

An Abstract in English of :

**HISTOIRE DE LA RECHERCHE AGRICOLE
EN AFRIQUE TROPICALE FRANCOPHONE :
*A HISTORY OF AGRICULTURAL RESEARCH
IN FRANCOPHONE TROPICAL AFRICA***

by René Tourte, tropical agronomist, responsible for the FAO study

SCOPE AND GOALS OF THE PUBLICATION

FORWARD (2005 edition, Volume I)

Africa is the birthplace of man and undoubtedly also one of the first breeding grounds for human agriculture, pastoralism and forestry. In Africa today we can still find a broad range of traditional production systems that attest to the diversity of farming techniques in prehistoric times that have traversed through time and space to take their current forms.

The outlook for food security on this continent today remains tenuous over the short and medium term for the majority of its populations. In the second half of the 20th century Africa never managed to capitalize on its rich heritage of agricultural techniques to raise production or the productivity of its agriculture systems to the level necessary for feeding its inhabitants. This has not always been the case.

A History of Agricultural Research in Francophone Tropical Africa recounts the long journey traveled by this heritage through the millennia. It traces the rise of technology, from its “obscure and silent” beginnings toward the organized scientific research of the late 19th century, which had one enduring purpose in mind: satisfying the food requirements and economic, social and cultural needs of human beings.

René Tourte is a great agronomist, friend and historian (even if he denies so with humility and modesty). He enables us to draw two essential lessons from this long journey through time. Firstly, that the African agricultural heritage, like that of other continents, is an inextricable mix of technologies encompassing both endogenous and exogenous origins, giving weight to the notion that no agrarian system is static, whether ‘traditional’ or not, and that all agriculture follows an evolutionary dynamic resulting in multiple legacies.

Secondly, that the current weakness of agricultural research in the tropical regions of the continent was never predestined. In the 1950s, this part of the world was home to several centers of excellence for global agricultural research. This was due to the priorities accorded to research by French politicians within the prevailing economic development strategy for overseas territories, even if the African hosts were not always the main beneficiaries.

These two lessons have a double meaning today:

- The technological development of agriculture in Africa constitutes an essential part of humanity's overall agricultural heritage just as much as any other continent. As such, it deserves the full consideration of not just Africans themselves, but also anyone who cares about the technological progress of agriculture.

- Agriculture in sub-Saharan Africa will never be able to take the necessary technological leap until it is accorded the attention it deserves so that it can fulfill its role in the fight against food insecurity and poverty. Policymakers in African nations and in donor countries or institutions should take note of this.

This history has arrived at the right time. The Millennium Development Goals, adopted by the United Nations Millennium Summit in September 2000, puts food security and the fight against poverty at the top of their agenda.

In addition, the African Agricultural Development Program, which the FAO has contributed to under the auspices of the New Partnership for Africa's Development (NEPAD), and which has been sanctioned by heads of state and African ministers for agriculture, has endorsed agricultural research and the dissemination of this knowledge as the fourth pillar in agricultural progress in Africa.

I am confident that *A History of Agricultural Research in Francophone Tropical Africa* will become a useful reference tool for all, from politicians and citizens to agronomists, scientists and donors. May this history be their rallying point for a future African continent free from hunger, food insecurity and poverty once and for all in the 21st century.

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INTRODUCTION by the author (2012 unabridged edition)

"He who does not know where he comes from, goes nowhere"
(Confucius, Chinese philosopher, 5th century BC)

"Without the past we are without future; without the present we are without the past"
(Joseph Ki-Zerbo, Burkinabe historian, 1922-2006)

"Man is the beginning and the end of development"
(Léopold Sédar Senghor, first president of the Republic of Senegal, 1906-2001)

Origins

The idea for this publication was born from a simple discussion in 1996 when the author was with the FAO's Research and Technology Development Service, attached to the division for research, extension and training within the Department for Sustainable Development.

Fifteen years later, after exhaustive research, hunting down contacts, writing, proofreading and formatting with the help of his wife, the author finally completed this history of agricultural research in Africa: in six volumes comprising some 2,700 pages.

The context and historical-geographical boundaries

This history is concerned only with tropical and equatorial sub-Saharan Africa, specifically its French-speaking populations, with the exception of those countries formerly under Belgian administration (Congo-Kinshasa, Burundi, Rwanda), which have already been covered by the excellent publication *Le développement rural en Afrique centrale 1908-1960/1962*, written by Vladimir Drachoussoff, Alexandre Focan and Jacques Hecq, and published by the Baudouin Foundation in 1991.

Although the present history is focused on fifteen French-speaking countries, from Mauritania to Madagascar, a half-dozen Portuguese-speaking countries, from Cape Verde to Mozambique, are also partially covered due to various historical and geographical reasons. These twenty or so countries represent more than ten million square kilometers (one third of the African continent) and today comprise more than 250 million inhabitants, of which 150 million still live in rural areas and 80% of which still speak French. The publication also touches upon the history and agriculture of neighboring English-speaking countries whenever the need arises.

Regarding the historical scale of the study, it was originally intended to deal solely with the beginnings of organized agricultural research (crops, livestock, forests, fisheries) up until the independence of the African states, roughly from the 19th century until the early 1960s more or less.

However, the insatiable curiosity of the author for the ‘unknown’ swayed him to travel back further than the 19th century, firstly to the ‘discoveries’ of the 15th century by Europeans exploring the African coastlines; and then even further back in time, to the earliest exchanges between the Arab-Berbers of the north with their sub-Saharan neighbors, before reaching all the way back to the Neolithic Age when farming first began and the Sahara was green.

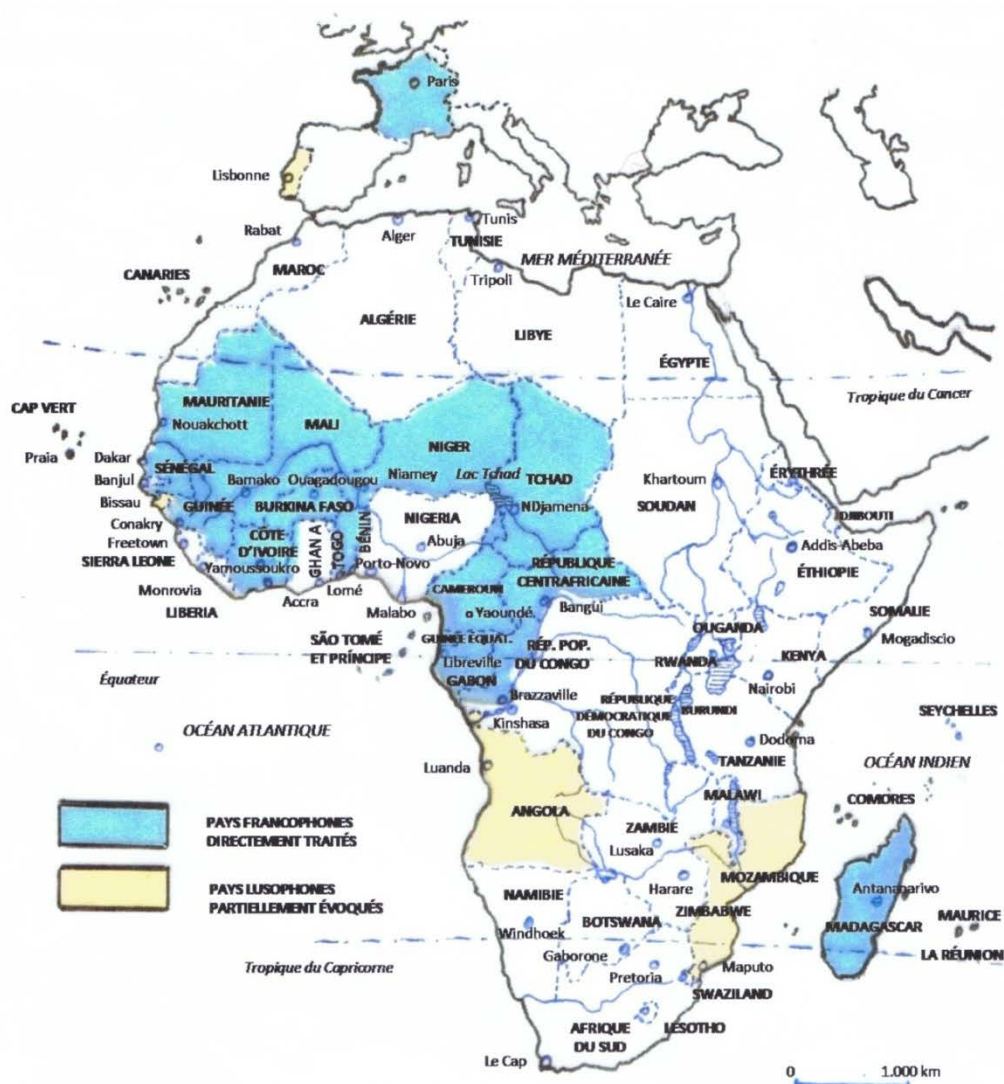
This long voyage from prehistoric times up until African independence is divided into six logical stages distinguished by major shifts in politics and history. These stages correspond to the six volumes of this publication:

