hillsides.
October:	Further sowings of beans, planting of potatoes and sweet potatoes, harvesting of beans and sweet potatoes grown in the marshes.
November:	Weeding work in the banana groves, harvesting the leaves of beans and pulses, planting of banana trees.
December:	Harvesting the first potatoes and the first green beans.
January:	Bean harvest; preparation of the mixed crops of sorghum, beans, maize, and sweet potatoes under the banana trees and of the fields of peas, beans, and sorghum in the open air.
February:	Potato harvesting. Continuation of the sowing of beans, peanuts and sorghum, etc. Planting of sweet potatoes and pulses, harvest of gourds.
March:	Planting of potatoes and sweet potatoes.

[5] Consumption by self-sufficing families accounts for about three-fifths of the national income of Ruanda-Urundi.

TABLE 7.—FOOD CONSUMPTION PATTERN OF A HUTU FAMILY OF RUANDA, 1956–62*
(*Percent of total calories*)

Food	1956	1957	1958	1959	1960	1961	1962
Legumes and nuts	*28.1*	*28.4*	*32.7*	*29.3*	*35.6*	*29.0*	*27.6*
Dried beans	24.3	23.7	30.5+	26.2	32.4	26.9	26.2
Green beans	.7	.7	.8	.6	.7	.9	1.4
Dried peas	2.8	3.3	1.0	2.5−	2.0	1.1	—
Green peas	.1	.2	.1	—	...[b]	...[b]	—
Peanuts in shell	.1	.3	—	—	—	—	—
Peanut flour	—	.1	.3	—	.5+	—	—
Cereals	*4.6*	*1.1*	*1.2*	*3.3*	*1.3*	*1.8*	*.8*
Whole ears corn	.5+	.4	.6	1.0	.7	.2	.4
Dried corn	—	...[b]	—	—	—	—	—
Sorghum flour	4.0	.6	.6	2.4−	.6	1.6	.4
Roots and tubers	*55.7*	*57.9*	*54.8*	*57.9*	*56.8*	*56.1*	*64.1*
Sweet potatoes, peeled	9.5−	6.6	11.2	4.1	3.7	2.8	2.4
Sweet potatoes, not peeled	17.2	12.8	20.8	30.5+	25.6	22.1	34.7
Manioc flour	22.5+	31.7	17.6	12.0	17.4	14.6	11.6
Fresh manioc	1.3	1.4	1.9	2.9	3.5−	3.2	6.0
Fresh manioc, not peeled	—	2.1	—	—	—	.7	—
Potatoes, peeled	4.9	2.9	3.1	8.2	6.6	12.3	9.0
Taro, grated	.4	.3	.2	.2	—	.3	.1
Yams	—	—	—	—	—	—	.3
Fruits							
Peeled bananas	2.6	3.1	2.5	2.6	1.2	.3	.7
Vegetables	*1.9*	*1.2*	*1.3*	*.9*	*1.4*	*1.0*	*.9*
Green vegetables[a]	1.1	.6	.6	.5+	.6	.6	.4
Eggplant	—	—	—	—	—	...[b]	—
Tomatoes	.1	...[b]	...[b]	—	—	—	—
Cabbage	...[b]	.2	...[b]	...[b]	—	.1	.1
Onions	...[b]	...[b]	...[b]	—	—	—	—
Taro leaves	—	...[b]	...[b]	...[b]	—	—	—
Gourds	.6	.4	.7	.4	.9	.3	.4
Beverages	*6.2*	*7.5*	*6.0*	*4.4*	*3.0*	*10.5*	*4.9*
Banana beer	1.0	1.3	.8	.3	.3	1.6	1.3
Sorghum beer	5.2	6.2	5.2	4.1	2.8	8.9	3.6
Palm oil	.4	.2	.2	—	...[b]	—	.2
Meat and milk	*.6*	*.7*	*1.1*	*1.4*	*.6*	*1.4*	*.7*
Beef	.4	.3	.5−	.7	.3	.4	.7
Pork	—	.2	—	—	—	—	—
Milk (5.4% fat)	.2	.3	.7	.7	.3	.9	—
Total all foods	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

* Original data collected by the author with the kind assistance of IRSAC. Prepared foods were weighed daily before cooking. The daily consumption of beverages was partly estimated. Converted to calories using FAO, *Food Composition Tables—Minerals* and *Vitamins—for International Use* (Nutritional Studies, No. 11, 1954); FAO, *Food Composition Tables for International Use* (Nutritional Studies, No. 3, 1949); and for beverages, B. S. Platt, *Tables of Representative Foods, Commonly Used in Tropical Countries* (Great Britain, Medical Research Council, Special Reports Series No. 253, 1945). See Appendix Tables I for data in kilograms and litres per year. In 1956 the family included the husband, about 20 years old, his wife, possibly a year younger, and one child born in February 1955; by 1962 there were three more children, born in April 1957, September 1959, and December 1961.

[a] Mainly leaves; converted to calories assuming half dark green, half light green.

[b] Less than .05.

April:	Green bean harvest.
May:	Bean and maize harvest.
June:	Preparation of the marshes for the planting of sweet potatoes, the beginning of the sorghum and coffee harvest.
July:	Harvesting of peas, potatoes, coffee. Storage of sorghum, threshing of dried beans, mulching of coffee trees.
August:	Reconstruction of huts, brewing, marriages.
All year around:	Care of banana groves, preparation of banana beer and harvest of fruits, harvest and preparation of manioc, harvest of sweet potatoes, care of animals.

At times of heavy labor, such as sowing, harvesting, reconstruction of huts, neighbors come to help and are offered beer in return. This is one of the principal amusements. Food consumption varies, of course, in different regions: here more maize or eleusine, there more potatoes. Regardless of the particular variety of crops, the system of cultivation that prevails among the peasants of Ruanda-Urundi has always this multitude of activities, constantly employing all available labor and yielding more or less continuous harvests. Seasonal unemployment is almost unknown.

As with any agriculture reposing on a long tradition, these methods change but slowly except in sectors where the European administration has had a decisive influence.

Yields

As was said earlier, it is difficult to get a precise notion of the yields by reason of the great variability of climatic conditions, of variations in the quality of soil, of altitude and exposure. This imprecision is made worse by the fact that a considerable part of the potential harvest is sacrificed for immediate needs: sweet potatoes reach their maximum yield after eight months but they are harvested after four months; much maize is eaten when it is tender, some beans and peas in green pods. However, the annual estimates of agricultural yields according to the figures collected either by the agricultural service and by INEAC* indicate an improvement.

From one region to another the variations in yield are such that the change in average yields means nothing. For instance, maize yields around 1959 varied from 500 to 1,400 kilos, although the mean yields grew from 840 kilos in 1940 to 1,000 kilos around 1959. In general, yields have increased, following the diffusion of selective seeds introduced by INEAC. In the Ngozi district in 1956 white grain maize had almost entirely replaced the traditional red and purple types; the red Carolina bean introduced in 1938 and the small black beans, although thought little of for cooking, had spread widely on account of their high yields. New varieties of manioc and sweet potato have likewise contributed toward improving agricultural productivity. On the other hand there has been a fall in the yield of potatoes owing to black blight (Table 8).

Yields of crops for processing, which are wholly exported, have increased

* See p. 48, above.

TABLE 8.—YIELD OF CROPS PRODUCED BY AFRICANS IN RUANDI-URUNDI, 1940, 1949, AND AROUND 1959*

(*Kilograms per hectare*)

Crop	1940	1949	Around 1959 Average	Around 1959 Range
Grains				
Sorghum	990	1,085	1,200	600 – 1,300
Maize	840	900	1,000	500 – 1,400
Eleusine	475	555	600	400 – 700
Legumes				
Beans	700	640	750	400 – 900
Peas	585	715	800	600 – 1,100
Starchy roots				
Sweet potatoes	6,190	6,530	7,500	... ...
Manioc (fresh)	6,500	7,365	13,000	... ...
White potatoes	7,855	8,865	7,000	3,000 –10,000
Industrial crops				
Arabica coffee[a]	333	416	1,160	... ...
Cotton (seed)	557	557	1,216	... ...

* Data for 1940 and 1949 computed from area and production in *Plan Décennal*, pp. 348–52 (see 7 for complete reference). Data around 1959 from *Étude Globale*, pp. 178, 187, 200 (see *3* for complete reference).

[a] Beans. If the small amounts of arabica coffee produced by Europeans at 926 and 802 kg. per hectare in 1940 and 1949 respectively are included, the total yields are 349 in 1940 and 418 in 1949.

in a spectacular fashion; 1959 was a record for both coffee and cotton. The yields of both have doubled in ten years.

Output

Of all the Ruanda-Urundi statistics those which purport to measure changes in the production of food by self-suppliers are the most disputable. This is particularly true of information about the production of bananas and manioc and of the figures from Burundi. According to a critical study of 1959 data the overestimation of these must in general be of the order of one-half (*3*, p. 108). Hence the figures in Table 9 should be accepted only with some reserve, particularly so far as they concern bananas, roots and tubers. Nevertheless, this table indicates the general trend.

The increase in food production is due both to the use of better seed and to the bringing of more land under cultivation. Thanks to population pressure the less peopled areas are being progressively colonized. These are the drier regions—Imbo, Moso, Mayaga, Mutara—well-suited to manioc and sorghum, and, above all, the lands formerly given over to pasture. The settlement of cultivators on these lands and their diversion to tillage lead to the establishment of more and more banana groves. Hence a notable increase in the output of bananas. The foregoing gives a very approximate idea of the development of agricultural production. Having regard to the roughness of the estimates, the conclusion to be drawn would appear to be that, between 1945 and 1960, in spite of an extremely rapid growth of population (43.5 per cent), the food situation

TABLE 9.—PRODUCTION OF PRINCIPAL CROPS IN RUANDA-URUNDI, 1940, 1949, AND 1960*
(*Thousand metric tons*)

Crop	1940	1949	1960
Grains			
Sorghum	128.4	147.2	197.0
Maize	60.5	108.7	149.2
Eleusine	18.3	30.1	22.6
Legumes			
Beans	146.2	205.2	249.8
Peas	70.0	97.9	62.2
Starchy roots			
Sweet potatoes	870.0	1,110.5	1,089.5
Manioc (fresh)	367.2	958.0	1,501.5
White potatoes	320.0	93.1	101.3
Bananas	...	929.3	2,170.6
Industrial crops			
Arabica coffee[a]			
By Africans	6.0	7.9	20.1
By Europeans	.1	.1	.2
Cotton (seed)	3.6	3.7	9.5

* Except as otherwise indicated for coffee, production is by Africans. Data for 1940 and 1949 from *Plan Decennal*, pp. 348–52, 356 (see 7 for complete reference); for 1960 from *Rapport Annuel*, 1960, p. 440 (see citation 6 for complete reference). In view of the disrupted condition of the country it is the present author's belief that the figures for food crops in the latter report are more representative for 1959 than for 1960.

[a] Beans.

remained satisfactory, since cropping became at once more extensive and more intensive.

