



New Perspectives on the  
History of Brazilian  
Agriculture

Francisco José Becker Reifschneider | Gilmar Paulo Henz  
Carlos Francisco Ragassi | Uander Gonçalves dos Anjos | Rodrigo Montalvão Ferraz

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*Brazilian Agricultural Research Corporation  
Ministry of Agriculture, Livestock and Food Supply*

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*“Si hortum cum bibliotheca habes, nihil deerit.”*

(“He who has a garden and a library lacks nothing.”)

Cicero  
(Ad Famil. lib ix, epist. 4)

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### So, what does this have to do with me?

**7**his book attempts to recover a bit of the rich, varied and often hard to find history for the student of agriculture and related areas. Understanding a bit more of the history of Brazilian agriculture is not something that normally attracts the attention of students of the agricultural and environmental sciences, whether at the technician or university level. The excellent books available on the subject, such as the General History of Brazilian Agriculture, by Luis Amaral, give a detailed view of the evolution of agriculture, but they concentrate on the major cycles, they're hard to find, they require a careful reading due to the length and complexity with which the topics are covered, and they're not attractive to the internet generation, so they end up being read by few people – very few indeed. Therefore and thereby, we all miss out on such invaluable references and so does Brazil.

Studying a bit of history, and thereby understanding why we are where we are, and why we are what we are, also helps us to think about what has been done and to recognize that a country is built little by little. At the same time, it helps us to recognize the contributions made by so many people which over time end up becoming lost, giving us a good idea of our humble contributions, as big as they may be or appear to be, giving us the opportunity not to repeat mistakes, and, most importantly, giving us the opportunity to grow as citizens and as professionals.

A casual journey through centuries of cumbersome, difficult and often troubled development helps deepen our strategic vision of where we have been, where we are and where we are going. It helps us to understand our options for the future and thereby for our own individual space. That's why you, as someone interested in agriculture and the environment, have everything to do with this!

The authors.



Beginnings  
and  
pioneers





# 1. Agriculture in Brazil outside the major cycles: an introduction to the book

**B**razil's agricultural vocation was recorded as early as its discovery in 1500. The formation of Brazilian agriculture took place principally through the colonizers, who brought animal and plant species and who knew, together with the peoples already here or forced to work here, how to develop very rich agricultural activities in this tropical region.

The study of tropical agriculture in Brazil is complex and still needs much attention from scholars, including archeologists and historians. Because of this need, it is commonly thought that during the development of agriculture in these last centuries, the country only went through the great cycles of crops. Completely untrue!

Quite rightly, the abundant literature available in the Portuguese language reports of the various cycles that, at specific times, powered the development of what is now the Brazilian nation. The cycles of pau-brasil, sugarcane, tobacco, cattle, coffee, cocoa, rubber and more recently, soybeans, poultry, pork and sugarcane once again, this time as a producer of fuel rather than of sugar, marked these periods of high growth in production.

Often these periods of growth had enormous positive impacts on the development of the country, although not so positive impacts and even negative ones were seen in our social structures, the environment and in the balance of growth of the various regions of Brazil.

This publication is not intended to diminish the huge importance of the major cycles of Brazilian agriculture which have been so well studied and documented in various publications. By focusing on those cycles, an historical injustice is committed: the richness and complexity of the agriculture that took place and evolved constantly and gradually in Brazil since the arrival of Cabral is not documented.

The basic objective of this publication is to recover at least part of this tangled web of activities carried out over the centuries in the development of what we now call Tropical Agriculture, in a consolidated manner that is accessible and easy to read. The Tropical Agriculture, like its contributors, is eclectic – diverse and rich in examples which may be little known or even completely unknown to the people who will be responsible for conducting our agriculture and the public policies that will strengthen it.

The bibliographic research carried out in the preparation of this book showed the authors the wealth of publications on our non-cyclical agriculture, and also showed the evident difficulty of accessing these books of immeasurable historical value. This involved many visits to libraries in various states, and it was obvious that internet searches alone would not be sufficient to make this recovery, at least for now.

It is necessary and fitting to underscore the agricultural knowledge and work of the original owners of *Terra Brasilis*. For this reason, a little pre-history on the origins of the terra preta and a snapshot of the plants used by indigenous Brazilians before Cabral arrived would seem to be essential. With these initial elements, we open the New Perspectives on the History of Brazilian Agriculture. Enjoy!



## **Δημητηρ (Demeter) and Ceres, goddesses of Agriculture**

The Roman goddess of agriculture, Ceres – Demeter for the Greeks – came to the Romans from Sicily. Ceres was the goddess of plants in growth, especially cereals, and of maternal love. Ceres was adopted by the Romans in 496 BC during a significant food crisis. Demeter was the daughter of Chronos (Saturn) and Rhea, and sister of Poseidon and Zeus. As with the two other daughters of Chronos, she was devoured by her father, but he had her reborn after he took an emetic given to him by Metis. The first temple to Ceres in the city of Rome, on Mount Aventino, was built to help avert the food crisis that threatened the city during a war with the Latins.

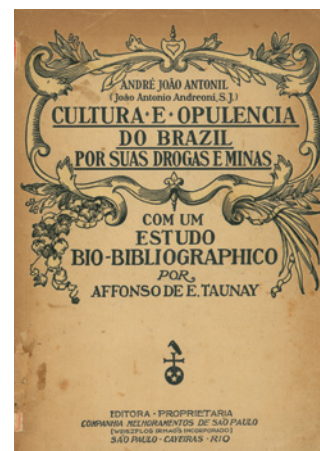
In paying homage to this foreign divinity adopted from Greece, the Romans created a festival with games and gave the management of the sacred rituals and ceremonies to a Greek priestess, who normally

## Principal references of the chapter

AMARAL, L. **História geral da agricultura brasileira**. São Paulo: Companhia Editora Nacional, 1939. 2 v.

ANTONIL, A. J. **Cultura e opulência do Brazil por suas drogas e minas**. Com um estudo bio-bibliographico por Affonso de E. Taunay. São Paulo: Companhia Melhoramentos, 1923. (Original work from 1711, rare, with 205 p., published by the Officina Real Deslandesiana, in Lisbon, Portugal. The original work may be consulted at the Biblioteca Virtual do Estudante Brasileiro, at: <<http://www.bibvirt.futuro.usp.br>> or at: <[www.brasiliana.usp.br/bbd/bitstream/handle/1918/06000400/060004\\_COMPLETO.pdf](http://www.brasiliana.usp.br/bbd/bitstream/handle/1918/06000400/060004_COMPLETO.pdf)> or at: <<http://dominiopublico.gov.br/download/texto/bv000026.pdf>> Accessed on: 13 May 2010)

EMBRAPA. **Terra e alimento**: panorama dos 500 anos no Brasil. Brasília, DF: Embrapa-ACS, 2000. 196 p.