- I. The beginnings of African agriculture: from Prehistory to the Middle Ages.
- II. The Age of Exploration and cross-cultural influences: from the 15th to the 18th centuries.
- III. Explorers and merchants in search of the African El Dorado: 1800 to 1885/ 1890.
- IV. Colonization of Africa and the great Garden Trials: 1885/1890 to 1914/ 1918.
- V. The first research stations and their development: 1918 to 1940/1945.
- VI. From colonial imperialism to African independence as research paves the way for development: 1945 to 1960.

It should be noted that the author has allowed himself some liberties beyond the 1960s so that the reader may appreciate how agricultural experimentation in the past, as described these volumes, has come to shape research in the late 20th century and beyond.

The final volumes in this series, which explore the emergence of organized research and its subsequent development, provide a condensed overview of the pioneering work accomplished during this period in multiple areas of agricultural science. The author plucks from history characters and their achievements largely forgotten today: groundbreaking research conducted by numerous scientists, but also by other members of society, including the administrators, traders, missionaries, and military. All these contributions have been largely forgotten in countless old documents – old grimoires – which the author has endeavored to breathe new life into for the digital generation.

Africa: francophone countries principally concerned by this publication (marked in blue) and Portuguese-speaking countries indirectly addressed (in yellow)



Principales caractéristiques globales	Superficies (km ²)	Populations 2016 (hab)
Pays tropicaux francophones (hors Congo-Kinshasa, Burundi)	8.300.000	200.000.000
Pays tropicaux lusophones	2.000.000	55.000.000
Total	10.000.000	255.000.000

The broader context of the term ‘research’

This long journey through the different epochs of the African tropics was originally conceived as a ‘simple’ reconstruction of agricultural research. Two requirements radically changed all that:

- Firstly, in addition to the information directly concerning agricultural research – its conditions, its institutions, its means and its results – the FAO ‘mandate’ to the author specified that, “the person in charge of the study should indicate, as far as the available information permits, the state of agricultural development for each historical period...” and concerning the research results, to describe “their degree of utilization concerning production and their impact on this production”.

This clause, so seemingly logical and innocent on the surface, led the author to profoundly expand the central theme of the study. Not least by dedicating specific chapters to each of the periods under examination that expand upon the socio-political and economic conditions and the general situation of agriculture at that particular time or place, in addition to reviewing the key experiments and projects of the later epochs and explaining how their results applied to overall research.

- The second more drastic requirement arose from the no doubt risky decision to trace the history of sub-Saharan agriculture all the way back to its origins. Of course, we are no longer dealing here with institutionalized research but empirical experimentation by innumerable generations of peasant farmers, pastoralists and forest peoples, all in search of production strategies adapted to their way of life, which was often harsh and at the mercy of nature, which could be restless, hostile and unpredictable. Our African ancestors had to master extreme conditions and despite the odds they often did so with success.

But as Claude Lévi-Strauss reminds us, such an approach “supposes centuries of active and methodical observation, strong assumptions and controlled hypotheses to reject or prove right by tirelessly repeating the experiments.... It required [of our ancestors] ... to have a veritable scientific spirit, a diligent curiosity and to be always alert... Neolithic or Prehistoric man, who knew how to domesticate plants and animals, was thus already the beneficiary of a long scientific tradition...” (*La pensée sauvage*, 1962).

These twofold requirements – situating the history as much as possible in the socio-political context of the particular periods, and expanding the study to the countless silent generations of farmers prior to European contact – has resulted in this sweeping historical fresco of farming practices of the African Tropics from their origins right through to the latter half of the 20th century.

It is inevitable that such an ambitious tome, perhaps the first of its kind, will contain uncertainties, gaps, even errors. But the author is merely a humble agronomist who was tempted to tell the whole story.

A BRIEF ABSTRACT OF THE COMPLETE WORKS (2700 pages in 6 volumes)

VOLUME I: The beginnings of African agriculture – from Prehistory to the Middle Ages

All of man's genetic roots can be traced back to certain species of *Homo* roaming the Rift Valley and the Chad Basin millions of years ago in Africa. Taking a gigantic leap across the Stone Age, this first Volume begins our historical fresco in earnest around 12,000 to 10,000 BC when the long Pleistocene era was drawing to a close and the Holocene was asserting itself. In the late Pleistocene, Africa was gripped by extreme drought, a 'hyper-aridity of the Sahara desert, which was considerably larger at this period, extending south all the way to 12 degrees north of the equator (present-day Bamako, Niamey and Khartoum), where the tropical-equatorial forests had retreated. During the late Pleistocene, these isolated forests were strewn with vast clearings where man could hunt and gather seeds and tubers.

The late, dry Pleistocene gave way to the African Humid Period of the Holocene, which broke quite abruptly across Africa and led to much wetter conditions in the Sahara, probably reaching its peak some 8,000 years ago. Torrential rains led to the formation of formidable inland lakes, some of which flowed into the ocean. The once dry Sahara was transformed into a vast, green, wooded savannah dotted with huge lakes. The African Humid Period, which would last some five millennia, led to widespread settlement of the 'Green Sahara' by Neolithic man. Over in the Middle East, the Fertile Crescent was giving rise to the first Neolithic farming settlements and the domestication of the wild ancestors of sheep and goats. Farming arrived a little later in the 'Neolithic Sahara', roughly around 5,000 BC, with the domestication of plants such as *Penicillium* millet, sorghum and wild rice. It is also thought that the pro-Mediterranean tribes of northern Africa were able to freely travel south to this green Sahara, bringing with them their domesticated sheep and horned bovine. Obviously hunting and fishing practices continued unabated, especially the hunt for such wild species as antelope, hippopotamuses and giraffes.

The African Humid Period lasted some five millennia before the wet and rainy conditions of northern Africa abruptly ended. Vegetation started declining and the lakes drying up, with the sand dunes gradually reclaiming the green Sahara, turning it into a desert once again.

But further south, toward that tropical-equatorial forestland, tubers and oil palms were still plentiful, and the people there had begun to cultivate yams and beans and to taste for the first time palm wine. Nevertheless, the environmental pressures of the now dry Sahara led to the great migrations of the Bantu peoples around 2000 BC. From their sub-Saharan homelands – roughly present day Nigeria and Cameroon – they spread out across the continent to the east and the south.

The second part of this first volume begins with the major human migrations southward as a corollary of the advancing desert and ends with the arrival of the first Portuguese carvels. In fact, the mouth of the Senegal River was sighted by the Portuguese in the mid-15th century just a few decades before the 'great discovery' of the West Indies" by Christopher Columbus toward the end of the Middle Ages.

During antiquity the Saharan populations were forced to migrate southward and in so doing they transplanted certain types of agriculture born in the savannahs of the wet millennia. The first African kingdoms of Ghana and Tekrur rose up in West Africa during the early part of

the first millennium AD while other kingdoms emerged in the savannahs toward the Middle Ages: that of Mali, Songhai, as well as the Kanem-Bornu Empire. At the same time, other organized societies and cities were developing further south, at Akan, Yoruba, Igbo, Bantouphones, and others beyond the equator and all the way to southern Africa.

Arab, Persian, Chinese and Indo-Malaysian ships began visiting the east coast of Africa, and probably also Madagascar, from the early Middle Ages onward and establishing trading posts for the kingdoms of the interior. From these eastern trade routes arrived new plant species in Africa – bananas, sugar cane, citrus fruits – as well as exotic animals such as zebus and horses, in addition to camels.