Changes in Factors of Production

The African farmer has neither the resources nor the opportunity to buy feedstuffs, farm machinery, or manures. Except on the experimental fields of INEAC (126 tons in 1959), chemical fertilizers are not used; transport costs from the seaboard and distribution expenses for small parcels are too high. In the immediate future there seems to be no possibility for their employment except for certain export crops of high unit values such as coffee, tea, and pyrethrum. Systematic trials on African coffee plantations were undertaken in 1958. After two years of trial the profitability of applying fertilizers to coffee trees appears to be proved in spite of their high price (*19*). Of animal feedstuffs, cotton cake, brewers' grains, and sugar cane molasses (from the Ruzizi factory) are available within the country; for want of local outlets the first are exported, the second are thrown into the lake, and the third used to correct the alkalinity of the cane fields.

On the other hand, the introduction, selection, adaptation, and multiplication of improved seed by INEAC have played a vital role in agricultural development. In 1946 the Kisozi station distributed maize seed giving yields exceeding those of the local varieties by 150 per cent, and bean seed giving 30 to 50 per cent better

yields. In 1950 the Karuzi farm distributed 18 tons of selected bean, maize, peanut, and soybean seed, and 226,000 tubers of sweet manioc; at the same time the seed farms distributed 51 tons of selected seed, 3,006 tons of sweet potato tubers, and 68,000 manioc tubers (*6*, 1950, p. 88).

In 1952 INEAC's Rubona station (Map 5) supplied, among other things, 4,200 kilos of food crop seeds, 733 kilos of tubers, and 507 kilos of tree seed for reforestation. The Kisozi station released 2,217 kilos of grain, 3,593 kilos of tubers, and 887 kilos of high-yielding pulses. It introduced peas at the same time which had a yield double that of the local peas, and it acclimatized the sweet potato type Norton Sam, which opened an entirely new district to sweet potato cultivation. From 1952 onward the plant breeding stations of Mugamba in Bururi territory distributed 50 tons of tubers in the high regions where the sweet potato was unknown ten years earlier (*23*, p. 214). Fresh introductions are constantly being made. In 1960 an especial effort was made with plants for animal feeding (Table 10).

All but the simplest tools of cultivation are virtually unknown. Over the years attempts have been made to introduce draft animals without the least success. Modern methods are used only on the export crops. Small hand tools

TABLE 10.—PRINCIPAL SELECTED SEEDS AND PLANTS DISTRIBUTED BY INEAC IN RUANDA-URUNDI IN 1960*

Product	Seeds (*kilograms*)	Plants	
		Kilograms	Number
Coffee, arabica	706		600[a]
Grains			
Maize	2,658		
Wheat	1,626		
Sorghum	852		
Eleusine	310		
Buckwheat	291		
Oats	97		
Legumes			
Beans	1,829		
Soybeans	1,364		
Peas	900		
Roots and tubers			
White potatoes		3,480[b]	
Sweet potatoes		2,453[c]	688,950[d]
Forage plants			
Pennisetum		1,500[c]	
Setaria Sphacelata		307[c]	
Paspalum notatum		300[c]	
Brachiaria ruziziensis	20	2,921[e]	

* Data from INEAC "Semences et plants fournis par l'INEAC en 1960," *Bulletin d'Information de l'INEAC*, October 1961, pp. 325–26.

[a] Seedlings.

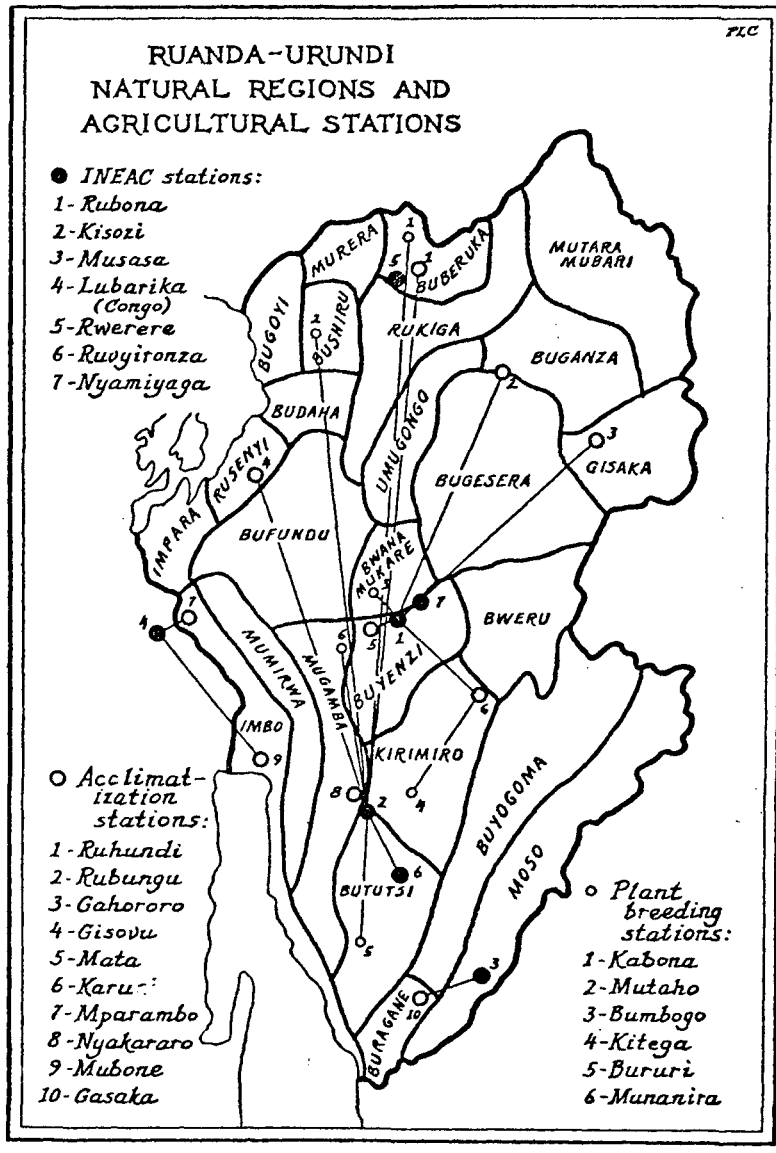
[b] Tubers.

[c] Cuttings, reported by weight.

[d] Additional cuttings reported by number.

[e] Root cuttings.

MAP 5



bought with the interest on the stabilization fund and distributed free to growers, such as dusters, saws, pruning shears, and drying screens, have helped to improve the quality of coffee; the cotton-growing paysannats have taken advantage of mechanized cultivation and of weed-killing by spray from aircraft.

Public Works in Aid of Agriculture

In the last few years the countryside of Ruanda-Urundi has undergone transformation through a variety of public works: irrigation channels, marsh drainage, anti-erosion measures, forestation.

Irrigation.—In Ruanda-Urundi irrigation works have a limited importance.

Above a thousand meters rice cultivation is difficult and the dry season relatively short (two to three months). During the dry season the marshes, after being well drained, are planted with sweet potatoes or maize; on the other hand in the warmer Ruzizi plain it is possible, thanks to irrigated paddies, to cultivate rice on the warped soils hitherto considered completely infertile and obtain relatively high yields, 3,500 kilos per hectare. In 1960, 5,000 out of the 6,700 hectares of irrigated crops in Ruanda-Urundi were to be found in the Ruzizi plain (*6*, 1960, p. 12).

Drainage.—The great extension of dry weather crops, particularly sweet potatoes, has been made possible by drainage of marshes, particularly the small and medium size marshes at a high altitude. At the end of 1960, 107,857 hectares of marshes had been drained; 92,502 hectares were under cultivation in that year. It may be recalled that as late as 1924 wet lands were reserved for livestock. By the end of 1950, 84,500 hectares had been drained. Marsh cultivation has several advantages. It is practiced at a season of relatively slack activity on the hillsides; it drives out the wart-hogs and the antelopes which damage the crops on the neighboring hills, so preventing the cultivation of root crops and reducing agricultural yields.

Anti-erosion Measures.—By reason of the country's relief and population density, cultivated land in Ruanda-Urundi is rarely on a slope of less than 5 per cent; very large areas have a slope of 10 to 25 per cent and particularly in the north of the country cultivation of slopes of 40 to 50 per cent is nothing extraordinary. The battle against erosion was therefore urgent and was undertaken on a grand scale. At the end of 1950 there were 110,100 kilometers of hedges and ditches protecting 142,931 hectares. By the end of 1955 there were 344,208 kilometers of hedges and ditches protecting 407,112 hectares and at the end of 1960, 557,359 kilometers of hedges and ditches protecting about 745,008 hectares (*6*, 1960, p. 111). At the rate of ten meters of ditch per man per day this represents 55 million days work. Anti-erosion ditches now protect more than half the cultivated land of the country. Formerly these ditches were continuous. Latterly a new technique, the criss-crossing of blind ditches or *baradines,* which retain the water better, has become common. These ditches extend the grazing season on the pastures by one month.

Forestation.—Among the measures taken against erosion, to insure the regular flow of springs and streams, and to provide wood for building, conservation measures were taken in the forest of the Congo-Nile watershed and numerous woodlands were planted. Reforestation has been stepped up during the course of the period covered by the Ten-Year Plan. In 1945 the native communities had replanted 27,150 hectares, by the end of 1949, 32,942 hectares and by the end of 1960, 48,880 hectares (Table 11).

Thanks to the favorable climate, tree growth is uninterrupted throughout the year and the production of wood is very high. Certain cypress plantations grow as much as 35 or 40 cubic meters per hectare per year between their eleventh and fifteenth years. Forestation also insures that the flow of streams is more regular. A woodland of 90 hectares in area from a mountain of 2,200 meters overlooking Astrida (elevation 1,750 meters) has brought about an increase in the flow from springs and has raised the water-table substantially. Some sixty families have put under cultivation land that hitherto gave only a meager pasture.

TABLE 11.—STATUS OF REFORESTATION IN RUANDA-URUNDI, 1960*
(*Hectares*)

Category	Details	Total
Foreign-controlled		3,277
Government		2,350
Commercial woods	1,407	
Black wattle (acacia)	943	
African communities		49,732
Communal	48,051	
Chiefdom account	372	
National account	465	
Administrative posts	844	
Other		12,121
Individuals	12,085	
Shaded pastures	36	
Grand total		67,480

* Data from *Rapport Annuel, 1960*, p. 447 (see *6* for complete reference).

Attempts at Resettlement.—With the aim of creating communities of a more developed sort than at present exist, and at the same time to make it easier to install public services such as water, schools, and markets, part of the population has been grouped into villages. These innovations have been accepted with reluctance. Africans are wary about adopting new methods of construction that give bigger but far more costly huts.

TRADE AND TRANSPORT

Agriculture, stock raising, and fishing form together three quarters of the gross domestic product. Data for 1959 are shown in Table 12; no comparable statistics exist for 1945 or even for 1950. It may be surmised that the production of food per head has remained roughly constant throughout the period, and that the total gross income from livestock has remained stationary.