*Facsimile of the book cover of **Cultura e Opulência do Brazil** by the Italian Jesuit André João Antonil. Written in 1711, the book describes the economic and social aspects of Brazil in the eighteenth century which help in understanding the evolution of Brazilian agriculture.*

came from the city of Naples or Velia, south of Rome. As part of the ceremonies in homage to Ceres, pigs were slaughtered during the planting and harvesting, as well as during the burial of the dead. This festival, called *Cerealia* or *Ludi Cerealis* (the games of Ceres), was established in the third century BC, taking place annually between the 12<sup>th</sup> and 19<sup>th</sup> of April. The worship of Ceres was associated with the plebeian classes who dominated the grain trade.

The city of Ceres, in Goiás, formerly Goiás National Agricultural Colony (see Part II, Chapter 1. Introduction) is named in homage to the goddess of agriculture. One of the most beautiful examples of an ivory bust of Ceres is on display in the lobby of the Ministry of Agriculture, Livestock and Food Supply in Brasília, DF. The Ministry of Agriculture, originally named the Secretariat of State of Agriculture, Commerce and Public Works, was created in the nineteenth century by the Legislative Assembly through Imperial Decree no. 1.067 on July 28, 1860, becoming part of the formal structure of the Cabinet of the 2<sup>nd</sup> Empire.

## 2. The beginnings of agriculture: archeological sites in Brazil and the rupestrian paintings of the central Plateau

**V**estiges of the primitive agriculture practiced in Pindorama (which means Land of the Palm Trees in the Tupi language – the name given to reaches of this vast territory by the Indians living here before Cabral) are found at archeological sites in all regions of Brazil.

The oldest archeological sites in Brazil are: Cipo, Abrigo Santana and Lagoa Santa, in Minas Gerais; Brejões in Bahia; Lapa do Sol and Santa Elina in Mato Grosso; São Raimundo Nonato in Piauí; Alice Boer in São Paulo; Arroio dos Fósseis in Rio Grande do Sul; and Chã do Caboclo in Sergipe.

The river valleys where some of the sites are located were very attractive regions to primitive man due to various competitive advantages, such as the indispensable element of water, the facility of fishing, the moist and fertile soil for planting and for making vases and other utensils, as well as being strategic spots for hunters in attracting animals to drink. Thus the river valleys are frequently rich in vestiges of pre-historic settlements and are therefore fertile places for archeological research.



*Rupestrian paintings in the municipality of Serranópolis, Goiás, signs of human presence in Brazil many centuries before Cabral and the "discovery" of America.*

The dispersion of archeological sites proves that the first inhabitants of Brazil occupied a vast territory. In Serranópolis, Goiás, there are a large number of rupestrian paintings of birds and animals drawn in caves and on stone slabs, with an estimated age between 8,000 and 10,000 years. In other regions of the Goiano Plateau there are also found paintings and pottery remains, such as in Caiaponia, Rio Verde, Jaraguá, Cristalina and Chapada dos Veadeiros. Pottery remains have also been found at Ribeirão Ponte Alta, to the west of Gama, a satellite town of Brasília.

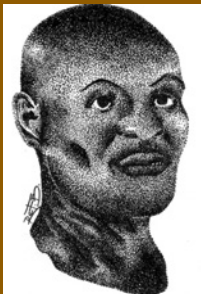
Rupestrian figures, as well as mollusk shells, pottery, stone objects and other materials accumulated at places where primitive peoples probably lived, have been found at many other sites studied, and not just on the Central Plateau.



The first inhabitants of the Central Plateau date from approximately 10,000 years ago. They lived in groups and survived basically on hunting, fishing and gathering of fruits, starting to practice agriculture later on. As the Cerrado region offers a very wide range of fruits at some periods of the year, it is believed that these pre-historic groups lived on pequi, guariroba, quince, murici, pineapples, babaçu, gabiobas and mollusks.

In the other regions, the occurrence of native species is also very rich, which leads to the belief that the indigenous diet was similarly rich and varied. The propagation since then of native species (see chapter 4), plus the later introduction of foreign species, explain in part the diversity of Brazilian agriculture.

### Luzia, the first Brazilian woman: African and non-Asian ancestry



Brazilian archeology is forever finding new evidence of our origins, such as the famous and controversial Luzia, considered to be the first Brazilian. The Biological Anthropology Sector of the National Museum in Rio de Janeiro reconstructed her face and features by modeling from the skull, dated at almost 12,000 years, found in excavations made in the region of Lagoa Santa, Minas Gerais. The result was surprising, because Luzia showed similar features to the human groups who inhabited Africa and Australia but not Asia, from where at least three waves of migration had headed to the Americas.

#### Principal references of the chapter

ARQUEOLOGIA da Paraíba. Available at: <[www.arqueologiada.paraiba.blogspot.com](http://www.arqueologiada.paraiba.blogspot.com)>. Accessed on: 13 May 2010.

BERTRAN, P. **História da terra e do homem no Planalto Central: eco-história do Distrito Federal, do indígena ao colonizador.** Brasília: Solo, 1994. 270 p.

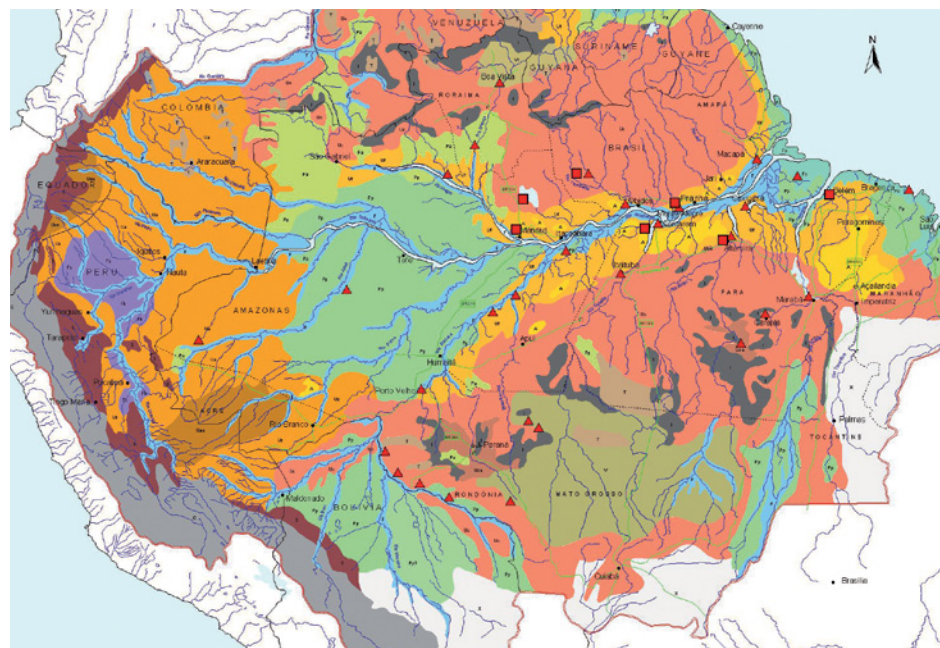
PROUS, A. **Arqueologia brasileira.** Brasília: Editora UnB, 1992. 613 p.