During the first millennium AD, numerous navigators, traders and explorers frequented the African eastern coastlines and reached its north-west coast, with others managing to cross the Sahara. The written accounts of these travelers, mainly of Arab-Berber origins, paint a positive image of some of the main types of medieval agrarian systems of sub-Saharan Africa, developed by competent farmers and pastoralists who knew how to adapt to the dazzling diversity of their ecologies.

The early Afrotropical agrarian societies described in this first volume evoke an overall impression of self-sufficiency, if not abundance, notwithstanding the inevitable inequalities in the distribution of food supplies, which no society, whether ancient or modern, seems able to escape. This early agriculture was labor-intensive, yet made use of tools of different shapes and usages that were remarkably adapted to the job at hand, covering a diversity of production systems: rain-fed crops and lowland cultivation, as well as marshes, mangroves, recession cropping, irrigated crops, grain and legume crops, in addition to tubers and roots. There was also extensive animal breeding by the nomads, some of whom were at least partially sedentary.

All these agrarian systems were the fruits of a very long and stuttering empirical process traversing countless generations of farmers – a long line of ‘silent’ experiments stretching back into prehistory that required our distant ancestors to adopt “a veritable scientific spirit, a diligent curiosity, and to be always alert” (Claude Lévi-Strauss, *La pensée sauvage*). Some of these systems, with their astonishing durability, still persist to this very day in some of the more ‘traditional’ regions of Africa.

VOLUME II: The Age of Exploration and cross-cultural influences – from the 15th to the 18th centuries.

This volume covers a period of around three and a half centuries and is dominated by a thirst for discovery and knowledge of the African continent whose hinterlands still remained more or less a mystery. The maiden voyages of Portuguese mariners in the latter half of the 15th century were instigated at the behest of Prince Henry the Navigator, culminating in the successful circumnavigation of Africa by Vasco de Gama in 1497-1498. These exploits of the Portuguese have left behind enticing glimpses of fabulous wealth in the different African kingdoms of the time. After Portugal signed the famous Treaty of Tordesillas in 1494, which allocated to them “the zone of discoveries and conquests to the east of the islands of Cape Verde” – in other words, basically all of Africa and beyond – Portuguese sailors continued to systematically explore the coasts of Africa and also to some extent Madagascar. They established the first trade links and even political relations with many kingdoms, societies and populations they visited along the coasts. Some of these Portuguese outposts become permanent settlements. The Azores archipelago, the Cape Verde islands, the Bissagos islands, São Tomé and Príncipe, Luanda (Angola), the islands of Pemba, and Zanzibar off the east

coast would all play their role in the exchange of foodstuffs, animals and plant species between Europe and Africa.

Other European powers followed in the wake of the Portuguese explorers in the 16th and 17th centuries, including France, the Netherlands, Great Britain, Spain, Denmark, and the Brandenburg Germans. Like the Portuguese, these newcomers established trading posts, sometimes fortified, all along the African coastlines, as well as in the lower valleys of the great African rivers. Unfortunately, these commercial activities would be indelibly marked by the infamous Triangular Trade, later known as the Atlantic slave trade, which would lead to the deportation of some 15 to 20 million Africans in chains, mainly to the Americas.

The French gained their first toehold in Africa with a permanent settlement at Saint Louis on the northwest coast of the future Senegal, from where they expanded their presence into sub-Saharan Africa from 1638 to 1659 with Gorée, Rufisque and Podor in Senegal, as well as Arguin in present-day Mauritania. Other French outposts and colonies would soon follow, such as Ouidah in Benin and Fort Dauphin at the southern tip of Madagascar. A veritable trade network arose within and around these various sites, leading to economic domination of these regions to some extent, albeit not necessarily with aspirations for territorial hegemony.

This permanent foreign presence and the increasing maritime links between Africa and the rest of the world – Europe, Asia and the Americas, albeit at the cost of long months at sea – led to profound upheavals in the agricultural systems of sub-Saharan Africa. Already enriched by an increasing number of popular Asian plant species, these farms across Africa now began to integrate into their cropping strategies, sometimes with surprising speed, a considerable number of American species, especially vegetables. Consequently, the African populations began to incorporate into their diets everything from corn and cassava to sweet potato, peanuts, cashews, and pineapple, in addition to growing cotton and tobacco. The once great trade routes of the African continent – trans-Saharan trade from north to south and other intracontinental routes – began to be subverted to the demands of the coastal trading towns and their sea lanes.

Meanwhile, Europe was developing a curiosity for all things exotic, which found expression in the creation of zoological parks and botanical gardens at the behest of the State or wealthy dilettantes; a curiosity fueled by the increasing number of scientific and commercial ventures to more and more distant lands. These missions and their tantalizing results warranted the founding of ad hoc organizations by the great powers of the time, such as France and England, and the mobilization of ever more men of science and the arts.

Thus came into being *Le Jardin royal des plantes médicinales* in Paris in 1635, which would give rise to the National Museum of Natural History; and in the 18th century the Kew royal botanic gardens in southwest London. Such institutions had begun to treat the natural world in a more systematic and scientific manner as they amassed increasingly more knowledge and samples from the ‘discoveries’ of distant lands. As the voyages and expeditions multiplied, so too did the plant and animal collections of these institutions, sometimes at a rapid pace, requiring a whole new class of scientists to identify, describe, classify, and name.

This second volume cites some of the contributions to the scientific revolution sweeping Europe made by the voyages of various traders and religious missionaries, not to mention military expeditions. Whether out of natural curiosity or formal scientific training, these early adventurers provided the foundations for research into tropical ecologies from multiple perspectives: botanical, zoological, mineral, and anthropological. Simply by observing and

recording the customs and practices of peoples in distant lands, these voyagers provided some surprising insights into these agrarian systems and foreign landscapes.

Two contributions are of particular interest to this volume: that of Étienne de Flacourt, 'governor of the French' in Madagascar from 1648 to 1655. His unquestionable fascination for the people and their island not only benefited his contemporaries back home, but also subsequent generations with his detailed and unprecedented accounts of 17th century Malagasy society and military campaigns. The other figure that stands out is Michel Adanson, one of the first natural historians to spend an extended period of time in the tropics. He lived in Senegal from 1749 to 1753, studying its ecology and culture, and providing the West with some remarkable descriptions that are not lacking in human sympathy.

All these commentaries and journals helped fill in a detailed picture of the plants, animals, techniques and tools used by the farmers of these different regions. With unsuspected potential, this body of knowledge would go on to influence the political and scientific policies and interventions of the subsequent centuries, especially in the domain of agricultural commerce, sometimes on a grand scale.

Volume III: Explorers and merchants in search of the African El Dorado – 1800 to 1885/ 1890

The 19th century is marked by the systematic exploration of an African continent still poorly understood except for its coastal areas, as well as the first large European companies committing to a permanent presence in Africa following centuries of trade with the continent. These companies were not only commercial in nature but also increasingly political. For Europe was in the grip of expansionist fever and despite occasional opposition, the African continent together with Madagascar seemed offer themselves up as ideal places for the creation of colonies similar to those already established in the Caribbean and the Mascarenes.

Explorers such as Mungo Park of Scotland, René Caillié of France and Heinrich Barth of Germany (member of an English expedition) penetrated deep into the Dark Continent to return with stories and descriptions of ancient civilizations and sumptuous kingdoms with surprisingly robust economies that were no doubt largely agricultural, but boasting unexpected wealth and unusual specialties; and glimmering with potential by dint of their diverse production systems.

These voyages of discovery did not escape the attention of the great European powers, which were still expanding their scientific institutions, royal botanical gardens and national museums in cities such as Paris, London, Madrid, Amsterdam and Coimbra in Portugal. At the same time, these future colonial powers were setting up the first Gardens Trials overseas through the efforts of amateur naturalists, who could be simple travelers, soldiers, merchants, religious missionaries or civil administrators. Thus came into being garden trials on the islands of Cape Verde, São Tomé and Ile de France (Mauritius), paving the way for the Gardens of Richard Toll in Senegal and others in Elima in Ivory Coast and Libreville in Gabon, as well the gardens near Tamatave (Toamasina) in Madagascar.

Ever faster and more frequent shipping links in the 19th century gave rise to a superb network of intercontinental exchange for plant species and animals. The organization and working logic of this network led its organizers to proceed with the first major geographical zoning and ecological analogies, a symbol of the success of these exchanges. As a consequence, not only did biological diversity greatly increase, but so too did the economic expectations of all that was on offer in Tropical Africa.