The most important changes have arisen from the growing predominance of coffee. Production, in terms of beans, has developed as follows (*6*, 1960,[6] p. 440, and earlier issues):

1945	5,000 tons	1959	37,000 tons
1950	12,200 tons	1960	20,000 tons
1955	16,400 tons		

Cotton marketing has followed a comparable development (*6*, 1960,[6] p. 440, and earlier issues):

1945	2,500 tons	1959	10,313 tons
1950	3,500 tons	1960	9,500 tons
1955	7,000 tons		

[6] The figures in the 1960 report for coffee and cotton, unlike the food crops noted in Table 9, clearly apply to the year 1960.

TABLE 12.—GROSS DOMESTIC PRODUCT OF RUANDA-URUNDI IN 1959*
(*Million Congo francs*)

Industry	Value Details	Value Total
Agriculture		6,850
Food crops	5,700	
Industrial crops[a]	1,150	
Stockraising		650
Meat	480	
Milk	150	
Hides	20	
Fishing		40
Mining and quarrying		180
Industrial production		500
Construction		350
Transportation		130
Trade		850
Housing		160
Services		250
Public administration		1,000
Total		10,960

* Data in 1958 prices from *Étude Globale*, p. 353 (see *3* for complete reference).
[a] Mainly coffee and cotton.

Lastly, fishing has become important. In 1945 fish production was insignificant, but Greek fishermen have introduced on Lake Tanganyika methods used for sardine fishing in the Mediterranean. The Usumbura market has absorbed growing quantities of fish. The catches have been as follows, in metric tons (*3*, p. 266):

1952	2,500	1957	7,500
1953	3,000	1958	9,900
1954	4,100	1959	10,082
1955	5,500	1960	8,100
1956	4,500		

Technical development in respect of export crops has been rapid and this has led to a considerable increase in the production per unit. Production of mountain arabica coffee in 1959 reached one kilo per tree and Ruanda-Urundi thus attained a yield ten times that of African growers in Cameroun and double that of the small-holders of Colombia. In that year coffee occupied three per cent of the area under cultivation and furnished one-sixth of the agricultural income. It constituted the most important single item in trade.

The remaining agricultural output had no interior market worth mentioning. Ninety-five per cent of it is consumed by the producers themselves and the remainder generally speaking by others living near by.

Trade in foodstuffs has developed but little over the years. In 1955 the sale of agricultural products by Africans to Europeans brought in 61 million francs, barely one-tenth of the receipts from coffee at that time (*2*), or one per cent of

the estimated value of the total output. This figure has since shrunk owing to a reduction in purchases by the tin mines. The world tin crisis obliged the companies to reduce their production and at the same time the government in Leopoldville enforced constant wage increases which led to a reduction of the number of mines in operation and a rationalization of those remaining open, all of which diminished the market for food products bought to feed the miners. The farmers of the Ruzizi plain alone had in Usumbura a sizable market for manioc, rice, and palm oil. Even in this district, however, the idea of producing food for sale is a strange one to the African farmer.

Transport

Over the period 1945 to 1960 the road network developed rapidly. On the one hand the network has been extended. In 1945 there were altogether 7,000 kilometers of roads; in 1960 there were over 11,000 kilometers of which 45 were paved main roads, 2,676 were main roads six meters wide with maintained surfaces and permanent bridges, and 8,690 kilometers were local roads.

The road density, 200 meters of road per square kilometer, is the highest in Africa. Unhappily many of these roads were very rudimentary with excessive grades, and bridges that were temporary or bore insufficient weights. The maximum gross legal weight for vehicles was limited to eight metric tons on the principal roads and five metric tons on the secondary roads. Improvements in the network, even more than its extension, have made it possible to increase the average dimension of vehicles and so reduce considerably the cost of transport.

In 1950 the Ten-Year Plan estimated the cost of transport per ton-kilometer at 4.5 francs for three-ton trucks fully loaded and 2.7 francs for 15-ton trucks. In 1960, thanks to the improvement in the road network, the cost of transport per ton had fallen, principally through use of heavier vehicles. For full loads the ton-kilometer cost then about 3 francs for six-ton trucks and little more than 2 francs for 18-ton trucks. The improvement of the road network has led to an increase in the number of vehicles registered, mainly in the heavier kinds. Assuming an average weight of two tons for light vans and eight tons for heavy ones the latter accounted for a quarter of the total transport capacity in 1939, more than half in 1949, and about four-fifths in 1958 (Table 13).

TABLE 13.—PRIVATELY OWNED MOTOR VEHICLES IN USE IN RUANDA-URUNDI, 1939, 1949, AND 1958*

Type	1939	1949	1958
Passenger cars[a]	298	788	2,840
Trucks			
Small	150	749	949
Over 3 tons	13	254	912
Tractors	7	12	10
Buses	—	—	5
Other	—	—	174
Total	468	1,803	4,890

* Data from *Étude Globale*, p. 334 (see 3 for complete reference).
[a] Including station wagons and jeeps.

Consumption of motor fuel has climbed from 3,100 tons in 1946 to 19,000 tons in 1959 and 21,000 tons in 1960. The increased consumption has entailed rationalization of the supply network which has notably lowered the cost of petroleum products. The reduction in transport costs has considerably bettered the terms of trade from the point of view of the African producer. However, the improvement of means of transport has made little difference to the exchange of food products among Africans. These foodstuffs are carried only on narrow trails generally on the head and within a radius of two hours' walk of the markets. Occasionally middlemen, mostly coast Swahili, use trucks to transport peas, beans, and sorghum from one market to another: but overall this trade is insignificant. However, dry fish from Lake Tanganyika penetrates further and further into the interior markets of Ruanda-Urundi thanks to the improvements in transport.

The Organization of Trade

The principal export of Ruanda-Urundi is arabica coffee and its principal market is in the United States. Belgium buys tin ore and a little cotton. In 1959 the distribution of exports by destination was as follows: United States, 76.5 per cent, Belgium, 12 per cent, Congo, 7.8 per cent, other countries, 3.7 per cent (*3*, p. 19).

Imports were slightly higher than exports, which was made possible by the subsidies from Belgium (Tables 14 and 15).

The whole system of trade is organized around the export of coffee and the import of trade goods for African consumption. Subsidiary trading is virtually

TABLE 14.—PRINCIPAL EXPORTS OF RUANDA-URUNDI, VALUES, 1959 AND 1960*
(*Million Congo francs*)

Commodity	1959	1960
To foreign countries		
Coffee	1,176	679
Mineral ores	101	163
Cotton and cotton products	67	151
Hides and skins	27	25
Tin	22	10
All other	23	146
Total	1,416	1,174[a]
To Congo (estimated)[b]		
Live animals	70	150
All other	151	156
Total	1,416	1,174[b]
Grand total	1,637	1,480

* Data from *Étude Globale*, pp. 317–18 (see *3* for complete reference). Through 1959, while the Belgian Congo Ruanda-Urundi Customs Union was in effect, statistics were not collected for trade between the two. During 1960 the situation was statistically confused. See notes [b] and [c] for some clarification from the source cited, pp. 313–14.

[a] Includes 98 million reported to the Congo via the port CFL at Usumbura and via the Katumba road.

[b] Presumably includes transit trade through Congo.

[c] Estimated: via the Northern roads.

TABLE 15.—IMPORTS OF RUANDA-URUNDI; VALUES, 1960*

	Million Congo francs		Per cent
	Details	Total	
Nondurable consumer goods		903	57.0
Textiles	390		
Foods	227		
Other	286		
Producer goods		280	17.7
Vehicles	191		
Other	89		
Raw materials and semi-manufactured products		216	13.7
Iron and steel	103		
Other	113		
Consumer durable goods		96	6.0
Electrical equipment	46		
Other	50		
Fuel and oil	88	88	5.6
Total	1,583	1,583	100.0

* Total imports less re-exports. Excludes trade via the Northern roads and via the airport at Usumbura, but includes other trade with the Congo. The estimated total including the omitted routes is 1,737. Data are from *Étude Globale*, pp. 314–15 (see *3* for complete reference).

non-existent, as witnessed by the rapidity with which the seasonal increase in monetary circulation disappears once the coffee harvest is over (*23*, p. 71).

Local industry is little developed: the value of its production in 1959 was put at 228 million francs, of which 140 million were represented by beer. As was remarked earlier, agricultural production is mainly consumed by the producers themselves. Furthermore, the producer co-operatives for coffee, the cotton company, and the tin mines trade directly with the foreign customer without going through the normal channels of internal trade. Accordingly, in 1957 the sector labeled "commerce" stood for no more than 4.7 per cent of the gross national product; in 1959, following a great development of the coffee market, the "value added" of commerce, 700 million francs, was equal to 7 per cent of the gross added value. Nevertheless, business is highly competitive. In 1960 three great Belgian banks were operating in the territory. Thanks to the assistance of the coffee exporters, who are, above all, anxious to swell their turnover, the petty traders in the interior, mostly Greeks, Ismailis, Hindus, or Muscat Arabs, are able to get easy credit, often without sufficient security (*21*).

Distributive Network

The majority of traders are Africans. In 1960 the trading establishments could be divided into:

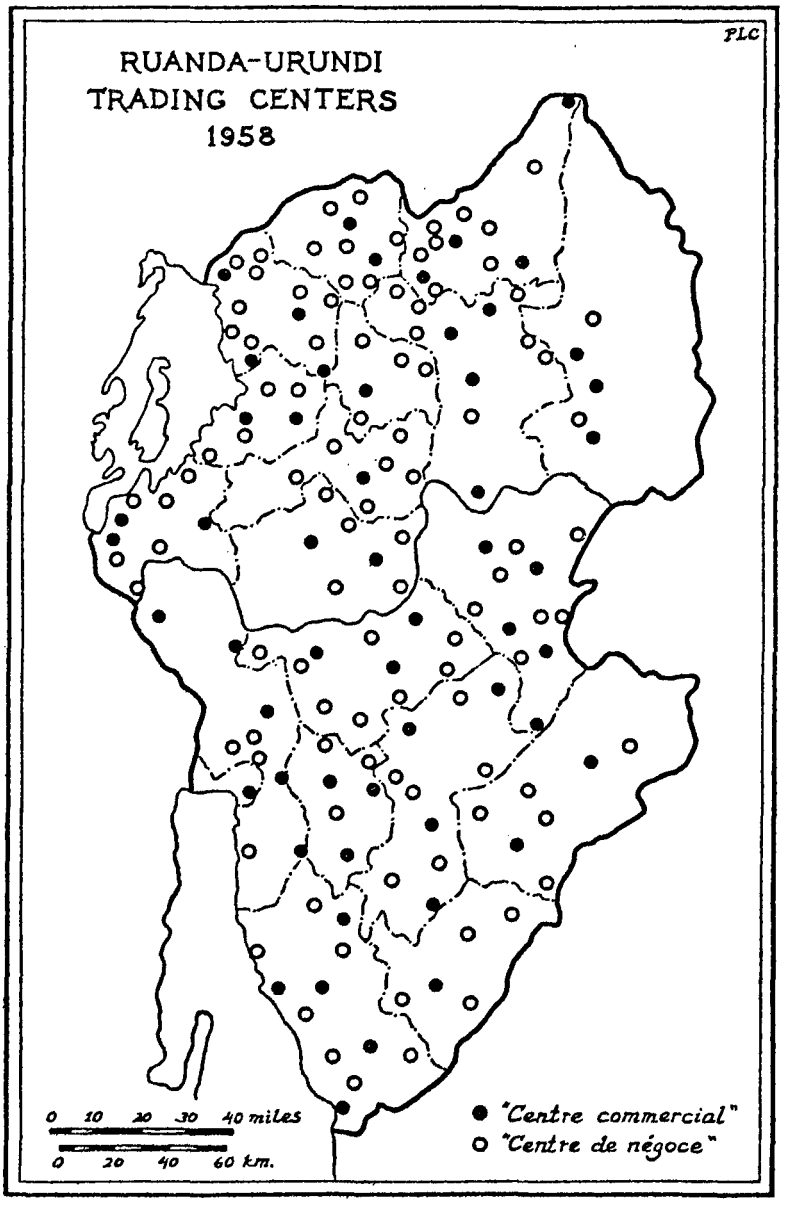
435 banking and commercial establishments belonging to Europeans, of which 181 were Belgians and 155 Greeks.