### 3. Technology in pre-historic Amazonia: the Dark Earth of the Indians

Some of the oldest remains of human presence in South America are in Amazonia. Archeological sites dating from ten thousand years before Christ have been identified close to some of the largest rivers in the region, such as the Amazon and the Caquetá.

On reaching Amazonia in the sixteenth century, the European colonizers encountered a large population of Amerindians. The banks of the river Tapajós were covered with dwellings and there were more than 5,000 native warriors. The route between the Negro river and Purus river was around 12 km in length, and along it there were more than 500 dwellings with possibly 10,000 inhabitants. Also, the size of the archeological sites along the Tapajós and Manacapuru rivers, among others, support the notion that the first contacts between the Europeans and the natives in Amazonia took place in large communities, unlike what is commonly imagined.

In all regions of the world, population growth occurred in association with increased food production, made possible by techniques such as irrigation and terracing. In the Amazon region,



*On the map, triangles show archeological sites, and squares show soil research being carried out at DEI sites in the Amazon.*

the growing population was sustained by means of the technology called Dark Earth of the Indians (DEI), so called because of the dark coloring of the surface soil layer, rich in decomposed organic material.

Unlike other soils of the region, in which organic matter comes predominantly from decomposition of the remains of plants and animals, in DEI, the organic components are principally from residues of human occupation. The high levels of organic matter in DEI, as well as of phosphorous, calcium and magnesium, are the result of deposition of ashes, residues of fish, shells, hunting, human waste and other organic composts. Thus, the fertility of DEI is higher than that of most soils of the Amazon, which in general are naturally acidic and poor in nutrients.

It is worth pointing out that DEI has not lost its fertility even after thousands of years under the climatic conditions of the wet tropical forest, because the charcoal which is part of its composition does not decompose easily, staying intact for a long time.

The occurrence of DEI is common in the Brazilian Amazon and also in Colombia, Ecuador, Guyana, Peru and Venezuela. It is estimated that TPI sites cover between 0.1% to 0.3%, or 6,000 km<sup>2</sup> to 18,000 km<sup>2</sup>, of the Amazon Basin. Their distribution in the Amazon region is quite diverse, occurring predominantly on dry, well drained land close to running water and almost always in a topographical position that allows good visibility of the surrounding area, an important factor in the survival strategy of pre-historic man.



*Soil profile of Terra Preta of the Indians, rich in decomposed organic material.*

## Coivaras: The ecological agriculture of the Amerindians?

A large proportion the indigenous groups who inhabited Brazilian territory practiced “coivara,” which consists of opening a clearing in the forest by cutting down trees and hoeing in the dry season, letting the vegetation dry until the end of this season and then burning it to convert the plant matter into ash, rich in nutrients. In these areas, the Amerindians used to grow cassava, corn, pumpkins, sweet potato, yams, peppers, banana, papaya and pineapples. The Tupi term *coivara* appears for the first time in a Portuguese text in 1607, by Father Jerónimo Rodrigues, in *Relação. Missão dos Carijós. Relação do P. Jerónimo Rodrigues*, pub. Serafim Leite, in *Novas Cartas Jesuíticas*, 1940 pp. 196-246, in which he wrote “And as the trees are small and of soft wood, they clear them easily, and once they have burn them, they soon plant, without doing coibara nor even making holes for the cassava’ [...]” (CARDIM, 2009, p. 188).

## Principal references of the chapter

CARDIM, F. **Tratado da terra e da gente do Brasil**. Edição organizada por Ana Maria de Azevedo. São Paulo: Editora Hedra, 2009. p. 188.

KERN, D. C.; D'AQUINO, G.; RODRIGUES, T. E.; FRAZÃO, F. J. L.; SOMBROEK, W.; MYERS, T. P.; NEVES, E. G. Distribution of Amazonian dark earths in the Brazilian Amazon. In: LEHMANN, J.; KERN, D. C.; GLASER, B.; WOODS, W. I. (Ed.). **Amazonian dark earths: origin, properties and management**. Dordrecht, The Netherlands: Kluwer Academic Publisher, 2003. chap. 4, p. 51-75.

KERN, D. C.; KÄMPF, N.; WOODS, W. I.; DENEVAN, W. M.; COSTA, M. L. da; FRAZÃO, F. J. L.; SOMBROEK, W. **As terras pretas do índio na Amazônia**. Parte II. Available at: <[http://www.biochar.org/joomla/images/stories/Cap\\_6\\_Dirse.pdf](http://www.biochar.org/joomla/images/stories/Cap_6_Dirse.pdf)> Accessed on: 12 May 2010.

MANN, C. C. Ancient earthmovers of the Amazon. **Science**, v. 321, n. 5893, p. 1148-1152, 2008. Available at: <[www.sciencemag.org](http://www.sciencemag.org)>. Accessed on: 16 April 2009.

MYERS, T. P.; DENEVAN, W. M.; WINKLERPRINS, A.; PORRO, A. Historical perspectives on Amazonian dark earths. In: LEHMANN, J.; KERN, D. C.; GLASER, B.; WOODS, W. I. (Ed.). **Amazonian dark earths: origin, properties and management**. Dordrecht, The Netherlands: Kluwer Academic Publisher, 2003. chap. 2, p. 15-24.

NEVES, E. G.; PETERSEN, J. B.; BARTONE, R. N.; SILVA, C. A. Historical and socio-cultural origins of Amazonian dark earths. In: LEHMANN, J.; KERN, D. C.; GLASER, B.; WOODS, W. I. (Ed.). **Amazonian dark earths: origin, properties and management**. Dordrecht, The Netherlands: Kluwer Academic Publisher, 2003. chap. 3, p. 29-50.

## 4. Pre-Cabral indigenous peoples and plants

**D**uring the period of the discovery, it is estimated that there were about 2,000 nations and/or tribes in Brazil. These indigenous peoples were mostly semi-nomadic tribes living from hunting, fishing, gathering and itinerant agriculture. Some, known by the generic name of Tupinambás, lived along a significant part of the coastal region where the landscape was predominantly tropical forest. Others, the Guaranis, were concentrated principally on the southern coast. Meanwhile the people of the Jê group, called Tapuias by the Tupis, had been forced by the latter to migrate towards the interior, occupying areas of sertão and cerrado. There were also the Aruaques, who lived in the most northerly regions.