The vast spaces and rolling farmlands of Africa, so welcoming and fertile, stirred up frenetic ambitions among the Europeans. Already thriving on this continent were local or long-established species such as palm, cotton, and coffee, not to mention cattle, zebu and sheep, and the ready availability of timber. Then there were the other recently introduced plants species such as peanuts, cacao, maize, and Asian rice – all assured of rich markets in Europe. In a flurry of feverish enthusiasm, large-scale projects were drawn up and put into action, such as the extraordinary plans of Baron Roger to reclaim the Senegal River Valley for agriculture; or the bold attempt made by the merchants of Nantes to establish agro-industrial plantations in the estuary of Gabon; or the multifaceted construction projects undertaken by the Malagasy monarchs at the encouragement of Jean Laborde and friends. Many of these hasty and ill-conceived projects would have only a fleeting existence, yet their economic, social and even cultural repercussions would resonate long after the works themselves had fallen into ruin.

While these lofty projects were underway, activities of a more modest nature, yet nonetheless revolutionary, were taking hold in farmer fields as the whole agrarian system was turned upside down, to the economic benefit of some. Such was the case with butter beans (*pois du Cap*) in southwestern Madagascar, the expansion of Asian yams and maize around the Gulf of Guinea, or the spread of peanuts in West Africa, in addition to the market gardening around the pre-colonial towns and trading posts. These and many other vivid examples are presented in this third volume.

The first modest attempts at animal traction in francophone Tropical Africa, for both tillage and transport, took place during the 19th century. In Senegal they used cattle, horses and donkeys; in Madagascar, cattle. These experiments with animal traction were accompanied by an increase in livestock exports, particularly Senegalese cattle to the Caribbean, which led to the emergence of the first veterinarians trained in tropical diseases. In the latter half of the 19th century, these veterinarians would participate in the supply and maintenance of saddled animals, as well as caring for draft animals assigned to military garrisons and expeditionary forces. More fundamentally, they were the first to bear witness to the some of the major endemic diseases responsible for the mass death of certain animals in Africa.

These first tentative efforts to harness animal power for farm work, aside from the long tradition of pack animals, does not in any way diminish from the almost exclusively manual nature of sub-Saharan agriculture, fortunately served by a profusion of tools with endless variations and adaptations for man, his land and his jobs at hand. Some of the main types of tools are described in this volume.

The closing years of the 19th century were overshadowed by the Berlin Conference of 1885, where Africa was divided into zones of influence by the colonial powers, who sketched out the broad outlines of their agricultural ‘policies’, notably the great regional specializations they intended to favor or impose their will upon. The Scramble for Africa was transformed into harsh reality at the dawn of the 20th century when foreign administrations were set up in the colonial nations together with the full presence of European commerce and its downstream markets and industries. The invaluable scientific, technical and socio-cultural knowledge garnered throughout the 19th century would provide the foundations for entrepreneurial undertakings in the ‘colonial period’ – scientific endeavors that would all too often become isolated or turn into personal quests, whose lack of technical or economic legitimacy could not guarantee the necessary coherence or sustainability.

IV: Colonization of Africa and the great Garden Trials – 1885/1890 to 1914/ 1918

This volume opens in the wake of the Berlin Conference of 1885. If Africa was starting to take on the appearance of a complementary continent to Europe, then nothing could hide the high stakes of the Europeans' expansionist appetites. Despite a certain reticence in Europe itself and, evidently, pockets of resistance in Africa not afraid to impede scheduled shipments or the transferal of property, the die had been cast. Around 1880 only a few parts of Africa were under foreign domination; by 1914 almost the entire continent was occupied by imperialist powers.

French occupation of Africa was not just characterized by the establishment of a colonial administrative apparatus, which was fairly well structured and quite omnipotent at times despite its limited resources, but also by numerous exploratory missions and studies intended to assess the wealth and opportunities of those territories being progressively annexed. Under the tutelage of specific ministries for the phase of 'establishment and recognition', military and scientific expeditions, as well as explorers and merchants in ever increasing numbers penetrated evermore deeply into the interior to tackle the agricultural conundrums of the time. Notable names that stand out include the naturalist Auguste Chevalier in West and Central Africa, the agronomist Jean Dybowski in Equatorial Africa, and the geographer Guillaume Grandidier in Madagascar. Another essential step of the early Administration was establishing viable, long-term institutions capable of relaying orders, organizing manpower, multiplying the evaluative activities and exploiting their achievements; for instance, by developing operational practices that improved production and other conditions. In this way France came to know its new worlds.

The National Museum of Natural History in Paris continued to play a prominent role in the training of overseas naturalists and in the scientific exchange of information, documents, plants and seed between regions. Its role as coordinator of scientific and technical activities, however, was being gradually supplanted by the Colonial Office and the colonial gardens at Nogent-Vincennes in Paris. Created in May 1900, these gardens absorbed the national school of colonial agriculture (ENSAC) two years later. Subsequent generations of this school would go on to occupy the top tier of tropical agricultural research. The allure of the exotic was reaching well beyond the capital too. Numerous French cities, especially those with modest yet long-standing relations with the Tropics and particularly Africa, created their own colonial institutions as well as organizing special exhibitions, notably at Marseille, Bordeaux and Le Havre.

Back overseas, thanks to the implementation of permanent technical and scientific services at national, colonial and territorial levels, great strides were being made in terms of research and extension services for agriculture as well as for veterinary and forestry. At the same time as the first experimental stations were appearing, there was a veritable proliferation of botanical gardens and experiments, and not solely at the instigation of scientists either. Civil servants, soldiers, religious missionaries and merchants were all keen to make their mark on their new environments, in other words, to reproduce their former lifestyles and former culinary habits through the introduction and implementation of foreign techniques and materials. More than a dozen stations and around sixty gardens are described in this volume. The existence of some of these stations and gardens would be as fleeting as their founders' stay in Africa; while others would become permanent links within a scientific chain stretching across Tropical Africa and into the next century.

While agriculture on the whole was asserting itself as a prime asset for the sub-Saharan economies and as a major source of external trade as it progressively replaced the gathering of

natural products, different forms of land usage or exploitation arose. For it was a time of convenience, not exempt from cowardice – a time when the major companies were extracting concessions from governments, especially in Equatorial Africa. This practice came under increasing criticism, not only for its inefficiency, but also, more fundamentally, for its untenable abuses.

This *modus operandi* came to replace the ‘plantation’ model, especially in western Africa and Madagascar. Driven by the appeal of quick gains and adventure, companies or individuals set up capital-intensive operations with local labor to produce commodities for export. These newer plantations emerged in areas that were, in theory, ecologically favorable but still largely inaccessible to the local market economy, sparsely populated and long accustomed to a balance of self-sufficiency in their natural environment. Thus coffee plantations were pioneered in these regions before the end of the 19th century – in Guinea, the Ivory Coast, the ‘French Congo’ and Madagascar – often following the example set by the Portuguese and their much earlier plantations in Cape Verde, São Tomé and Príncipe, as well as Angola and Mozambique. The first plantations of ‘dessert banana’ for export emerged at the dawn of the 20th century in Guinea with a view to conquering a market principally dominated by the Canary Islands and Madeira. Other ‘cash crops’, too, were attracting the interests of these new plantation owners: tobacco in Cameroon, vanilla in Gabon, and sugar cane, clove and vanilla in Madagascar. Despite the inevitable setbacks due to a lack of knowledge about the local environments and a shortage of technical and scientific support, all still in its infancy, the majority of these attempts were nevertheless successful, thus generating a ripple effect among the local African and Malagasy farmers, who began experimenting themselves more and more with these ‘cash crops’ in the early decades of the 20th century.

However, a third use of agricultural lands, which goes back centuries, was increasingly seen by the public authority as a way of generating the kind of progress desired in the rural world: peasant agriculture or family farming, regardless of the predominant crop or farming preference: vegetables, fruits and trees or raising animals. Some old examples of this were the farming of groundnuts in West Africa, maize in the Gulf of Benin and butter beans Madagascar. The public authority saw market demand as the most convincing strategy for expanding and supporting these family farming activities. The Europeans were finally beginning to recognize the value of the local farmers’ knowledge and skills. In these environments they were undoubtedly the experts when it came to diversity and quality, not to mention the pitfalls.