479 establishments belonging to Asiatics, i.e., Ismailis, Pakistanis, Hindus, and Muscat Arabs.

4,831 establishments belonging to Africans of which 4,760 were natives of Ruanda-Urundi.

Map 6 shows the trading centers, in which commercial establishments have to be licensed. There are two types of trading centers: principal (*centres commerciaux*) and secondary (*centres de négoce*). In the first the shops have to be built of durable material and may be kept by non-Africans; the license for Africans has however been reduced to one-fifth of that for non-Africans. In the secondary centers the shops may be built of non-durable material such as clay. The license fee was tiny. Africans might establish themselves freely. Only the shops of the nearest centres commerciaux were permitted to open branches, directed by Africans. The 57 centres commerciaux had already been set up in 1949.

MAP 6



On the other hand, the number of centres de négoce has more than trebled since that date, from 31 to 106. Two-thirds of the total business turnover takes place in the centres commerciaux, at prices generally lower than those in the secondary centers. This tends to reduce the share of natives in trade; in spite of tax discrimination in their favor, they had in 1960 no more than 2.2 per cent of the establishments in the centres commerciaux compared with 79.5 per cent of those in the centres de négoce. Traditional markets are generally linked with centres de négoce; they chiefly deal in foodstuffs, cattle, pottery, and basket work. They are held once or twice a week for the neighboring residents; the amounts traded are generally small and the goods are mostly carried on the heads of the suppliers and the customers.

At the end of the period under discussion African traders were settling more and more commonly in the countryside so as to escape the sometimes lively competition that prevails in the organized trading centers. The number of itinerant traders is insignificant.

Marketing Organizations

The two principal export crops, coffee and cotton, are controlled by national organizations. Coffee exports are organized by OCIRU, and cotton is entirely excluded from the normal commercial channels.

Coffee.—In 1960 arabica coffee grown by Africans accounted for 98 per cent of the total coffee production. In December 1948, with the aim of improving the conditions under which this coffee was exported, the government created the *Office des Cafés Indigènes du Ruanda-Urundi* (OCIRU). This organization which works in close collaboration with the research stations of INEAC and the agricultural services has a three-fold task: to encourage production, to improve trading conditions by classifying the beans into standard types, and to stabilize the income of producers by setting up a reserve and stabilization fund. Take production first. In 1959 there were seventeen agricultural technicians, assisted by some four hundred African instructors or one for each one thousand coffee planters. These people watched over the maintenance of the plantation, methods of cultivation, mulching, pruning, and pest control, and maintained the pulping centers. At Usumbura OCIRU submits each batch of coffee to minute examination, and classifies it into one of a number of categories, according to the number of broken cherries, their color and size, percentage of impurities and the color of the sample brew (Table 16).

TABLE 16.—CLASSIFICATION OF ARABICA COFFEE MARKETED IN RUANDA-URUNDI, 1960*

Type	Per cent	Type	Per cent
Caracoli A	—	Ociru 3B	4.52
Caracoli B	.06	Brokens 4	.42
Ociru 1	—	Brokens 5	5.50
Ociru 2	36.09	Below grade	.51
Ociru 3A	52.90	Total	100.00

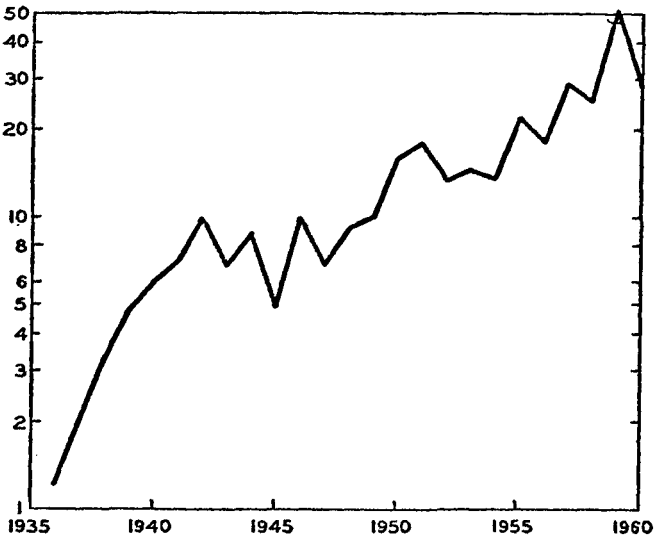
* Data from Ruanda-Urundi, Service des Affaires Économiques, *Rapport, 1960* (Usumbura, mimeo.) p. 88.

Thereafter, an export certificate is attached to each sack, giving a description of the coffee in its green and roasted state and indicating the nature of the brew. This classification enables the manufacturers to standardize qualities, type 3A being the most popular. The trade in arabica coffee has thus been enabled to develop on the basis of established criteria.

As a stabilizing measure and as a means of providing funds to carry on the organization, a levy was payable each year which varied according to the price of arabica coffee on the world market. In 1956–57, this levy amounted to 5.03 francs per kilo, or around 10 per cent of the export price f.o.b. Usumbura; 3 francs went to the equalization fund and the remainder to the budget of OCIRU. The equalization fund amounted in 1960 to about 400 million francs. Unfortunately, as things turned out, most of it was invested in Congolese loans. The interest on the equalization fund was used for programs of technical assistance such as the free distribution of tools, already mentioned, research into improvements in cultivation, fertilizer trials, and measures against coffee pests and diseases, notably a complete spraying of all the trees on two occasions (*6*, 1960, p. 121). This caused a fall in the percentage losses from diseases and parasites from 30–35 per cent to 12 per cent in 1957 and 1958 (*12*, p. 239).

The success of these methods and the value of an efficient technical staff can be illustrated by two comparisons. In Ruanda-Urundi in 1959 the production of salable arabica coffee was 1,160 kilos per hectare compared with 100 to 200 kilos per hectare in the African plantations of the Cameroon. Even in Colombia, as has already been mentioned, the yield per hectare is no more than half that in Ruanda-Urundi. In 1960 the powers of the administration were reduced and the production of coffee fell by 45 per cent (Chart 1); two-thirds of this fall was due to the biennial production cycle but the remaining third must be attributed

CHART 1.—PRODUCTION OF PARCHMENT COFFEE IN RUANDA-URUNDI, 1936–60*
(*Thousand metric tons; logarithmic vertical scale*)



* Data from Ruanda-Urundi, Service des Affaires Économiques, *Rapport Annuel, 1960* (Usumbura, mimeo.) p. 131.

to negligence. It represents a loss for the producer of between 70 and 100 million francs.

The processing of the beans has made comparable progress. Formerly pulping was done by primitive methods, by mouth or by beating on stones. Nowadays it takes place in small mills installed all over the country, by OCIRU, in the proportion of one pulping machine for each 100,000 coffee trees (see Map 7). Even so, this method gives only a mediocre quality product which is not com-

MAP 7

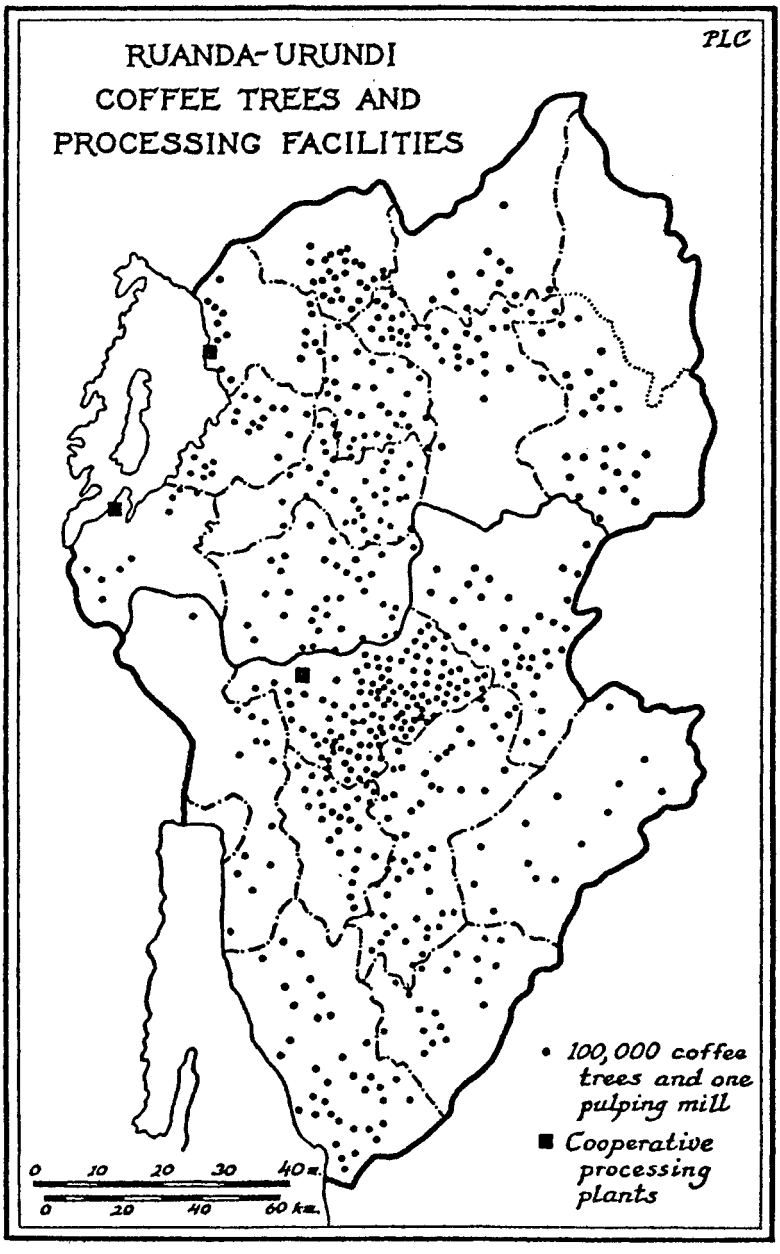


TABLE 17.—PROVISIONAL ADVANCES PAID ON DELIVERIES OF SEED COTTON IN RUANDA-URUNDI, 1952–62*

(*Congo francs per kilogram*)

Year	1st quality (white)	2d quality (yellow)
1952	7.00	5.00
1953	6.50	4.50
1954	6.50	4.50
1955	6.50	4.50
1956	6.50	4.50
1957	6.50	4.50
1958	8.00	5.00
1959	8.00	5.00
1960	8.00	5.00
1961	6.00	4.00
1962	6.00	4.00

* Data from Banque d'Emission du Ruanda et du Burundi, *Bulletin Mensuel* (Usumbura), Nov.–Dec. 1962, p. 13.

parable to that of coffee treated by dry methods. Accordingly since 1953 OCIRU has promoted the creation of three coffee-cherry co-operatives. The members bring their cherries to the factory which converts them into raw coffee; thereafter it is graded. These co-operatives, two in Rwanda and one in Burundi, have dealt with the coffee of 23,000 members. In 1960 the creation of a network of processing plants to treat the cherries was under consideration.