The native peoples had a rich nature at their disposal and thus they could collect a wide variety of natural products. Some plants, such as pequi, açaí, Brazil nut and buriti, produced seeds and fruits rich in proteins, vitamins and fats. The Indians also collected tree or shrub species for the extraction of timber, fibers and oils, as well as raw materials for the preparation of medications made from seeds, roots, leaves or bark. The domestic utensils and those used for hunting, fishing and in rituals were made from straw, wood, lianas, stones, bones and animal teeth.

As they lived from hunting and gathering at first, these peoples migrated whenever the plant and hunting/fishing resources ran out in the occupied area. Later on, some of these people, such as the Tupis, developed planting techniques and became farmers. The Tupis adapted the planting to the natural conditions, using the better drained hillsides for some crops, and using the richer soils with better moisture for other more demanding crops. They also planted vegetable plots around the villages, making use of domestic waste, and using simple agricultural practices, planting beans, corn, jerimum (pumpkins), sweet potato and other plant species.

In 1587, Gabriel Soares de Sousa (see chapter 5) had already cited more than fifty species of plants native to Brasil, giving their common names used by of the local population, and their indigenous names, such as in the Tupi language predominant in Bahia at the time.

### Paleo-Indians and the diversity of Amazonia

The first peoples to live in the Brazilian Amazon Basin were hunters and gatherers who, at the height of their civilization, reached a population of three hundred thousand. These peoples contributed decisively to the biological diversity of the Amazon forest. It is not by chance of nature that the forest is rich in fruit trees. Apparently, the careful work of selection of species made by the Paleo-Indians had a large impact.



Brazil is the cradle of a wide diversity of Indians, such as the Tupinambá, the Munduruku, the Maxakali, the Bororo and the Paresi, as shown in the illustrations by Jean de Léry, Hercules Florence, Johann M. Rugendas and Aimé-Adrien Taunay. The town of Bertioga, São Paulo, pays homage to the first inhabitants, with the figure of a Tupinambá leader (last photo on the right). These Indians lived on the Brazilian coast, in a continuous migration that took them from the north of São Paulo state to Amazonia. In the valley of the Paraíba river, in Rio Janeiro state, they were called Tamoios. In the Amazon, they occupied the island known as Tupinambarana, among other areas.

Due to this diversity, it is often hard to define exactly which plants were cultivated at that time. Even so, it is possible to empirically establish which were the main species cultivated and consumed, by considering the cultural legacy of the tribes and archeological finds:

- **Cassava:** possibly domesticated by the Tupis in the Amazon Basin in the first millennium BC, reaching the whole coastal area.
- **Corn:** initially found in areas of contact with pre-Andean tribes of the Guaporé river in Mato Grosso, to the Paraná-Paraguay river basin in the western part of Brazil.
- **Sweet potato:** apparently, it was from Central Brazil, reaching the coastal area.

Pero Vaz de Caminha, in his famous detailed letter to the king of Portugal, reported that there were various “carazes” in the new land, certainly referring to cassava, then unknown to the Portuguese because it was a plant native to Brazil. Soon after the arrival of the European colonizers, cassava was always compared to yam in the reports of the time from Pero Vaz de Caminha, as the latter plant (*Dioscorea*) was already well known and consumed in Africa.



*The forests offered the natives a rich diversity of natural food, which together with hunting and fishing, formed the basis of their diet. The domestication of many of these plants gave rise to agriculture around the villages.*

The colonizers called the flour obtained from the cassava root “farinha-de-pau,” which in fact replaced the bread from Europe made from wheat flour. In 1549, Manoel da Nóbrega, coming as the first governor-general Tomé de Souza, recorded in his letters the use by foreigners of the basic sustenance of the natives: “farinha-de-pau.”

Father Anchieta, according to information from 1585, promoted the food, raising it to the category of bread, and later in 1706, Father Martinho de Nantes, referring to the adoption of cassava in the form of flour in the Catholic liturgical rites, said, “[...] every Sunday [...], in the place of blessed bread [...], they bless and distribute cassava flour, which they receive and eat with devotion.” (NANTES, 1979, p. 16).

Recognized by Theodore Peckolt in his work “História da Humanidade e das Plantas Mediciniais,” published in 1847, as the “bread of the tropics,” cassava fed all races and peoples who came to the American continent looking for a tropical paradise.

For some peoples who began farming, the cultivation of corn prevailed over that of cassavas. It is not known why this and other choices were made by the tribes regarding the species they decided to grow. However, scholars believe that the reasons go no further than the capacity of the plants to grow in the environments they were subjected to, while also possibly being cultural in nature.



*Flour mill typical of early colonization times and still found nowadays in the countryside of Brazil, depicted by Frans Post.*



## The bread of the tropics

Mani was the name of a very white baby girl who died at the age of just one and was buried in the hut ["oca" in the Tupi language]. Her grave was watered every day and from it a plant sprouted that came to be called manioca and later mandioca [cassava]. The natives had stone tools to cut down and clear forest, as well as pointed wooden tools for plowing and making holes. At places where cassava was grown, the planting was done in clearings, after cutting down and burning the existing vegetation. Cassava was prepared in various ways. The women dried it in the fire or grated it fresh. Cassava was grated and squeezed to separate the poisonous juice from the starch, which was passed through a sieve. The food was prepared by cooking, roasting or fermentation. Flour was made of two types: 1) flour for war, which was cooked more, being harder and drier, used during warring expeditions because it kept better; and 2) less cooked flour which was less hard, more tender, rather like the soft part of white bread.

Besides the flours, cassava also had other uses for the Amerindians. The diet of the natives also had various foods made from the gum resulting from decanting the water used to wash the cassava, such as porridges, cakes and biscuits. Cakes were also prepared from the cassava dough, baked directly in enormous pottery pans placed on top of the oven.

Among the cakes, there was puqueca, made with pepper and wrapped in banana leaves; curuba, in which the dough is mixed with broken Brazil nuts; membeca, which had a soft consistency; tinin, dried in the sun; cariamã, used in the puberty rituals of girls; carimã, prepared with flour of the same name; beiju-teica, made from tapioca dough; marapata, protected by a banana leaf and roasted directly on hot ashes; and various others, depending on the region and the customs of each people. There was also the big beiju-açu, which fed five people, and, left to ferment, was used in the preparation of a stimulant drink called caxiri, and another, taruba, which when taken in excess would lead to drunkenness. Catimpuera, made from cooked and kneaded cassava, was then seasoned with water and honey from bees. When ginger and honey was used, it produced acaçuma. Besides these drinks, there was also alua, chicha and cauim oucauim-etê (strong drink), which was made from boiled cassava chewed by young girls and after having been boiled again, was placed in lidded vessels which were buried for fermentation. Another drink was caracu, made from cassava flour mixed with corn flour, which looked like wine and was served warm, with a spicy and pleasant taste.