The efforts of the Administration and its extension services turned increasingly toward the improvement of traditional agriculture, some products of which were financially interesting, such as peanuts, cotton, beef and wool; while other products were important to food security, such as millets, rice, cowpea, and yam. Within these two main types of production, African farmers also showed a remarkable capacity for accepting or introducing into their farming systems some radical innovations, such as cocoa in Ivory Coast and Cameroon, plowing in Madagascar, and in the Sahelo-Sudanian zone taking the first major steps against the worst livestock diseases, such as rinderpest and bovine pleuropneumonia.

While agricultural production, practices and systems were diversifying, scientists, technicians and officials were endeavoring to ensure their continuity through the first systematic studies of soil fertility in the tropics (which, according to legend, was inexhaustible), as well as scientific studies on parasites and other foes of plants and animals, in addition to investigating strategies and techniques for overcoming climatic hazards, such as the first large hydro-agricultural schemes in the valleys of major rivers (Senegal, Niger) and in the rice plains of Madagascar.

These agricultural security measures were advocated by the French services for agriculture, livestock and forestry. Toward the end of the first decade of the 20th century another security measure was the formation of a remarkable institution for supporting the rural world: *la Société de Prévoyance*. Extended to all administrative districts, this collective insurance cooperative would for decades provide the logistical groundwork for innumerable transactions, to the benefit of the rural communities: not only credit, but also the supply of inputs, materials, plants and seeds, even the marketing of products. To a large extent, *la Société de Prévoyance* protected rural communities from extreme market swings while providing a solid bridge between the technical and the practical, the desirable and the possible.

Volume V: The first research stations and their development – 1918 to 1940/1945

This period is profoundly marked by the appalling butchery that overtook Europe from 1914 to 1918; and from which France came away deeply scarred – in its flesh, its assets and its reputation. It decided the best way to retain its international standing was by consolidating its empire and developing its overseas possessions and fortifying these populations. A duty was also felt to recognize the painful sacrifices made by the overseas territories in this Great War. Hence, a development plan for the colonies already envisaged prior to the armistice was transformed into a veritable ‘Colonial Development Plan’ between 1918 and 1919 by an ex-ante assessment mission before being presented to the French Parliament by Minister Albert Sarraut in April 1921.

Although not ratified by the assembly, the ‘Saraut Plan’, as it became known, would serve as a set of guidelines for actions undertaken overseas between the two world wars. These guidelines were further enriched or influenced by some major meetings and events during this period: the International Colonial Exhibition of Paris in 1931, the Imperial Economic Conference of December 1934, and the Congress of Scientific Research in the Overseas Territories of September 1937. Acting with more consistency were the official departments and associated institutions and other professionals who ensured the efficient design and execution of these programs and policies, including control and monitoring, evaluation, and the training of senior scientific and technical staff whenever necessary.

Forming a permanent backbone for these agricultural policies and their strategies from the French capital was the respected National Museum of Natural History, the National Institute of Colonial Agronomy (INAC/ INAFOM)) and the tropical agronomists it generated, as well as the institute for exotic veterinary medicine (IMVE) and the ministerial services for livestock farming and forestry. These endeavors were further supported by the academy of colonial sciences, the *Association Colonies-Sciences*, as well as the Chambers of Commerce and Agriculture of several French regions, and other learned societies. All these organizations provided the necessary forums for exchanging views and presenting proposals by political bodies and personalities of the time, scientific professionals and savants who were able to provide the impetus and alternative perspectives to the research and actions underway. The foundations for the Office of Colonial Scientific Research were born from this intellectual effervescence, which continued even during World War II and the occupation of France, giving form to resilient organizational structures and an expanded organization of technical and scientific services for agriculture, generally overseas. Also toward the end of this period emerged the first specialized and privately-owned research institutes: IRCA for rubber, IRHO for oilseed, IFAC for fruit and citrus fruit, and UCEF for cotton.

Overseas meanwhile, these State mechanisms were being replicated within the larger politico-administrative network created by the federations of West and Equatorial Africa, as well as that of Madagascar and Indochina; the managers of which were delegated real power to make decisions, often via an omnipresent and multi-skilled Administration. In each of the federations and at the level of each of the territories that made up these federations, technical and scientific services were established or consolidated, including agrosilvopastoral activities. Yet although the rural economy represented the bulk of the inferred resources of these tropical countries, this does not mean that they agreed to these services or the means to fully develop their coveted resources.

With specific regard to agricultural research, each Federation acquired, under the supervision of its general inspectorates, institutional networks with a regional focus that were connected to the territories by equivalent structures and branches on a more modest scale, and, where appropriate, specializing in certain production methods or research topics. In the same vein, the somewhat disorderly gardens, farms and stations from the preceding period led to a more logical redeployment of establishments according to their ecologies, their needs and their economic outlook, ensuring for more durability. Thus, at the dawn of the 1940s there were around 150 centers, stations and farms ‘covering’ all of Tropical Africa under French administration. This volume concentrates on these French establishments, while also taking a passing glance at their Portuguese and English counterparts.

Some of these overseas establishments, to which qualified scientific and technical staff were gradually assigned, were equipped with the appropriate equipment and their infrastructures expanded ad hoc, thus laying the foundations, in a broad sense, for the establishment of the first agronomic research stations for plant and animal production. The names of these embryonic stations, which had a broad and sustainable regional focus to begin with, still resonate in the 21st century: Bambey and Dakar-Hann in Senegal, Bamako-Sotuba in Mali, Bouaké and La Mé in Ivory Coast, Pobé in Benin, Dschang in Cameroon, Bébedjia in Chad, Boukoko in the Central African Republic, and Lake Alaotra and the Antananarivo laboratories in Madagascar.

Their relative youth and hesitant knowledge notwithstanding, these nascent research stations supported all the major agricultural developments undertaken in the overseas territories at the time, and with aplomb too, as evidenced by the skill with they developed their own studies and experiments. Although instructed to prioritize market output above all else, these research teams nevertheless increasingly engaged with traditional production and food crops such as the millets, sorghums and rice, in addition to nomadic or extensive livestock breeding and the products of natural forest stands.

Among the ‘industrial’ products expected by the domestic markets, and above all the external ones – thus products favored by the Administration – many were already being produced in great quantity by the family farms, which had largely opened up to the market economy. Such products included groundnuts across West Africa, especially Senegal; cotton in Mali and along its borders; the products of natural palm groves (oil, palm kernels) in Ivory Coast, Togo, Benin, and the Congo; cocoa in Ivory Coast and Cameroon; cassava in Madagascar; wool and sheep breeding in Mali; and meat and cattle breeding in Madagascar. These crops and animal products received special attention from the research establishments too; and, perhaps more importantly, were the subject of targeted interventions by the technical extension services attached to larger organizations but whose activities were often the responsibility of the local representative of the ‘administrative authority’, which set objectives and limits according to its own criteria.

If this combination of ‘research and outreach’ among traditional farmers and pastoralists achieved only humble returns for some products, other products experienced spectacular increases. Groundnut production doubled in Senegal and the same went for rice in Madagascar while cocoa production was booming in Ivory Coast and Cameroon. The interbreeding of Merinos and Karakul with Sudanese sheep for wool, and Montbéliard crosses for zebu in Cameroon for meat, also met with success. Furthermore, veterinary interventions managed to partially eradicate some major epizootic diseases, such as rinderpest, bovine pleuropneumonia, tuberculosis and rabies.

Concurrent to these efforts in favor of indigenous family farming, the Administration and its services were providing substantial support to the medium and large plantations, as well as new farms generating products for export. This included irrigated cotton in Mali; bananas in Guinea and then Ivory Coast and Cameroon; oil palm in Ivory Coast; and coffee in Guinea, Ivory Coast, Central African Republic (Oubangui Chari) and Madagascar. More often than not initiated by European companies and entrepreneurs, these newer plantations were established on frontier lands that pushed back the desert, the forests, the swamps and mangroves. Aside from their important economic effect, notably by ensuring the Afro-tropical products a significant market in the industrialized countries, these plantations also had an undeniable knock-on effect in the training of African and Malagasy planters. Insignificant participants at the beginning of the 1920s, they would progressively become majority stakeholders in these plantations by the time WWII was looming, as was the case for coffee in Ivory Coast. This profound socio-economic upheaval, which was irreversible and enthusiastically welcomed and supported by local political movements and trade unions, favored the expansion of family farming so long as it did not try to compete with the big plantations. The system of concessionary companies and colonial rule over immense territories, still in force at the beginning of the 20th century in certain equatorial regions, was now definitively being condemned for its inefficiency and vile abuses.