Cotton.—Ruanda-Urundi is a small producer of cotton. The crop occupies some 8,000 hectares in the Ruzizi plain; the amount of land suitable for cotton is extremely limited. Its production and marketing are highly organized, both commercially and technically, in such a way as to yield the African planter a much higher income than that of the mountain farmer. More than 60 per cent of the production comes from cotton growing paysannats, composed of immigrants from the overpopulated uplands. Each member was allotted a holding of 4 hectares in a band 630 meters long by 63 wide. The holding comprises ten equal strips of which two are under cotton every year. The rotation comprises two years of cotton, two years of manioc, together with maize or beans, and four years of fallow. As the location of the strips sown to cotton is determined centrally, it is possible to dust them with insecticides from aircraft and to undertake other collective work; in 1960, 5,784 hectares were dusted from the air.

The Ruzizi company has an effective monopoly of cotton ginning.[7] According to the terms of the cotton decree applying to Ruanda-Urundi beginning with the harvest of 1950, the cotton planters remain owners of their cotton until it is sold; the cotton companies are confined to purchasing it for market. A central organization, the *Comptoir de Ventes des Cotons Congolais,* sells the cotton fiber on behalf of the native planters. Each producer receives an advance payment on the outturn at the time he delivers his cotton (Table 17). The balance was credited to him after the cotton had been sold on the domestic or international market. Reductions were made to cover transport costs, the cost of proc-

[7] For further information on the cotton industry see *5*.

essing (a fixed sum calculated according to the accounts of a Congolese factory considered as exceptionally efficient), the costs incidental to cultivation such as sterilization of seed, dusting from the air, and free distribution of insecticides, together with a stabilization fund levy.

The cotton stabilization fund, which was common to the Congo and Ruanda-Urundi, was administered by a board of directors with offices at Leopoldville. Its total reserves at one time were as high as 2 billion francs but had diminished by one-half at the beginning of 1960 because of a fall in the international cotton market.

With the aim of securing a higher price for cotton, production techniques have been constantly improved; the law requires the complete destruction of cotton seed. The only seeds now to be planted are of selected varieties, treated with acid against parasites. Harvesting by hand yields a high grade cotton too valuable to be used within the country; white cotton accounts for four-fifths of the total. The maximum use is made of by-products (seed and lint). Under the Ten-Year Plan, a crushing mill was built at Usumbura, adjoining the cotton gin. Half the profits were to go to the producers and the other half to the mill. Some of the resulting oil was used locally. A blanket factory, using the lint, supplied the interior of the country with blankets very cheaply.

Returns to the producer have risen along with production. Up to 1951, production varied between three and four thousand metric tons, from an area of around 6,700 hectares; for instance, in 1950, 6,850 hectares yielded 3,220 tons of cotton. In 1959 an area of about 8,440 hectares produced 10,313 tons of cotton. In 1960, following less favorable weather, the production fell back to 9,483 tons (*6*, 1960, p. 440, and earlier issues). Productivity of cotton fields in Ruanda-Urundi compares favorably with that of other regions in Africa, as will appear from the following figures in kilos of cotton fiber per hectare (*3*, p. 201):

Country	Year	Production (kg. per ha.)
Ruanda-Urundi	1956	210
	1959	386
Chad	1956	110
Uganda	1956	110
Cameroon	1958	164
Congo	1956	150
Angola	1956	100

Massive spraying with insecticides has had another fortunate consequence. It has much reduced the incidence of malaria in the marshy zones of the lower Ruzizi.

Pyrethrum.—Pyrethrum production is limited to regions about 2,000 meters in altitude, with a mean rainfall around 1,500 millimeters (60 inches) and with rich soil. European settlers produced 959 tons in 1959; 225 hectares were planted on the Kinigi state farm and 30 hectares in the region of Bugoyi provincial farm; it was hoped to raise this total eventually to 600 hectares. Pyrethrum is one of the ingredients in the insecticides that are applied to arabica coffee trees in Ruanda-Urundi.

Co-operatives

The Belgian Administration systematically encouraged the establishment of co-operatives. The Treasury advanced the capital of a number of them, interest-free in the first year and afterwards at very low rates, 2 per cent from the beginning of the second year and 4 per cent from the beginning of the third year. Moreover, for five years all their profits were exempt from taxation. In return for these concessions, a government official was put in charge of the co-operative movement with the right to supervise their financial management and verify the regularity of their accounts (*6*, 1960, pp. 99–100).

Twenty-one co-operatives were in operation in August 1960. Only a few were consumer co-operatives; however, these existed for the workers in the tin mines, for the educated natives, for instance Trafipro at Kabgaye and Copico in Usumbura, and for the members of a planters co-operative at Nyarusasa. Producer co-operatives, particularly for coffee marketing, were very much more important.

The three co-operatives of the Imbo Co-operative Union, under European management, were responsible for the flow of foodstuffs grown in the paysannats of Ruzizi to Usumbura. Among the coffee co-operatives, one must distinguish between those which treat coffee cherries and those which market the coffee bean. The former, covering more than 23,000 coffee planters, have already been mentioned. The burdensome character of their administrative machinery, the tiresomeness for the producer of having to transport his cherries over long distances, perhaps as much as 15 kilometers, on foot, and heavy amortization charges which wiped out any immediate advantage to the producer from using a co-operative, have acted as a brake on their development. On the other hand, the eight co-operatives preparing coffee beans for the market and thereafter selling them to the exporters have been successful, having 40,000 members in 1959. They are a recent development, entirely organized by the Africans to free themselves from middlemen.

DEVELOPMENTS IN STOCK RAISING BETWEEN 1945 AND 1960

In spite of the gradual changes that have taken place, Rwanda society remained a pastoral one until the revolution at the end of 1959, and Burundi remains such to this day.

"Nothing is better than a cow," runs a Rwanda adage. The cow was the instrument by which one man became the vassal of another under the contract of pastoral serfdom. According to this contract, called *ubuhake* in Rwanda and *ubugabire* in Burundi, each holder of cattle held his herd by grant of a superior. The suzerain had an obligation of protection and assistance. He was obliged to help his vassal in his intrigues to protect him against the covetousness of other powerful men and help him if he went to law; he had to defend him by force of arms in case of need. This protection was made manifest by the grant of a head of cattle and land to go with it. The protection, however, was not given without a *quid pro quo*: the vassal did not obtain the cow, the symbol of his contract, except after long and assiduous paying of court. He was obliged to perform many labor services, carry the suzerain's messages, build his huts, culti-

vate his fields, furnish him with rents in food or pots of banana beer, or accompany him on military expeditions (*17*). A sort of equilibrium was established between the rights and duties of suzerains and vassals respectively. A vassal could defend himself against the rapacity of the suzerain by multiplying his contracts by intrigue, playing off one master against another. If his situation became intolerable he would leave his hillside and go and establish himself in a new fief, with the protection of a more favorable master. In all this the cow herself played only a minor *economic* role. The cows in Rwanda calve only once in three years and produce at best 150 litres of milk per lactation (*1*, p. 63). Moreover, a part of the milk had to be returned to the lord. In regions with poor soil the manure was the chief advantage gained by the vassal.

Since the European occupation the contract of vassalage has changed. The services imposed by suzerains and chiefs have been limited by law. On the other hand, the state called upon the Hutu vassals for labor services in the construction of roads and trails, in the struggle against erosion, in the compulsory growing of foodstuffs, for reforestation and drainage. Labor services disappeared little by little but the burden of taxation increased. As nonpayment of taxes was enforced by imprisonment, many suzerains, in accordance with their obligation to protect the vassal, paid the latter's tax directly. In spite of this adaptation to modern circumstances, pastoral serfdom has become more and more unpopular.

From 1945 onward the native authorities in Rwanda proposed the suppression of the *ubuhake* contract, and this was included in the objectives of the Ten-Year Plan. It began in 1954 in the Nyanza territory at the lowest level of the contractual pyramid. By 1959, 21,000 contracts, covering 210,000 head of cattle, or about one-third of the livestock of Rwanda, had been dissolved. The tribunal setup for the purpose awarded two-thirds of the value of the herd to the vassal and one-third to the suzerain. From November 1959 onward the process took a revolutionary turn; the Hutu government liquidated the contract of pastoral serfdom which it considered as a vestige of Tutsi domination. By contrast, in Burundi, where the density of population, both human and animal, is less marked and the problem less urgent, the contract still remains.

Stock-raising

In contrast with other African countries, the raising of cattle for their own sake, unaccompanied by agriculture, is less and less common in Ruanda-Urundi. The majority of cattle owners maintain one or two cows who live in close relationship with the family and are extremely docile. At night the cows rest within the enclosure of spurge or dried sorghum, grouped around a fire of cow dung which protects them from the mosquitoes. The calves sleep in the hut, very often along with the goats. At daybreak the farmer, always sitting on the right side, milks the cows, first using the calf to set the milk flowing. The calf afterwards empties the udder and the cows go to pasture. Where the animals graze in common groups of twenty to thirty, they are watched over by a band of boys and girls "of age to look after cattle," twelve to fourteen. Generally speaking, the cattle are watered daily toward the beginning of the afternoon and they return each evening to the family enclosure.

The graziers know how to deal with ticks and in general possess a good

elementary notion of their business. Nevertheless, cattle suffer at times from serious diseases and from undernourishment; moreover, too many superannuated beasts are kept in the herd. Some serious diseases, notably rinderpest, have disappeared, thanks to mass vaccination, but other diseases have been on the increase. Bovine sleeping sickness has advanced from the Tanganyika frontier toward the west and has decimated the herds of the pastoral zones on the frontier of that country.