Cassava was the food common to all groups, despite differences in climate, soil and tribal reality, becoming the unifying link between native Brazilian peoples: the real bread of Brazil.



RELATION  
SUCCINTE  
ET  
SINCERE

De la Mission du Pere Martin  
de Nantes, Prédicateur Ca-  
pucin, Missionnaire Apostoli-  
que dans le Brezil parmy les  
Indiens appellés Cariris.



A QUIMPER,  
Chés JEAN PERIER, Imprimeur  
du Roy, du Clergé & du Collège.

*Facsimile of the title page of  
an original work by Father  
Martin de Nantes, published  
in France in 1706.*

## Principal references of the chapter

EMBRAPA. **Cassava: o pão do Brasil**. Brasília, DF: Embrapa, 2005. 279 p.

NANTES, M. **Relação de uma missão no rio São Francisco**: relação sucinta e sincera da missão do padre Martinho de Nantes, pregador capuchinho, missionário apostólico no Brasil entre os índios chamados cariris, 1706. Tradução e comentários de Barbosa Lima Sobrinho. 2. ed. São Paulo: Editora Nacional, 1979. 123 p. (Brasiliana, v. 368).

PECKOLT, T. **História das plantas alimentares e de gozo do Brasil**. Rio de Janeiro: Eduardo & Henrique Laemmert, 1871–1884. 5 v. 🐾

ROOSEVELT, A. C. Determinismo ecológico na interpretação do desenvolvimento social indígena da Amazônia. In: NEVES, W. O.(Org.) **Origens, adaptações e diversidade biológica do homem nativo da Amazônia**. Belém: Museu Paraense Emílio Goeldi/CNPq, 1991. 192 p.

## 5. A great Brazilianist: Gabriel Soares de Sousa

**G**abriel Soares de Sousa was Portuguese and came to Bahia at the age of twenty something, between 1565 and 1569. Like other immigrants, he started life as a colonizer, and was very successful because he ended up as a sugar mill owner, and was thought to be one of the men who were “good with the land”, being a local councilor in Salvador. Gabriel had a brother who had explored part of the sertão of the São Francisco river and apparently found valuable mines. After the death of his brother, Gabriel decided to continue with the exploration and thus returned to Europe in 1584 to ask for authorization and help from the Court of Madrid.

To justify his request, on his return to Brazil, he wrote a long descriptive report between 1584 and 1587 on Brazilian nature and its particular details. Gabriel Soares de Sousa was intelligent, curious and had great powers of observation, and he was certainly well-educated, which was rare at the time. The book he wrote in 1587 – “Tratado Descritivo do Brazil” – is a very good read, in short chapters of 3–4 pages, with objective descriptions of Brazilian nature, geography, history, topography, hydrography, mineralogy, agriculture and even aspects of horticulture.

The purpose of the book written by Gabriel was to obtain authorization from the Court to explore the sertão, in order to take possession of the lands and its wealth, and for this reason the publication has detailed and patriotic language, a description of the natural resources which is quite enthusiastic and which led to his success in obtaining the authorization he sought.

In 1591, Gabriel obtained the Court’s approval and was named commander and governor of any wealth he might discover in the sertão. He made an expedition with 360 men and four monks. The expedition did not go well, with the ship being wrecked on the coast of Sergipe, and the survivors traveling through the sertão. Gabriel died during the journey through the interior of Bahia. The book remained unknown for 300 years after being written. Francisco Adolfo de Varnhagen, a diplomat, historian and Brazilian soldier, rediscovered the value of the work in the nineteenth century, attributing its authorship to Gabriel Soares de Sousa and highlighting its value as a historical document, considering

### **Brazilianist: Brazil seen from the outside by others**

“Brazilianist” is a foreign scholar specializing in Brazilian matters. The term was apparently first used in 1958 to designate USA researchers who received funding from the United States of America government to study the history, geography, culture, politics, economics and sociology of Brazil at a time when the United States of America had a special political interest in Brazil. As Gabriel Soares de Sousa was Portuguese and made a complete and broad-ranging study of Brasil in the sixteenth century, he can be considered the first Brazilianist.

it the “true Brazilian encyclopedia of the sixteenth century”. For this reason, Gabriel Soares de Sousa can be considered the first systematic scholar of Brazil – a “Brazilianist”.

At the same time as Gabriel Soares de Sousa made his detailed reports, other travelers were recording the birth of a new continent. Ulrich Schmidel, a German who served as a soldier in Pedro de Mendoza’s fleet, wrote his memoirs when he returned to Germany, publishing on his return to Europe the book “Reports of the Conquest of the Prata and Paraguay Rivers, 1534–1554” about the time he traveled in Brazil, in Espírito Santo, describing the importance of sugar, cotton, pau-brasil timber and “many other things”.

Visitors, shipwreck survivors and colonizers of recently discovered lands, such as Gabriel Soares de Sousa, Ulrich Schmidel and Hans Staden, quickly spread knowledge about Brazil to Europe, often spiced with extreme fantasy.

## Pau-brasil finances discoveries

The pau-brasil (*Cesalpinia echinata*), the tree that gave Brazil its name, was abundant in the coastal region. For the Indians, pau-brasil was only one of thousands of trees in the rich tropical forest. However, for the Portuguese coming to the recently discovered land, this tree, along with so many other novelties such as peppers and parrots, constituted the main attraction, as at this early stage no precious metals had been found close to the coast. In Europe, the colorant obtained from the timber of the pau-brasil (brasiline) was used principally by the textile industry as an alternative to red colorants. At this time, red was known as the color of the king and of the nobles. To extract pau-brasil, the Portuguese used indigenous labor. By way of payment, the Indians received various objects not known in the region up until that time. Possibly the iron tools were what interested the Indians most, as this metal was unknown in Brazil before Cabral.

The Portuguese Crown at that time was more concerned with the expeditions to India, where they intended to establish a vast colonial empire. Thus Brazil was given secondary importance. So it was that in 1502, Dom Manuel, the King of Portugal, leased part of what is now Brazil to a consortium of Jews who had converted to Catholicism, the new Christians. Fernão de Noronha, leader of the consortium, together with his partners, obtained a contract from the Portuguese monarch for exploitation of pau-brasil timber. They extracted more than 20,000 quintals of timber per year (a quintal was equivalent to approximately 58 kilograms), which was sold in Lisbon at a profit of 400% to 500%. With part of the profit, an expedition was financed to survey and map the Brazilian coast, without satellites or GPS. The discoverer, Gonçalo Coelho, was the key to this adventure, discovering in 1503 a large island that would later take the name of the consortium’s leader – the island of Fernando de Noronha.