With regard to forestry resources, the inter-war period was marked by increasingly assertive policies for protecting existing stands in the grasslands and savannas of Africa by means of reserves, classifications, and parks. In the large forests, this period was characterized on the one hand by a major effort to inventory the most interesting forest species and carry out technical analyses of their woods; and on the other hand, by increased exploitation of these forests, mainly by private companies, which the services of the Administration tried to control and regulate.

On the whole, the rural economies of the African tropics experienced robust growth during the two decades between 1920 and 1940, largely due to increased productivity of the family farms and through the impetus and training provided by the pioneering sector of dynamic and innovative plantations. This synergy, encouraged by the public authorities, was further enhanced by the actions of a better organized technical services, despite their relative lack of administrative resource, and by the progress made in agronomic, veterinary and forestry research thanks to a gradual influx of qualified personnel and the creation of stable and well-equipped facilities.

Schematically, five major themes of intervention were developed through the research-outreach combination for supporting agricultural development in the territories, as outlined in the 1921 ‘Sarraut Plan’ and which was generally accepted by the French territories: 1) genetic improvement, essentially by selection of local material, plant species and animal breeds, along with the identification of their greatest threats (insects, diseases) and the development of the first methods of control; 2) the beginnings of a systematic approach to traditional techniques and know-how of farmers drawn from generations of practice, as well their

knowledge of ecological conditions, especially soil quality and constraints; 3) the first extensive testing of mechanization on small family farms, essentially with equine and bovine traction, accompanied by the organic manure it produced; 4) the already ambitious hydro-agricultural schemes, mainly in Mali and Madagascar, which enabled the reclamation of thousands of hectares of previously undeveloped deserts and plains for farming and animal grazing; and 5) the safeguarding of agricultural activities by pooling resources, largely through the *Sociétés de prévoyance*. These five major themes laid the foundations and future interventions of a post-WWII Africa.

VI: From colonial imperialism to African independence as research paves the way for development – 1945 to 1960

This volume is grounded in the decolonization of sub-Saharan Africa. At the end of World War II, Europe was in ruins, faced not only with the enormous task of reconstruction, but also significant food shortages due to five years of underproduction, blockades and war shortages. For certain Western metropolises, it became evident that their overseas possessions – especially those they still held onto in the Africa with its immense ecological, territorial and human potential – could make a swift and substantial difference to rectifying these cruel and persistent privations. But now that peace had descended upon the world, neither could these European countries ignore the extreme sacrifices made by their overseas nationals in this terrible conflict. They deserved some sort of recognition, if not some sort of sacrifice from Europe to compensate for their war efforts.

This twofold necessity – the urgent revival of the European economies and the accelerated development of those overseas countries still under their supervision – led the European governments to draw up ambitious development plans to be implemented under very trying conditions, thus requiring rigor and rationality in the definition and implementation of these policies. In the spirit of the Conference of Brazzaville, opened by General de Gaulle in January 1944, a Ten-Year Plan was established in 1946 in France at the behest of Jean Monnet, leading to the creation of the French Union on 27 October 1946.

In the heady days following the Marshall Plan and the first signs of a revitalized Europe, various planning commissions proposed the creation of, or the strengthening of, organizations endowed with powerful means and a certain degree of administrative and financial autonomy for supporting or applying policies and strategies in Tropical Africa, particularly in the larger agricultural sectors and their research arms. The Overseas Territories Investment Fund (FIDES), funded by the French state budget and managed by its *Caisse centrale de la France d'outre-mer* (CCFOM, the future *Caisse Centrale de Cooperation* or CCCE) ensured ongoing financing and was supplemented by the resources of the federations and territories themselves (taxation, borrowing).

In addition to these structural measures, the planning commissions elaborated and supported numerous agricultural development projects in Africa. Some of these projects were designed to urgently address the most extreme food deficits in Africa itself (lipids in particular) and envisioned interventions across immense regions, from the deserts to the great forests. All too often, unfortunately, the excesses of these plans were only equaled by their lack of preparation and improvisation in the use of imported technologies that were complex, capital-intensive and requiring supervision by highly trained personnel as well as heavy infrastructure and sophisticated equipment. Many of these hastily-drafted projects would die in the bud while others would be more successful, albeit not always as their architects had originally envisaged.

Within the State apparatus, the agricultural sector for plant and animal production was provided with scientific and technical services commensurate with the political and socio-economic ambitions of the Ministry of French Overseas Territories, especially with regard to the management of agriculture, livestock and forestry. Created in July 1944 by the French National Liberation Committee of Algiers and entrusted to Maurice Guillaume, the Technical Section of Tropical Agriculture, based in Nogent-Vincennes in Paris, supervised the general inspections of the governors general in West Africa, Equatorial Africa and Madagascar, sometimes relying on its armed branch.

From these general inspections it was revealed that technical services (agriculture, livestock, forestry, rural engineering) for each of the federations' territories were responsible for extension services and possessing wherever necessary a local network of experiments (stations, farms, test points). The inspections further revealed that some of the federal research structures had acquired during this period of 1945-1960 a genuinely regional and multidisciplinary dimension. These were, or were to become, the Bambey Agricultural Research Center and the Federal Livestock Laboratory in Dakar-Hann, Senegal; the Federal Livestock Research Center in Bamako, Mali; the Koba Rice Research Center in Guinea-Conakry; the Bingerville Agricultural Research Center and forest research stations in Ivory Coast; the Nkolbisson Institute of Agricultural Research in Cameroon; the Farcha Veterinary Research Laboratory in Chad; the agronomic research center of Boukoko in the Central African Republic (then Oubangui Chari); the Loudima-Malela agricultural modernization station in Congo-Brazzaville; and the Central Agricultural Station of Lake Alaotra in Madagascar.

This relatively dense network across Tropical Africa (which may have covered as much as 70 million hectares of agricultural land, worked by some 30 to 40 million farmers under the French Administration) was devoted to applied research, primarily through organic growth, that directly benefited short and long-term development. Science was finally being officially recognized as the key driver. Further, the political decision-makers had to associate more fundamental research to this applied research, albeit through organizations partially or fully oriented toward the Tropics, such as the venerable National Museum of Natural History and its chair of tropical agronomy led by Professor Auguste Knight; or the Office of Colonial Scientific Research (ORSC), established in 1943, the 'Colonial' part of the title being quickly replaced with 'Overseas' (*Outre-Mer*) the following year to become ORSOM. These organizations carried out 'basic' research, inventories, characterization of physical components and biological systems of tropical environments, including the mechanisms of evolution and functioning of these environments. They also assured the bulk of training for the scientists assigned to agricultural research. Engineers, veterinarians and forestry officers, on the other hand, remained in the hands of specialized French schools, such as the *École supérieure d'application d'agriculture tropicale*, *Institut de médecine vétérinaire exotique*, and the *École des eaux et forêts tropicales*.

While the National Museum of Natural History intervened in Africa mainly via scientific missions from its Parisian chairs, ORSOM, whose main institute of teaching and tropical research (IDERT) was located in Bondy, Paris, offered overseas establishments of prime importance, such as the *Centre de pédologie de Dakar-Hann* in Senegal; the IDERT at Adiopodoumé in Ivory Coast; the Cameroon research institute of IRCAM in Yaoundé; *l'Institut d'études centrafricaines* (IEC) in Brazzaville; and the institute of scientific research of Madagascar (IRSM) in Antananarivo. It should be noted that an effort was made, and very much supported by the public authorities, to merge applied research (the scientific agricultural services for French overseas) with the basic research of ORSOM, as decreed in 1953, resulting in the creation of ORSTOM with the simple addition of a 'T' (*technique/ technical*)

in the acronym. The merger, which nearly succeeded in the French capital, suffered many setbacks overseas until being abandoned in 1960, justifying the creation of an institute for tropical agronomic research and food crops (IRAT), which took over research into orphan crops conducted by the former overseas scientific services.

In the process of finalizing research activities seeking to better match the demands of production with the needs of the market, new institutes specializing in large groups of products were created during this period of 1945-1960: “The application of various scientific disciplines contributing to agricultural development in a particular field,” according to the principles of professional circles at the time, as expressed by Robert Michaux, President of *l’Institut de recherches pour les huiles et oléagineux* (IRHO), established in 1942.