In the course of the last few years cysticercosis,[8] a cattle malady that is associated with improper hygiene and improper food preparation, has become problem number one for the stock raiser, and has removed all possibility of economic pig raising. Bovine cysticercosis, which infests 0.002 per cent of the herd in the United States, 0.05 per cent in Argentina, 0.2 per cent in Europe, 10 per cent in Senegal, 12 per cent in Madagascar, 21 per cent in Kenya, and 24 per cent in Indonesia, infests more than half of the cattle herds of Ruanda-Urundi, 80 per cent of the animals at Astrida, and 90–95 per cent in the pastoral sector of Kibuye along Lake Kivu. This situation is derived from a density of population, human and animal, and from the promiscuity in which both humans and animals live. The human beings are infested through consuming food insufficiently cooked, and reinfest the animals in their turn by defecating whenever or wherever the need arises. For pigs the evil is even worse. The first case of porcine cysticercosis was reported in Usumbura in 1949 and a whole year passed before a further case was heard of. In 1953, 103 cases were reported; in 1957, 825 cases. Today 90 per cent of the pigs that are eaten are infected.

Seasonal undernourishment of cattle is general: the pastures are undergrazed during the rainy season and overgrazed in the dry season which, fortunately, is very short. In former times, during this season, the cows were pastured on the marshes and on sorghum stubble; after the first rains the fields, cleared of their coarse straw by brush fires, gave tender grass. Today the majority of marshes are under cultivation; the Hutu are vehemently opposed to any right of pasturage of sorghum stubble, and brush fires are severely regulated. Competition between man and beast is more and more open; it is much to the credit of the graziers that in such conditions the herds have not diminished over the years. The annual output of the herds remains at about 12 per cent of the total, more than in the llanos of Venezuela, and double that of the herds of Madagascar.

Despite numerous efforts, feeding of cattle other than by grazing, is not yet general. The Administration enforced the planting of elephant grass on the lands enclosed by anti-erosion hedges and ditches. Like the bent grass which it superseded, elephant grass was not used for the purpose for which it was intended. Instead of serving to feed cattle, for which it would have had to be cut, it was grazed and destroyed by starving beasts or used when the reeds were dry for covering huts. It was remarked earlier that the brewers' grains of the Usumbura brewery were thrown into the lake, the molasses from the Ruzizi sugar factory was used to modify the alkalinity of the cane fields, and the cottonseed cake was exported to Europe.

[8] Infestation with tape-worm larvae.

Government Action Concerning Cattle Raising

During the period 1945 to 1960, the veterinary services were progressively enlarged. In 1945 the veterinary service numbered 14 staff members and 29 veterinary assistants. It ran the only breeding station in the country (which was handed over to INEAC in 1950) and collaborated with the agricultural service in encouraging the use of better sires and of fodder crops, a responsibility taken over after 1958 by the livestock services. In 1959 the veterinary service comprised 20 veterinarians, 12 technical officers, 23 technical assistants (formerly veterinary assistants), 14 technical aides (formerly veterinary guards), 35 laboratory workers, 294 veterinary nurses, and 12 veterinary trainees. Veterinary assistants are trained at the school of Astrida by the veterinarians; after three years of secondary schooling they take a four-year course in the theory of veterinary medicine and two years of practical training. The livestock service employed ten European officers. It was charged with disseminating the use of forage crops and of modern methods of animal feeding, and it ran five breeding farms in collaboration with INEAC, which itself possessed two main selection centers, one in Rwanda and the other in Burundi. The primary function of the veterinary service is medical. It is by control of cattle plagues since 1922 that the veterinarians have won the respect of the graziers. Gradually the service has extended its activities. It was observed that animals suffered from chronic undernourishment in each dry season; consequently, the Ten-Year Plan of 1950 provided for a drastic reduction in herds, as much as 45 per cent. Thereafter, the hypothesis of overstocking of pastures was examined more closely. Experiments undertaken by INEAC showed that the problem had been badly stated; thereafter, the policy was directed toward a gradual increase in forage crops. The increase in veterinary care called for the establishment of an infrastructure, notably the building of numerous dipping tanks to fight against ticks, and of numerous veterinary centers.

Lastly, the veterinary service concerned itself with the better utilization of animal products, the drying of hides destined for export, the sterilization of meat that might carry cysticercosis, control of milk, and manufacture of butter.

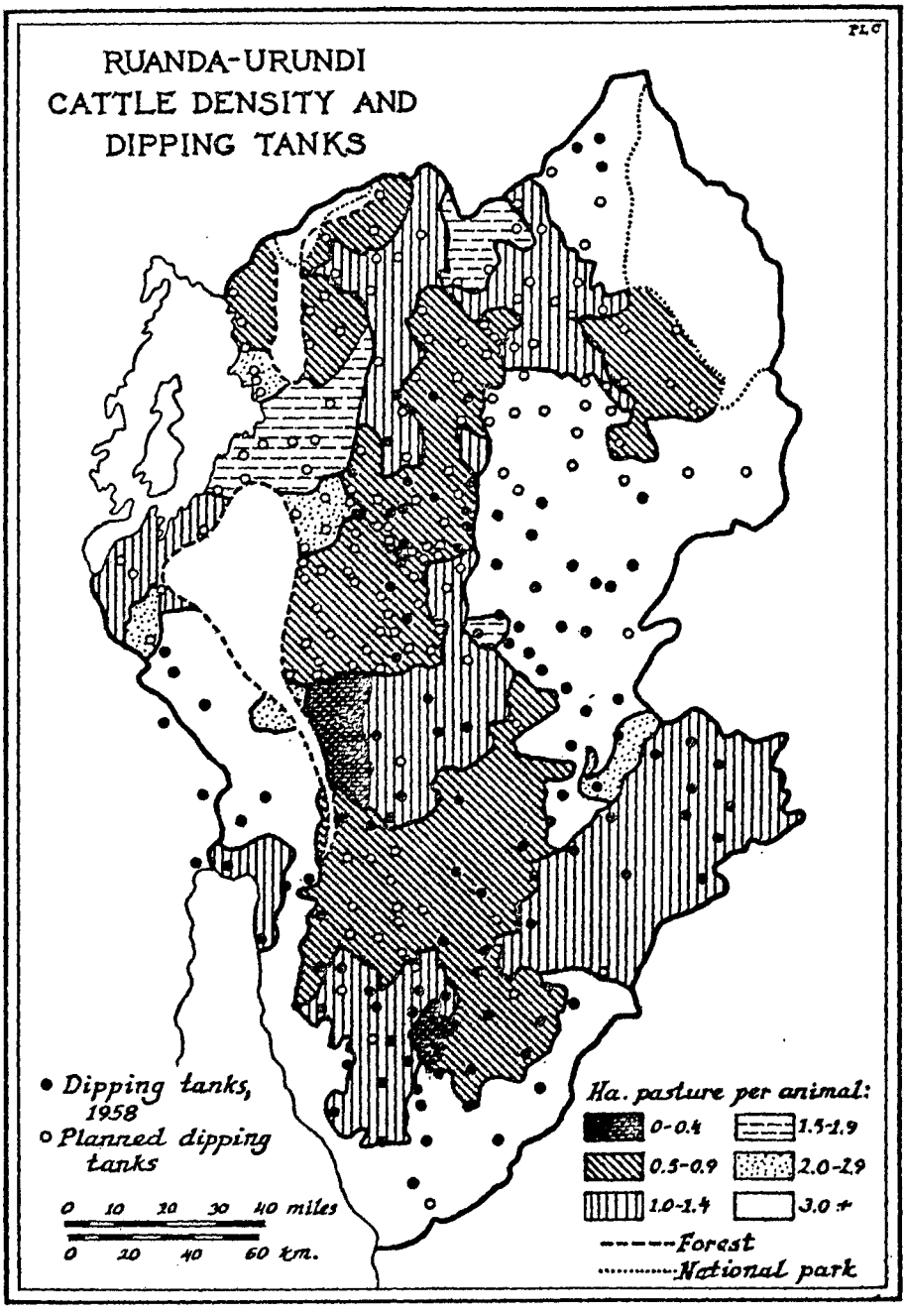
The original veterinary laboratory of Kisenyi was replaced in 1957 by a new laboratory at Astrida, provided with up-to-date equipment, for producing vaccines on a large scale to supply the veterinary service. In 1959 the veterinarians and their assistants vaccinated 845,000 head of cattle, principally against anthrax; furthermore, they conducted 4,630,000 examinations and treated 77,000 sick animals. In the field of preventive medicine, 393,000 head of cattle were marked in 1959 so as to trace the means by which trypanosomiasis is spread. Owing to the political troubles in Rwanda the activity of the veterinary services that year was less intense than in previous years; in 1955, for instance, there were 1,904,727 vaccinations of which 1,801,145 were against anthrax (*6*, 1955, p. 130).

The fight against ticks was carried on, on a large scale. More than 10 million dippings took place in the course of the year 1959, or, on the average, ten for each animal. In 1960 the number of dippings rose to 17 million. Equipment for this purpose has rapidly improved. In 1949 there were 136 driers for hides, but dipping tanks were virtually unknown. The Ten-Year Plan provides for the construction of 80 dipping tanks over ten years, but this target was soon overshot

(see Map 8). By the end of 1955, 53 dipping tanks had been constructed (6, 1955, p. 130). At the end of 1960, 270 dipping tanks were in service and 47 under construction.

Veterinary centers were established rapidly. There were 28 of them in 1950 and 60 in 1960. These centers were directed by a veterinary assistant under the

MAP 8



supervision of a veterinarian. They comprised dispensaries, stables for the animal patients, enclosures for examinations, dipping tanks, houses for the assistants in charge, and living accommodations for their staffs.

As has been said, the Ten-Year Plan provided for a reduction of 45 per cent in animal numbers. This task proved politically unattainable; moreover, the technical grassland studies by INEAC and trials in the paysannats and the subdistricts showed the value of numerous native plants and the possibility of improving pasture conditions by relatively simple means. The Ten-Year Plan estimated that three hectares were required for each head of cattle, but INEAC trials showed that 0.7 hectares in paddock would suffice, even without changes in the types of plants for applications of manure. Accordingly effort was more and more directed toward the dissemination of fodder crops among the African farmers. However, the idea that the grazier should nourish his cattle, construct stables to protect them from cold at night, or collect the manure to improve the meadows has made only very slow progress.

Alongside the indecisive trials that had been undertaken in two selected subdistricts, an action in depth was undertaken in the area around the INEAC station at Kisozi in upper Burundi (see pp. 85–86).

Several attempts have been made to improve marketing. The local creameries, in spite of heavy import duties, have not been able to compete with butter imported from New Zealand. There were nineteen creameries in 1955 and only three of them remained in 1960. Hides, in spite of an intensive publicity campaign, were not dried in the public drying stations, for middlemen would not offer a higher price for hides dried in the shade rather than the sun. Local meat was infested with cysticercosis, so rather than deprive the undernourished population of meat altogether, the administration prescribed the freezing down of meat that did not pass veterinary inspection.