Old map illustrating that the exploitation of pau-brasil took along the whole of the Brazilian coast, with the Indians as workers.

## Introduction of the coconut to Brazil

As with other plants common in Brazil nowadays, such as the mango tree and orange tree, there were no coconut palms in these lands at the time of the discovery by the Portuguese in 1500. The first references to the coconut palm in the country appeared in the “Tratado Descritivo do Brazil,” written by Gabriel Soares de Sousa in 1587, which said, “The palm trees that give coconuts do well in Bahia, better than in India, because placing a coconut under the soil, the palm tree that is born gives coconuts in five or six years, and in India these plants do not give such fruits in twenty years.” (SOUSA, 1879).

The giant coconut palm was introduced for the first time in Brazil in 1553, in the state of Bahia, from the Cape Verde islands. The remote origin of this material was from India or Sri Lanka, from where coconuts are said to have been introduced to Mozambique. This hypothesis was confirmed by the similarity between the coconut palm from West Africa and the giant coconut palm from Mozambique. The second introduction took place in 1939 with the cabocla variety from Malaysia. The third introduction was made in 1978 by CEPLAC (Executive Commission for Planning of Cocoa Farming), using the giant coconut palm from the Ivory Coast. The fourth introduction took place in 1981, when the Companhia Sococo imported the West African giant coconut to set up a production field of these hybrids in Pará. The fifth introduction took place in 1983 through the Brazilian Agricultural Research Corporation (Embrapa), which imported various populations from the Ivory Coast to establish its Active Germplasm Bank which is located in Sergipe and which has samples from West Africa, Malaysia and from South Pacific islands, such as Tonga, Polynesia, Vanuatu and the Salomon Islands, among other places.

The introduction of the coconut palm to Brazil is an excellent example of the historic importance of the introduction and exchange of plant germplasm in the country. Currently, many of Brazil’s agricultural exports are obtained from introduced plants, such as soybeans, oranges and sugarcane.



*The coconut palm is a species introduced to Brazil which has adapted well to the climate and to the soils of the Northeast.*



## Cattle arrive in Brazil

It is always hard to state with any precision who was the first in any given historical matter, principally when more than four hundred years have passed since the initial fact. This is the situation pertaining to the introduction of cattle to Brazil, for which there are two dates recording the event. According to Bertran (1994), cattle were introduced by Tomé de Souza, who arrived in Brazil in 1549. They were of the small English milk-bearing Jersey stock. The descendent of this stock, the Curraleiro cattle of the Central Plateau, became even smaller. Their robustness allowed them to survive in precarious sanitary conditions, and they spread throughout the neighboring pastures. In the dry season, they would seek out the moist fields and the veredas, which were burned to form a greener grass.

However, according to Dean (1996), cattle were brought by Martim Afonso de Souza in 1532 from the Cape Verde, where they had also been raised free-range. At this time, cattle mainly occupied the semi-arid Northeast, but later found more suitable habitat in the Cerrado. Dean points out that the first observers spoke of the advantages of the pastures, which were exuberant, with fast growing grass that fattened the cattle quickly. However, one or two generations of pasturing transformed “these Eden-like landscapes,” with the grass withering, not just from pasturing, but also from being trampled on.

Antonil describes in detail the situation of cattle at the beginning of the eighteenth century as one of the principal items that sustained Brazil at that time: sugar, the gold and silver mines, tobacco and cattle. Cattle in the South became important only in the second half of the eighteenth century, when Rio Grande do Sul, which had been territory disputed by the Spanish and Portuguese, was effectively incorporated into Brazil. Its importance was linked to cattle, favored by the good topographical conditions and pastures. In the South, the principal business was initially leather, with the meat at times being discarded due to the small consumer market. With the decline of cattle raising in the Northeast, a powerful beef jerky industry developed. The 13,000 arrobas (one arroba is about 32 lb.) exported in 1793, jumped to almost 600,000 arrobas at the start of the nineteenth century. A jump comparable only to that of gold!



*The arrival of cattle led to new economic activity based on the sale of meat and leather, as well as a means of transport. The ox cart is still seen in some rural areas.*

## Escape to the Central Plateau

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With the arrival of the Portuguese in Brazil in 1500, many indigenous tribes inhabiting the Brazilian coastline fled to the interior of the territory. Some established themselves in the Central Plateau, generating conflicts with those who were already there. Starting in 1700, the Portuguese organized expeditions to explore the interior of Brazil in search of precious metals. Their arrival at the Plateau was formally recorded in 1720, where the first contacts were made with the peoples of the region.

Although pioneers had come through the region since the sixteenth century, it was only after the large expeditions made to the interior of Brazil that the Portuguese came to have more contact with the indigenous peoples who inhabited the Central Plateau. With the arrival of the Europeans, most of the tribes were decimated and few were left, such as the Crixá, the Xavante and the Pedra Branca, fleeing and hiding close to the Maranhão river which bathes the states of Goiás and Tocantins. The Crixá, now extinct, were farmers and potters, whereas the Xavante dominated hunting. The Pedra Branca were very withdrawn and had little contact with the pioneers.

From 1732 onwards, the Central Plateau region attracted many people in search of gold and other minerals which were there in abundance. With this movement, the first settlements sprang up which would later become towns such as Corumbá, Pirenópolis and Luziânia (then Santa Luzia), in what is now the state of Goiás. Because it was at an intersection of roads coming from Bahia and going to Minas Gerais, the region where Brasília is now located came to be a strategic point for travelers. After the end of the mining age, many people continued to live in the region.

In the nineteenth century, an expedition to the interior of Brazil, in 1892–1893, led by Luiz Cruls, carried out unprecedented scientific studies, mapping climatic and topographical aspects, as well as studying

### Principal references of the chapter

A HISTÓRIA dos judeus no Brasil. Available at: <[http://www.judaismomessianico.net/brasil\\_judeus01.htm](http://www.judaismomessianico.net/brasil_judeus01.htm)> Accessed on: 28 Sept. 2009.

BERTRAN, P. **História da terra e do homem no Planalto Central: eco-história do Distrito Federal, do indígena ao colonizador.** Brasília: Solo, 1994. 270 p.

BUENO, E. **A viagem do descobrimento: a verdadeira história da expedição de Cabral.** Rio de Janeiro: Objetiva, 1998. 137 p. (Coleção Terra Brasilis).