Institutes already in existence prior to 1945, such as the IFAC (future IRFA) for fruits and citrus fruit as well as the UCEF for cotton, were successively joined by the institute of research for cotton and exotic textiles (IRCT), which grew out of the UCEF in 1946; the Institute of Livestock and Veterinary Medicine for Tropical Countries (IEMVT) in 1948; the Tropical Forestry Technical Center (CTFT) in 1949; an institute for research into African rubber in 1955; and a French institute for coffee and cocoa (IFCC, future IRCC) in 1957. These organizations of varying status, from private to public, not only had headquarters in Paris, but also overseas establishments, some of which swiftly garnered attention and even achieving regional or international scientific fame, such as the Central Fruit Station of Kindia-Foulaya in Guinea belonging to IFAC; the oil palm stations of La Mé in Ivory Coast; Pobé in Benin for the IRHO; the cotton stations of Bouaké in Ivory Coast; Anié-Mono in Togo; Bébedjia in Chad; and Bambari in the Central African Republic, which was run by IRCT.

The organizations evoked so far here generally fell under three categories – administrative, para-public or private – but they were soon to be joined by a fourth: the first scientific research institute located overseas, which was the IFAN in Dakar and its satellite offices (*l’Institut français d’Afrique noire*, which later became the *Institut fondamental d’Afrique noire*). Hence, we can see that the African tropics of the French Union were covered by a very respectable network of research establishments that prioritized the rural economies of these countries and the expansion of their agrosilvopastoral potentials. In fact, on the cusp of African independence these institutions represented some 1,000 researchers, both expatriate and national, working in more than 150 experimental centers, stations and experimental units, most of which are described in this volume. This network would of course provide the foundations for the first national research systems, which were gradually established following independence within the framework of scientific and cultural cooperation agreements with the former supervisory institutes in Paris.

The period of 1945-1960, with its renewal and strengthening of the structures and means for research, also saw a similar dynamic in the field of equipment and methods for engaging and supporting agricultural and rural development. These extension services were no doubt already substantially reinforced with personnel and material under the tutelage of the French Administration. However, new modes of intervention were emerging specifically aimed at involving the rural populations in the definition of the most apt ways to facilitate their own development, particularly from a technical perspective and at a territorial level. The human dimension was also being taken into account so that the strengths and constraints, whether they be agro-ecological or socio-economic, could be integrated into the intervention and potential problems solved through participation with the concerned communities. This ground-level approach was initiated by eminent agronomists Maurice Rossin and Roland Portères, with the support of senior government officials such as the governors general Paul Chauvet’s in French Equatorial Africa and Robert Bargues in Madagascar, and then tried and

tested during the decade of 1950-1960 across territories comprising several thousand hectares, notably, the experimental sectors of agricultural modernization in West Africa, the *Paysannats* in Central African Equatorial Africa (similar to other experiments in progress by INEAC Congo Kinshasa, at that time Belgian), and in Madagascar, known as the *Collectivités rurales modernisées et Secteurs de paysannat*.

These interventions possessed multidisciplinary teams for the design and realization, as well as the autonomous means for finalizing a common objective of development, the pre-established terms of which could be adjusted during its execution thanks to involvement and follow-up evaluations by the research institutions. From this fruitful synergy between the project leaders, the extension workers, the researchers and the farmers emerged the concept of research-development, or action-based research, which would gain a foothold and be progressively refined in post-colonial Africa.

Resource allocation increased substantially during this period of 1945 to 1960, especially to research and the application of its results. Technical progress was achieved, sometimes with spectacular results in productivity, no doubt as a corollary of efforts made in the previous interwar period, but also especially by resorting to innovative methods of scientific exploration and technological implementation. This sixth and final volume, which focuses on some of the major achievements and performance of this period, is devoid of any real pretensions to 'educate the reader', but rather to revive the works of some lamentably forgotten authors, as well as to draw the attention of present-day managers and stakeholders to the considerable potential of sub-Saharan agriculture.

On the whole, genetic improvement of plant and animal species still remained the disciplinary field of choice for research to increase agricultural production for this period, yet profound changes were underway, upsetting the balance of research pressures: the protection of crops and livestock; the regeneration, maintenance and augmentation of soil fertility; the mechanization of farming operations; the optimization of plant water supplies (rain, submersion, irrigation); and a better understanding of cropping systems and the techniques of livestock farmers and pastoralists. These themes became increasingly present in research programs before eventually becoming the norm. Rapid yet sustainable improvement of the environment began to take precedence over the plant or animal species being exploited in the environment.

As for the division of research among the species, the preponderance of 'industrial crops' over 'food crops' was seriously shaken during this time. Millets, sorghums, rice, maize, cassava, and sugar cane began to attract the attention of more and more scientific teams. In the animal kingdom, nomadic breeding had found favor again among the specialists, although they were dedicating more and more of their time to more sedentary pursuits, such as draft animals, slaughtering for meat, as well as wool and leather production.

Several chapters of Volume VI are dedicated to the remarkable, sometimes spectacular advances made in this postwar period by research, including groundbreaking initiatives of modernization and certain pilot projects, and the enhancement of the results and products of the traditional farming sector. From this long list of achievements we can highlight some of the most relevant here:

- Immense progress was made through genetic improvements, as well as through plant and agro-technical improvements of the main food crops. For instance, the productivity of traditional rain-fed cereals such as millet and sorghum were stabilized in the face of climatic and phytosanitary threats while their yields were greatly increased through fertilization. By

similar means, the productivity of wetland rice was doubled, even tripled, compared with traditional yields. Comparable results were achieved for tubers, especially cassava, due to certain varieties that were resistant to disease, and the addition of fertilizers.

Oilseeds, peanuts and oil palms were all growing strongly – oilseeds thanks to selected varieties, fertilizers, animal traction, and organized marketing (almost record-breaking production was achieved toward the end of this period). Peanut production was likewise thriving due to varietal selection, fertilization, and reorganization of artisanal and industrial harvesting methods. These jumps in production were a prelude to the post-colonial boom.

The remarkable work of genetic improvement, phytosanitary protection and careful crop management resulted in a tripling of cotton production from 1945 to 1960 across the whole of francophone Africa. This would prepare the way for the extraordinary rise of cotton in most countries of the sub-Saharan savannah by the late 20th century. The most crucial element of this economic upheaval was undoubtedly the high priority given by research and associated development companies to rain-fed cotton since the 1950s, with its advocates making a very confident wager on the large capacities of the family farm being up to such a challenge at a time when the large hydro-agricultural projects were being relinquished.

In the fruit sector, research work together with the dynamism of the planters – at first expatriates, then increasingly local nationals, who quickly became majority stakeholders – enabled the banana-dessert of various varietal origins (Canary Islands, Guadeloupe, Malaysia), to consolidate its place on the African continent before becoming a leading economic driver in Guinea, Ivory Coast, and Cameroon as a prologue to the massive expansion of the market following independence.

- Coffee growing experienced an upsurge similar to that of bananas. European plantations were revived while family coffee farms started multiplying. Robusta varieties were largely responsible for this upswing in Guinea, Ivory Coast and Madagascar. Remarkably, the Arabica variety found purchase only in Cameroon. The work of researchers made it possible to eliminate fairly rapidly the most serious threats related to the fungal pathogens of blight and tracheomycosis, either through phytosanitary control or varietal substitution, and coffee production doubled, even quadrupled, during the period of 1945-1960.

Cocoa production, which was introduced to the Gulf of Guinea at the beginning of the 20th century, was also showing great promise, especially in Ivory Coast and Cameroon, in addition to Madagascar. Genetic improvement of cultivated varieties together with effective phytosanitary protection provided by research and technical support services contributed to the robust increase in cocoa production, mainly among local planters on their family farms. Thanks to the dynamism of these farmers, Ivory Coast would become the largest exporter of cocoa in Africa by 1975 before becoming the biggest producer in the world.

- In the livestock sector so vital to the Sahelo-Sudanese economies, this period saw considerable headway made in the fight against major animal diseases thanks to research development into prophylaxis methods and eradication, as well as detection and vaccination campaigns run by well-organized services and response teams. A subsequent step, and a crucial one at that in the eyes of the Administration, was an absolute ‘rehabilitation’ of the nomadic livestock, whose numbers and movements were difficult to record at the best of times, let alone integrate into any control and management scheme.