Lastly, to encourage selective breeding, livestock contests have been held every year since 1956, the results of which are widely published in the local press. Prize winning animals were registered and their owners freed from tax obligations. Moreover, the selective breeding farms of INEAC supplied a number of breeding animals to the native graziers; i.e., 13 full-grown bulls and 15 young bulls in 1952 (*22*, p. 236), and 24 full-grown bulls, 29 breeding cows, 4 calves, and 95 heifers in 1960 (*23*, p. 329).

Taxation of Cattle

At all periods the taxation of cattle has played an important part in the life of the country, inasmuch as cattle are the sign of wealth *par excellence*. The head tax on cattle has risen progressively from 15 francs in 1945 to 75 francs in 1960, without reckoning the additional levies for the benefit of the native authorities and local government. Livestock taxes included in the general budget brought in 14,125,000 francs in 1945 and 56,353,750 francs in 1959.[9] As can be seen in Table 18, cattle numbers have remained stationary during this period; this is confirmed by the trend in cattle hides exported. On the other hand, the number of smaller livestock, goats and sheep, have increased. Fiscal pressure has

[9] This latter is the amount paid up to August 31, 1960. (*22*, p. 318).

TABLE 18.—ANIMAL NUMBERS IN RUANDA-URUNDI, 1945–59*
(*Thousand head*)

Year	Cattle	Goats	Sheep	Hogs
1945	876	...	...	...
1946	911	...	...	...
1947	927	1,190	405	22
1948	...	...	...	...
1949	974	1,255	424	35
1950	985	1,362	430	42
1951	972	1,204	385	31
1952	900	1,266	400	35
1953	937	1,266	391	56
1954	948	1,379	414	56
1955	907	1,465	459	58
1956	930	1,573	525	61
1957	966	1,698	531	53
1958	1,008	1,792	570	60
1959	1,032	1,761	591	54

* Data from *Rapport Annuel, 1960*, p. 441, and earlier issues (for complete reference see 6). No census of animal numbers was made in 1960.

contributed toward this development. The returns from goats and sheep, which are not subject to taxation, amount annually to 35 or 40 per cent, compared with only 11 or 12 per cent for cattle.

A special tax was levied to help pay for dipping tanks. The graziers who were going to profit from a dipping tank had to pay a supplementary contribution over and above the normal taxes whose yield was used to finance the dipping tank in question.

Furthermore, a charge is now made for veterinary services, 25 francs in 1959 for consultation and treatment, 10 francs for anti-anthrax vaccinations. These fees yielded 5,628,000 francs to the veterinary services in 1959. The possibility of charging fees for veterinary services proves that their utility is recognized today by the graziers. Thanks to the livestock tax and to the service payments, the veterinary service has cost the treasury practically nothing; in 1959 the total of taxes and charges thus paid, about 60 million francs, corresponded to the total budgetary expenses both ordinary and extraordinary on account of livestock, and this at a period in which there was a massive development of infrastructure.

ELEMENTS OF CHANGE

Demographic Factors

The native population of Ruanda-Urundi, as was remarked earlier, has increased by nearly half since the Second World War. It was estimated at upward of 3.4 million in 1945 and close to 5 million at the end of 1960. This increase bears witness to the efficiency of the health services, and it has perforce brought about a rapid development in agricultural production. Agrarian colonization is being rapidly pursued on two fronts. In the interior, former pastures are being transformed into productive banana groves; the edges of swamps, formerly left to wild animals, have been brought under colonization. Young people have mi-

grated in larger and larger numbers, either to Uganda or the Congo or into the town of Usumbura.

Migration to Uganda, unknown before 1924, has accounted for as many as a quarter of a million inhabitants of the trusteeship territory in certain postwar years (*20*). Migration increases when the franc is depreciated in relation to the East African shilling, or when the coffee harvest is bad in the hills. These immigrants have brought back cottonseed, tea seed, heliotrope seed, hay seed and banana seedlings. They spend their money in buying cattle or textiles or in paying their taxes. Many of them have settled along the highway; Ankole, between the frontier of Rwanda and Buganda, has more immigrants from Rwanda than natives.

Usumbura gives employment to the Rundi of the neighboring mountains, while the Congo has mainly absorbed the immigrants from the regions near Lake Kivu (*15*).

World Prices

The remunerative price of coffee has been one of the principal factors in the economic progress of the country since 1945. Under local conditions it is estimated that when coffee sells for 20 francs per kilo, the planter gets 40 francs for a working day in his coffee plantation whereas the average daily wage varies between 5 and 10 francs (*9*, pp. 20–24).

However, in 1954, arabica coffee gained the planter 40 francs per kilo. The expansion of production foreseen in the Ten-Year Plan was accelerated. Instead of the 17,500 metric tons forecast for 1963, 36,045 metric tons were harvested in 1959. Thanks to these high prices, OCIRU was able to command the means of carrying out the measures of crop improvement that have already been mentioned. The swelling of producers' revenues had other useful effects, most striking being a tenfold increase in meat prices. Taxes and charges in respect of cattle therefore increased rapidly; but for this it is unlikely that it would have been possible to establish 317 dipping tanks instead of the 160 previously envisaged. Adjustments in the prices of cotton were brought about by the action of the Cotton Reserve Fund.

Government Measures Making for Change

Ruanda-Urundi is relatively sheltered from outside influences; there are few white colonists—682 in 1960, of which 186 were Belgians. Furthermore, most of these are not engaged in agriculture.

The missionaries, quite apart from their religious activity and their virtual monopoly of education, have played a not negligible part in economic development. In former times it was they who harvested the first coffee, and who introduced wheat and pigs. However, over the last fifteen years it is the action of the government which has been pre-eminent in promoting economic progress. Its hand has been felt in the realm of the agrarian infrastructure, in forestation, in the fight against erosion, in marsh drainage, in improving stock-raising, and in attempts to develop coffee and cotton production. The government has organized markets and assisted in the creation of co-operatives; it has established a network of trading centers and established a road system.

The state has likewise intervened in the realms of land tenure, agricultural research, and land settlement. There, fear of famine has led to spectacular measures. The government has organized systematic movements of population, both into the Congo and into the less-peopled districts of Ruanda-Urundi itself. The financing of public works yielding local benefits has been undertaken more and more by means of service charges which have been gradually substituted for the *corvées* of former times.

Problems of land tenure.—As has been remarked already, Ruanda-Urundi is a country of small holdings. In 46 of the 65 natural regions into which it is divided, there are less than two and one-half hectares of land for each poll-tax payer, that is to say, for each family of five persons (Map 3, p. 45). The area actually under cultivation is customarily less than one and one-half hectares.

Generally speaking the cultivators enjoy no freehold, though in the area adjoining the Rwanda forest the heirs of the original settlers have retained a right of freehold over the lands originally cleared and in continual occupation (*ubukonde*). Elsewhere the land was eminent domain of the Tutsi lords and was granted to the Hutu in return for rents in labor and kind; as in feudal Europe, the lord retained the right to pasture his cattle on the harvested sorghum fields in the dry season.

The remnants of the contract of vassalage recently came into conflict with new ideas; a tendency was observed toward complete private ownership of land, a natural consequence of population pressure. This naturally led to proposals for suppressing the contract altogether, a task which was begun in 1954. In 1959 a revolution broke out in Rwanda, triggered by the dissatisfaction of the Hutu masses who were excluded from public office, had difficulty in getting secondary education (unlike the Tutsi), and were weary of their ancestral servitude. On May 2, 1960, a decree by the Mwami (king) of Rwanda suspended the lord's right of pasture on the fallow; and on May 20 the special provisional Council of Rwanda approved a decree legally abolishing all contracts of pastoral serfdom. On December 31, 1960 the Rwanda Council discussed the application of a new regulation on the ubukonde. In Burundi, on the other hand, although the problem of land tenure has been discussed for years, no radical step has yet been taken to deal with it.

The administration of the trusteeship territory left a degree of autonomy to the native councils in matters of land tenure. On the other hand, it pursued a very restrictive policy so far as land in the hands of non-Africans was concerned. In 1916, at the time of the Belgian occupation, non-Africans, principally missionaries, owned 1,607 hectares. On December 31, 1946 they had 6,408 hectares, of which 5,625 was in properties greater than 10 hectares. On December 31, 1960, foreign property larger than 10 hectares had risen to 9,600. Out of this total the 682 individual colonists owned only 3,100 hectares; the rest belonged to mining companies and their subsidiary enterprises, Protestant and Catholic missions, and to the Government.

Agricultural Research

The Ten-Year Plan brought about a reallocation of responsibilities of various services connected with agriculture, after which the *Institut National pour*

l'Étude Agronomique au Congo (INEAC) took over at length the complete administration of the three research stations at Rubona, Kisozi, and Nyamyaga-Songa. The first of these stations was concerned principally with crops grown at a moderate altitude like coffee and sorghum, the second with crops grown at high altitudes like wheat, eleusine, and peas, and the third with the improvement of livestock. In 1950 the staff of INEAC in Ruanda-Urundi was limited to three agronomists, three assistant technicians, and a secretary. The Ten-Year Plan provided for the engagement of 53 new European officials over the ten years. Thereafter a number of new stations were built, together with breeding centers and acclimatization centers (Map 5, p. 62).

Agricultural research has been extensive in range, from grassland studies to the parasitology of the coffee tree, from measures against erosion to stock-raising and reforestation methods. Studies in vegetable genetics were called upon to play a capital role in an undernourished country. INEAC selected new plant varieties suitable to the local conditions, of a kind that by themselves would be sufficient to produce doubling of maize and sweet-potato yields, and increases of 50 per cent in those of manioc and potatoes (Table 19).

INEAC provides technical direction for the coffee policy of the *Office des Cafés.* It has introduced methods of combating the *antestia,* a coffee tree parasite. Since 1958, it has conducted trials in which chemical fertilizers were applied to a sample of lands cultivated by Africans, and has drawn up a map of the zones in which the results were favorable. In its experimental stations, carefully husbanded coffee plantations produced 2,500 kilos of marketable coffee per hectare, two and one-half times the mean yield in 1959 which was the best year

TABLE 19.—CURRENT YIELDS COMPARED WITH YIELDS POSSIBLE USING INEAC IMPROVED SEED IN RUANDA-URUNDI*

(*Kilograms per hectare*)

Crop	Around 1959	Possible
Grains		
Sorghum	1,200	2,000
Maize	1,000	2,000
Eleusine	600	1,000
Wheat	700	1,000
Barley	1,000	1,250
Rice	3,500	4,500
Legumes		
Beans	750	1,200
Peas	800	1,000
Soybeans	500	800
Peanuts (in shell)	600	1,200[a]
Starchy roots		
Sweet potatoes	7,500	15,000
Manioc (fresh)	13,000	20,000
White potatoes	7,000	10,000

* Data from *Étude Globale,* p. 178 (see *3* for complete reference). See Table 8 for ranges in current yields.