CRULS, L. **Relatório da comissão exploradora do planalto central do Brasil.** 4. ed. Brasília: Codeplan, 1984. 389 p.



the fauna, flora and watercourses along the route, the way of life of the inhabitants, the town planning and architectural aspects of the towns. Six years before the mission led by Cruls coming to the region of the chapadas or highland plateaus (where the Federal District is situated), a local resident by the name of Joseph de Mello Álvares, who was self-taught, had already made a taxonomic study of the region. In the manuscript elaborated by Álvares, it is recorded that after the end of the mining era people living there had begun to live from cattle raising and farming. In the gardens on the plateau it was possible to find bananas, ground nuts, sesame, sugarbeet, sugarcane, yams, arrowleaf elephant ear (tannia), ginger, cassava, sweet potato, pepper, medicinal and aromatic herbs, peas, lentils, beans, coffee, broad beans, rice, and wheat, among other products. In the time of Álvares, the mixed system of farming and cattle and horse raising was common, which included small-scale raising of sheep, goats, pigs and poultry. 🍃



*Encampment of the Brazilian Central Plateau Exploratory Commission, 1892/93.*

DEAN, W. **A ferro e fogo: a história e a devastação da Mata Atlântica brasileira.** São Paulo: Companhia das Letras, 1996. 231 p.

SCHMIDEL, U. **Relatos de la conquista del Rio de la Plata y Paraguay 1534-1554.** Madrid: Alianza Editorial, 1986. 127 p. (Direct translation of Schmidel's report, based on the German edition printed in Nuremberg in 1602).

SIQUEIRA, L.A.; ARAGÃO, W.M.; TUPINAMBÁ, E.A. **A introdução do coqueiro no Brasil,** importância histórica e agrônômica. Aracaju: Embrapa Tabuleiros Costeiros, 2002. (Série Documentos, 47.)

SOUSA, G. S de. **Tratado descritivo do Brasil em 1587.** 2. ed. Rio de Janeiro: João Ignacio da Silva, 1879. 382 p.

## 6. Botanical gardens and collections (new plants, new habits): the garden of El Rey de Olinda

**G**ardens have always been admired and respected in various societies. The possibility of reproducing part of nature by transplanting plants into a private space sparks people's imagination with the multiplicity of plant colors and shapes. Among the types of gardens, certainly the most important is the botanical garden. These first appeared in Mesopotamia, ancient Egypt and in pre-Columbian America. Their fundamental concern was for keeping medicinal plants, both for use and for study purposes.

The first attempt to set up a botanical garden in Brazil was in Pernambuco, in the time of Nassau (see the following chapter which is specifically about Nassau) in the seventeenth century, between the years of 1637 and 1644. Nassau undertook this initiative in order to improve the nutritional quality of the diet in that time. Even with this initiative, it was only at the end of the eighteenth century that the Portuguese Crown issued instructions for establishing botanical gardens in the country, which were to be based in Olinda, Ouro Preto, Goiás, São Paulo and Belém. The first garden to be established was in Belém, where plants from the Guyanas were introduced, including coffee.

The naturalist Manuel Arruda Câmara (1752–1811) had a large influence with the Portuguese Crown on the botanical gardens in the provinces. Câmara stressed the potential of Brazilian flora, the high fertility of the land and the profit the spices produced in these gardens could bring to Portugal. The royal letter of instruction of November 19, 1798 ordered a botanical garden to be established in the province of Pernambuco similar to the one which had been created in Pará, in order to propagate seeds of trees for timber used in construction, which were to be sown later in the royal forests. But the founding of the garden only took place thirteen years later in 1811, after the publication of a work by Câmara, offered to the prince regent, under the title "Discourse on the utility of instituting gardens in the principal provinces of Brazil."



*Rio de Janeiro's Botanical Garden.*

The government created the acclimatization facility in Pernambuco due to the climate similar to that of Cayenne. In 1825, the president of the province approved the creation of a new garden on the banks of the Capibaribe river, with the one in Olinda then serving as a new nursery, and recommended the growing of mulberries, for raising silkworms and Indian tea. The Olinda Garden was admired by travelers passing through Pernambuco in the nineteenth century. Among these travelers were the Frenchman Louis-François de Tollenare and the Scotsman George Gardner, both botanists. Everyone was impressed with the richness of the tropical flora in Brazil, but also reported the poor administration of the gardens.

The Olinda Garden received donations and also served as an important center for distributing plants to other states of the Northeast, such as Rio Grande do Norte, Bahia, Alagoas, Ceará and Piauí, as well as constantly sending plant material to Rio de Janeiro, France and the United States of America. With this intense distribution, the Olinda Garden was prominent in the process of cultural and economic enrichment of the Northeast, especially the state of Pernambuco. This prominence culminated in the dissemination of species which were to become of extreme value to farming in Pernambuco: Cayenne sugarcane, which quickly became one of the most important types of sugarcane grown in Pernambuco, and Angola grass, which became widespread throughout Brazil and was pioneered by acclimatization in the Olinda Garden. However, the days of the golden age of the Olinda Garden were numbered after interest was expressed in creating a similar institution in Recife, but it ended up not working out; and the Olinda Garden fell into decline.



*Greenhouse of the Botanical Garden in Curitiba, Paraná.*

## The Quinta do Tanque

The country estate known as Casa Suburbana de São Cristovão, or the Quinta do Tanque, in Salvador, Bahia, is considered one of the most important monuments in Brazil. Its history began in 1555, when the Jesuits obtained a place called “Quinta” by donation from the governor Tomé de Souza at the beginning of the Brazilian colonization, where they built a country house for the college of Bahia. Later on, this building was given the name of the Fathers’ quinta (also Casa Suburbana de São Cristovão) as a resting spot for the priests. It was there that Father Antônio Vieira took refuge during the last stage of the Dutch siege, being a “visitor” at the Quinta in the period 1688–1691.

The Quinta, measuring about two hectares, had large gardens and a dam, or tanque. There, the Jesuits grew fruits and vegetables in an orchard irrigated by springs and precious water reservoirs, thus giving rise to the name Quinta do Tanque, as it was also known at the time. Besides the fruits and vegetables, plants from Europe, Asia and America were also grown at the Quinta.

Later on, the Quinta also served as an experimental garden, acclimatizing Oriental, European and American species. The growing of cinnamon in Brazil began at the Quinta, and the cocoa spread from Maranhão to Bahia through the intervention of the Jesuits.

In the second half of the seventeenth century, Sebastião José de Carvalho e Melo, Count of Oeiras, later Marquis of Pombal, Minister of Dom José the First, by the decree dated September 3, 1758, ordered the imprisonment and expulsion of the Jesuits, seizing their property and handing in what should be divine worship to the Bishop of Brazil. The Quinta do Tanque then passed to the Portuguese Crown and was publicly auctioned, being purchased by João Rodrigues Pereira on May 28, 1762.