The overall results of this technical and socio-political transformation, along with zootechnical advancements in animal feeding and animal usage, was a substantial jump in

livestock numbers, from 50 to 100% for the main domesticated species, to say nothing of the greatly improved health conditions for both traction and the transport animals, and the quality of milk and meat destined for the market.

- With regard to the development of the considerable forestry resources of these tropical countries, the view of the Administration and specialized services active in the steppe and savanna zones was basically that of protection and conservation: closing forest areas to animal grazing and ‘classifying’ were increasingly adopted by countries located in these ecologies. In the humid forest regions, special emphasis was placed on both qualitative and quantitative evaluation of species of interest, the characteristics of their woods increasingly recognized and appreciated. This diagnostic made it not only possible to develop methods for the rational exploitation and enrichment of these natural stands, but also the establishment of large-scale experimental plantations of the most attractive species for the market (teak, mahogany, okoumé).

Logging, which was essentially private and complemented by a promising industrial transformation at the local level, experienced exceptional growth between 1945 and 1960, with water and forestry services striving to standardize and regulate methods and techniques.

- These compelling examples, and many others provided in this volume, illustrate the enormous possibilities to be had from overhauling the entire agricultural sector in these regions and, consequently, the capacity of this sector to drive growth in the territorial economies during the decisive phase of independence, and long afterwards. Beyond these remarkable quantitative performances, however, a more fundamental evolution, perhaps even an agrarian revolution, was beginning to take hold. Ambitious experiments based on transforming traditional production systems – experiments undoubtedly still localized in privileged situations – were pursued during the 1950s and well after. These processes of transformation were predominantly based on such key factors as mechanization of agriculture, still almost exclusively manual at that time; the rational utilization of available water resources, whether it be rain, surface, or underground; and more intensive agronomic management of usable land, the availability of which was already shrinking due to accelerated population growth.

Since the 1940s, and well before for some nations, mechanization appeared to be the ‘magic bullet’ for modernizing the most archaic production systems, just as it had been transforming the western world since the early 20th century through the great agro-industrial revolution. But in all the enthusiasm, some essential stages were all too often rushed into practice for sub-Saharan Africa, such the adaptation or design of the materials, the training of people, the preparation of an institutional environment, or the logistics and commerce. All of these prerequisites were still in their infancy in sub-Saharan Africa. As an upshot, the large agribusiness enterprises remained with rain-fed agriculture while, at great expense, highly motorized machinery was either rapidly reconverted or abandoned. A mixture of solutions, however, soon emerged: service providers that offered powerful equipment to farming communities in need, as well as motor-animal combinations. Daily practice and a natural osmosis allowed for the development of much more durable schemes of mechanization, in which animal traction would play a dominant role for years to come. One fact, for too long denied, seems to have prevailed: agriculture of the African Tropics, like that of other regions of the world, has little future so long as its progress is tied solely to human energy, whose nobility cannot make you forget the weakness of this system, nor its human hardship.

The use and control of water required, in many instances, significant or partial changes, that is, direct or organized management of growers. The evolution of these development schemes

followed a similar path to that of the aforementioned large agro-industrial enterprises: complete motorization gradually gave way to mixed solutions (motor-animal) as realistic management of water resources began to assert itself, thus enabling more intensive farming by united communities. Until this point 'farm water' had been limited to particular situations in Tropical Africa (flood plains, coastal mangroves) or to very old ethnic traditions. Now it was being appropriated by a much larger range of people. This was a major breakthrough, and at a time in history when, contrary to many misconceptions, arable land in Tropical Africa together with rain-fed agriculture was becoming scarce, and forestry resources were coming under pressure. The fact was, water supplies were in abundance so long as one knew how to manage and equitably share this most precious resource.

In those regions where, for thousands of years, nomadism had enjoyed wide open spaces, a long 'fallow period' now took hold, which suddenly increased the needs of a rapidly growing nomadic population whose rural core was gradually giving in to the temptations of urban life. This disturbing scarcity of land demanded a strong response in terms of intensification. Crucial progress in agronomic engineering (organic and mineral fertilization, crop rotations, agrosilvopastoral associations) and the economic management of farms, from the largest capitalist venture or collective to the smallest family farm, together with varietal selection, mechanization and irrigation where appropriate, paved the way for this urgent intensification.

Agriculture of the African tropics, already capable of strong production, was now able to claim high productivity across much of its available agricultural lands, and predominantly at the hands of its own men and women. By 1960, the agricultural sector of the African tropics could meet the most serious challenges and overcome the most dramatic crises.

AFTERWORD

Acknowledgements

At the end of this *History of Agricultural Research in Francophone Tropical Africa*, whose length and breadth of subject took on unforeseen dimensions involving some fifteen years of research and writing, the author's gratitude goes firstly to Africa, which, despite its many challenges, taught him about the inestimable value of wisdom, courage and patience, dialogue and tolerance, as well as respect for others. Such lessons have not been in vain and the present work may be seen as one big African heart.

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A final word: Look to your past, dear Africa, it's full of bright futures

One only draws conclusions from history at the risk of seeing these conclusions contradicted in the future. The harshest critics claim that "history teaches absolutely nothing because it contains everything and gives examples of everything" (Paul Valéry, *Regards sur le monde actuel*, 1931; Gallimard, 1988). For other historians, however, "the past never completely dies in man. Man can try to forget it, but it will always be with him" (Numa Denis Fustel de Coulanges, *La cité antique*, 1864). But perhaps the wisest remarks are: "The true men of progress are those whose starting point is a deep respect for the past" (Ernest Renan, *Souvenirs d'enfance et de jeunesse*, 1883) or "Without past we are without future, without present we are without past" (Joseph Ki-Zerbo).

At the end of this very long voyage of a dozen millennia through the agricultural history of Tropical Africa, how is it not possible to recognize the incredible progress made by African man and woman in their incessant fight – or dialogue – with an often hostile environment that could only be tamed or appeased over time? The skepticism of our poet-historian Paul Valéry notwithstanding, should we not also recognize that, after this long journey of research – firstly empirical and silent, then much later scientifically organized – that remarkable levels of technology and productivity have indeed been achieved, which the sub-Saharan countries continue to broaden?

Let us then bring this tome to close on an overwhelmingly optimistic note, as is the humble view of an agronomist whose work in Africa has occupied most of his professional and personal life. May Africa finally reach its full potential in the 21st century and the next generations of farmers and leaders accept this message of optimism from someone entering the twilight years of his life.

René Tourte
Montpellier, December 2018

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- Former scientific director of the Bambey Agricultural Research Center, Senegal
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 - Retired Inspector general for the Overseas Scientific and Technical Research Office (ORSTOM), now known as the *Institut de recherche pour le développement* (IRD)

PS. Many thanks also to Tony McGowan - journalist, writer, scientific and technical translator, English teacher - for his excellent translation, from French lines full of difficulties and technical jargon.

APPENDIX: Some clarifications

- Since February 2012, these collected works have been freely available and free of charge, but only in French, on the FAO website [Title : " *Histoire de la recherche agricole tropicale en Afrique francophone* ; quick access by Google: *René Tourte FAO*]. Any use for educational purposes is permitted, provided the source is attributed. This digital version has been somewhat improved by the author in view of a possible paper edition.

- Each of the six volumes is illustrated with maps, photographs, diagrams and a bibliography (books, reports, notes, press extracts), as summarized in the table below.

Volume	Maps	Photo series* and diagrams	Bibliographic references**	N° Pages***
I	5	1	67	148
II	3	9	199	138
III	3	14	269	247
IV	7	24	633	475
V	7	27	785	634
VI	1	17	1,189	1,057
Total	26	92	--	2,699

* Each photographic series can contain up to 6 images

** The same reference may appear in different volumes. In total, around 2,500 titles were consulted for this history

*** On the basis of a paper edition in 16x23 format (80g paper), the entire works would occupy 15 centimeters in length on a library shelf and weigh nearly 4.5 kilograms.

Note that the number of pages dedicated to each volume is not a true reflection of the extent of research carried out for that period; it merely expresses the richness of the sources that were consulted. As for the impressive total number of pages in these collected works, the author takes refuge behind the illustrious Voltaire, who advised that a particular “book does not require a continuous reading; but wherever you open it, you will find something to think about” (Voltaire, *Dictionnaire philosophique portatif*, 1764). Here’s hoping it will be the same for the story told here.

- Below is a limited, personal edition of the collected works, for display only.