[a] With irrigation 2,000 is possible.

in the coffee growing history of the country. As a result of grassland studies, emphasis has been given to forage crops, notably leguminous types grown locally, and to the establishment of paddocks. The general introduction of paddocks, it is claimed, would release half the existing pasture for crops and at the same time improve the conditions of the cattle pastured on the remainder. INEAC likewise gives technical advice on the anti-erosion measures discussed earlier (p. 63). It has likewise introduced improved breeding animals and has imported zebu strains, which have been crossed with the local breeds. INEAC also directs the arboretum at Astrida and the reforestation campaigns.

INEAC has been well aware of the difficulty of branching from research to practical application among the African farmers. It has therefore played a leading role in the origination and establishment of the paysannats and the *zones d'action rurale*. Its paysannats have been set up close to the research stations so as to carry on their activity in the African milieu. At first, they were established in unoccupied areas so that land settlement was organized as well as cultural methods. The paysannat of Mohoro-Nytazo, established in 1953 on the bank of the Akanyaru, cultivates coffee trees in strips parallel to a trail, thus permitting the use of vehicles to apply insecticidal dust. Thanks to the special care given to the coffee trees during the first harvest season of the new plantations, in 1957 to 1958, the average income of the Mohoro settlers rose to 21,000 francs, more than double the national average (*11*, p. 101). The paysannat of Moso, around the Musasa station, was set up at government request and was intended to lay down the technical conditions under which directed colonization of Moso should take place. Unfortunately, it was not possible to promote the cultivation of an export crop such as would insure the black colonists with a regular monetary income, even though there were only 16,000 families settled on 287,000 hectares of agricultural land. The zone d'action rurale around Kisozi embodies a different principle. It was required to improve living conditions without interfering with existing rights of property and occupation, whether of arable or pasture land. The area in question, situated 2,000 meters above sea level, is cold and damp, with very poor soil. With an area of 89,000 hectares, it had on December 31, 1958, 14,432 African taxpayers, or roughly 70,000 inhabitants, and 40,774 head of cattle.

In 1954 the region was obliged to export cattle, and the young people went to work in Usumbura, and the inhabitants bought food in local markets. With the aim of establishing an efficient and intensive system of mixed farming each grazier was directed to plant a strip with forage crops for the dry season, and rudimentary cow sheds were constructed. Selected seed was distributed, and a methodical use was made of manure which was employed increasingly to fertilize the fields. The management of pastures was altered: the baradines and ditches served to prolong the grazing season by a month, and streams that had hitherto run dry at the end of the dry season became permanent. Paddocks were carved out of the pastures; cattle paths, drinking places, and breeding places were set up. In the five years, from 1954 to 1959, 8,290 kilometers of blind ditches were dug, 11,213 individual strips of annual or biennial forage crops established, 3,520 cow sheds constructed, and 47 watering places provided. The district, which habitually had been an importer of food, actually exported 270 metric

tons of peas in the year 1959–60. Graziers who had seen the effect of chemical fertilizers in fields of the agricultural research station asked to be allowed to buy them. Such was the success of the scheme that its extension was foreseen to all the other upland pastoral areas of Burundi (*11*, pp. 102–103).

Agricultural Extension Services

The agricultural services, which were responsible for agricultural extension work, numbered 42 European officers in 1950, of whom 16 were agricultural engineers; in 1960, 121 European officers, of whom twenty were agricultural engineers; there were 26 agricultural assistants in 1950, and 72 African associate agronomists in 1960. In 1950 there were 628 instructors; in 1960, 715. Like the veterinary assistants, the agricultural assistants were trained at the Astrida Agricultural School, where, after three years of secondary education, they took a four-year course in agronomy followed by a probationary period.

The technical staff was called upon to give particular attention to anti-famine measures, more especially to the overseeing of the collective plantation of manioc fields, at the rate of 15 ares per poll-tax payer, and to the checking of the stocks of seeds in the communal granaries. They directed the fight against erosion, the drainage of marshes and the distribution of selected seeds. In this work of general supervision, the agricultural services worked in collaboration with the district officers and with the staff of the *Office des Cafés.*

Organized Migration

In response to population pressure the Belgian administration from 1937 onward opened the wooded areas of the territory of Masisi in the Congo to immigrants from Rwanda, where they constituted a new chiefdom. In 1956 immigrants from Rwanda into the territories of Rutshuru, Masisi, and Kalehe in the Congo together made up a community of around 300,000 souls (*15*, p. 9). Within Ruanda-Urundi the agricultural service has likewise directed large-scale migration movements, of which the chief involved the settlement of 40,000 to 50,000 inhabitants in the Ruzizi valley. In 1950 this region was the constant resort of elephants and wild buffalo. In 1960 it produced around 160 million francs worth of salable crops, of which 60 millions of cotton and 60 millions of manioc were sold in Usumbura. The total investment including land apportionment and the construction of roads and irrigation channels is reckoned to have cost 33 million Belgian francs. In 1959 the annual expenditure on the project was estimated at 14 million francs (*3*, p. 151). The average income of the Ruzizi farmer, 16,000 francs for each taxpayer per year, compares favorably with the national average of 10,000 francs.

Compared with this success the attempts at colonization in the Moso and in Bugesera regions had more dubious results. As has been noted, the Moso is without an export crop and cannot sell its foodstuffs for want of a market. The Bugesera is an arid district partially subject to tsetse. The effort to colonize it was intensified after 1959, with the aim of resettling the Tutsi refugees who had been expelled from the highlands. Pedological studies, the laying out of trails, the delimitation of holdings, rice cultivation trials, and measures against the tsetse fly have been undertaken on a larger scale.

Agricultural Investment

The trusteeship authority has provided the organizers and trained the executives who have built up the infrastructure and the other services that have been created in Ruanda-Urundi. Unfortunately, the country is extremely poor and has a low taxable capacity. Accordingly, at the outset, whether for road construction, reforestation, improvement of marshes, or anti-erosion measures, forced labor was employed. Likewise the planting of coffee trees and manioc was enforced by law. But the system of corvées tends to fall again and again on the same shoulders, that is to say, upon those who are too poor to buy themselves off. Accordingly, taxes gradually took the place of corvées. The obligation to work on the roads was abolished and a permanent body of maintenance men established. In 1952 the obligation to plant a hectare of forest for each three hundred taxpayers per year was replaced by a special tax to finance the development of a permanent forest service (*6*, 1956, p. 146). The same principle was applied to such local amenities as dipping tanks, where, as has already been mentioned, a contribution was payable by each owner of cattle that would use the tank (25 francs per head in 1956). The same method was employed for the stores in which seeds for the anti-famine campaign were to be kept, for the drying sheds for hides, and latterly for the anti-erosion campaign. In this way the funds have been raised and expended for the creation of the whole rural infrastructure.

Summary

Food production per head has remained stable during the last fifteen years. In spite of demographic pressure, amounting to an increase in population of almost a half, the country did not experience famine between 1945 and 1960.

The most important changes have taken place in the field of export crops; coffee and cotton have made rapid progress.

Food crops have benefited indirectly from the use of insecticides, whether from the campaigns against insect pests in native huts, or the dusting of coffee and cotton; they have profited more directly from the new seeds introduced by INEAC and from the opening up of new districts through colonization and marsh drainage. Anti-erosion measures and reforestation will have more long-term effects.

In spite of the improvement in the transport network, marketing of local products has made little progress, too little at any rate to serve as the basis of a prosperous agriculture. Marketing organizations have played an important part in the expansion of coffee and cotton growing. The same is true of the co-operatives which have been fostered by the state. Livestock production progresses but slowly, despite persistent efforts. Vaccination has banished grave epidemic diseases such as cattle plague, anthrax, and sleeping sickness, but it has not been able to cure the endemic diseases, of which the most grave, cysticercosis, deprives the affected animals of all commercial value.

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APPENDIX TABLE—FOOD CONSUMPTION BY A HUTU FAMILY OF RUANDA, 1956–62*

(Kilograms per family per year)

Food	1956	1957	1958	1959	1960	1961	1962
Legumes and nuts							
Dried beans	145.3	150.8	179.8	154.2	221.6	193.4	176.8
Green beans	61.7	70.3	72.9	54.2	72.7	94.7	134.2
Dried peas	16.3	21.1	5.6	14.4	13.4	7.9	—
Green peas	7.6	14.2	3.9	—	4.2	2.6	—
Peanuts in shells	.6	1.4	—	—	—	—	—
Peanut flour	—	.4	1.2	—	2.2	—	—
Cereals							
Corn on the cob	31.6	24.9	36.4	57.0	46.6	12.7	27.9
Dried corn	—	1.0	—	—	—	—	—
Sorghum flour	24.0	4.0	3.3	13.8	4.3	11.8	2.9
Roots and tubers							
Sweet potatoes, peeled	165.8	122.7	193.8	71.4	73.4	59.3	46.3
Sweet potatoes, not peeled	361.7	288.1	433.5	634.8	618.8	561.8	805.3
Manioc flour	136.2	205.0	105.2	71.4	121.2	106.1	77.3
Fresh manioc	17.9	21.4	26.1	39.7	56.1	53.8	92.5
Fresh manioc, not peeled	—	43.0	—	—	—	16.7	—
Potatoes, peeled	122.3	76.1	75.7	201.4	189.4	370.2	245.5
Taro, grated	9.7	8.5	4.5	5.6	—	8.9	2.8
Yams	—	—	—	—	—	—	6.3
Fruits							
Peeled bananas	56.3	71.2	54.8	55.8	29.9	6.8	16.0
Vegetables							
Green vegetables[a]	114.9	63.2	60.7	55.1	66.0	69.3	42.4
Eggplant	—	—	.8	—	—	1.8	.4
Tomatoes	9.4	2.5	1.6	—	.9	—	—
Cabbage	5.1	27.8	3.8	2.3	—	9.8	17.1
Onions	.6	.6	1.0	—	—	—	—
Taro leaves	.7	1.1	1.1	2.4	—	—	—
Gourds	57.5	33.6	57.1	31.3	89.6	36.5	42.8
Beverages							
Banana beer	46.7	66.5	38.2	14.0	14.0	87.3	67.9
Sorghum beer	240.0	305.1	239.1	189.0	147.0	498.0	186.2
Palm oil	.9	.5	.5	—	.1	—	.5
Meat and milk							
Beef	5.0	3.8	6.3	9.6	4.5	6.9	9.9
Pork	—	1.0	—	—	—	—	—
Milk (5.4% fat)	4.3	7.8	16.0	16.0	8.5	28.3	—
Salt	.9	—	—	—	—	—	—

* Data collected by the author with the kind assistance of IRSAC. Prepared foods were weighed daily before cooking. The daily consumption of beverages was partly estimated. In 1956 the family included the husband about 20 years old, his wife possibly a year younger, and one child born in February 1955; by 1962 there were three more children born in April 1957, September 1959, and December 1961.

[a] Mainly leaves.