*Patio of the Quinta do Tanque,  
in Salvador, Bahia*

## Principal references of the chapter

A TRAJETÓRIA das quintas. In: <[http://www.bibliotecadigital.ufba.br/tde\\_busca/arquivo.php?codArquivo=1210](http://www.bibliotecadigital.ufba.br/tde_busca/arquivo.php?codArquivo=1210)>. p. 2. Accessed on: 12 May 2010.

LEITE, S. **História da Companhia de Jesus no Brasil**. Rio de Janeiro: Instituto Nacional do Livro, 1945. Tomo V, p. 161.

RODRIGUES, J.; DUTRA, M.; ALBUQUERQUE, P.; DIAS, S.; ALMEIDA, A. V. Aspectos histórico-ecológicos do Horto d'El Rey de Olinda, Pernambuco. **Revista de Humanidades**. Caicó, RN, v. 7, n. 19, p. 388-413, Dec. 2005 / Jan. 2006. Available at: <<http://www.seol.com.br/mneme>>. Accessed on: 12 May 2010.

## 7. A great entrepreneur and a poor manager: Maurício de Nassau

Jão Maurício de Nassau was born on June 17, 1604 (Johan Maurits van Nassau-Siegen, in Dutch), in Dillenburg, close to Frankfurt, now in Germany. At the age of just fourteen, Nassau entered a military career serving the Dutch State as various members of his family had already done. Nassau also had a humanist training at the University of Basel, where he had studied theology, music, philosophy, mathematics, military science, good manners, fencing and horseback riding.

While in Holland, Nassau built a mansion that was to become known as the Mauritshuis, designed with exuberant architecture and many works of art by Rembrandt and others. The house, located in the Hague, was to become one of the tourist sites of the Dutch capital. Because of the building work, he ended up getting into debt for half a million florins, and principally for this reason, he accepted the invitation from the Dutch West Indies Company to take up the post of governor, admiral and captain-general of the dominions conquered by the Company in Brazil. So, on October 25, 1636, Nassau left for Brazil, accompanied by about 600 Negroes slaves, 800 sailors and 3,000 soldiers.

They arrived on January 23, 1637 in Recife, which was then an important trading post for Brazilian sugar, supplying about 70% of European consumption. For this reason, Nassau planned and successfully carried out an important expedition to Congo in Africa, to round up slaves directly at their origin. Thus, he was free of the Portuguese and Spanish slave traders who were also enemies and adversaries in the hostile situation between the Netherlands and the Iberian countries.



In the period from 1637 to 1644, while still under his government, the military occupation of Pernambuco province was consolidated. This was the high point of Dutch dominion in Brazil and resulted in the incorporation of new coastal lands from Maranhão, Sergipe and Ceará, but failed in the attempt to conquer Bahia. Nassau also beat the last point of Portuguese resistance, Porto Calvo. Later, he granted loans to the Portuguese–Brazilian colonists so that they could rebuild their sugar mills.

With the aim of modernizing Recife and transforming it into an important capital, he ordered the construction of botanical gardens, a zoo, an astronomical observatory, a natural history museum, as well as the draining of lands, the building of canals, dykes and bridges, implementing the design of the city Maurícia (Mauritsstad), which defined the urban layout of the current Recife neighborhoods of Santo Antônio and São José. He was also responsible for the introduction of public services such as the fire brigade and trash collection.

In his government, Nassau was very concerned with bringing about improvements to the quality of life of the inhabitants and therefore promoted the sciences and the arts. His office included Dutch master painters such as Frans Post and Albert Eckout, as well as various artists and scientists, invited to join him in a grand project which he defined as the “deep and universal exploration of the earth.” He thus refused to exploit the colony merely for the benefit of the Dutch West Indies Company.

In 1641, Nassau left his post to return to Europe. This happened mainly because he disagreed with the way loans granted to the mill owners had begun to be collected, in a single installment and at very high interest rates by the Dutch West Indies Company after the price of sugar fell on the world market. Another significant event was the failure to take control of Bahia. His return stimulated the Pernambuco Insurrection, when the landowners together with the black slaves and Indians fought for nine years to expel the Dutch, beating them in 1654.



*Seal of the Supreme Government of Brazil. The shield has the four coats of arms of the four provinces of Dutch Brazil.*



*The Dutch invaded Brazil with their principal interest being the production of sugar. The engenho or mill for manufacturing sugar and rum portrayed here by Henry Koster in 1816 was and still is a scene typical of the Northeast.*

## Zoobiblion: Book of Animals of Brazil

Zacharias Wagener, one of the many members of the Nassau's entourage, was a clerk and was responsible during his stay in Brazil between the years of 1634 and 1641 for the book "Zoobiblion – Livro de Animais do Brazil," rich in watercolors which he drew himself. The author sought to display with absolute fidelity the characteristics of life in the Brazilian Northeast, including animals, plants, fruits and the inhabitants of the various races of human beings, with their customs and habits as seen through the eyes of a perceptive European observer.

This work is of great value, as at the time it was written, the descriptions of the New World of a scientific nature were full of fantastic reports, such as the half-man, half-animal creatures who supposedly lived in this land of the Americas. This initiative was especially important because it made available various pieces of information about Brazil to western Europe. The book not only contained scientific treatises in an academic language, but also paintings and drawings that could be understood by the wider public.

*Tamanduá-açu, one of the many illustrations of Brazilian animals contained in the Zoobiblion.*



### Principal references of the chapter

BARLÉU, G. **História dos feitos recentemente praticados durante oito anos no Brasil**. Belo Horizonte: Editora Itatiaia; São Paulo: Editora da Universidade de São Paulo, 1974. 418 p. ill.

BOXER, C. R. **Os holandeses no Brasil (1624-1654)**. São Paulo: Companhia Editora Nacional, 1961. 465 p.

CASCUDO, L. C. **Geografia do Brasil holandês**. Rio de Janeiro: Livraria José Olympio, 1956. 303 p.



EMBRAPA. **Animais do Descobrimento**: raças domésticas da história do Brasil. 2. ed. Brasília, DF: Embrapa-SCT, 2006. 274 p.

MAURÍCIO de Nassau. In: **NetSaber Biografias**. Available at: <[http://www.netsaber.com.br/biografias/ver\\_biografia\\_c\\_1290.html](http://www.netsaber.com.br/biografias/ver_biografia_c_1290.html)> Accessed on: 12 May 2010.

MAURÍCIO de Nassau. In: **UOL Educação**. (Biografias). Available at: <<http://educacao.uol.com.br/biografias/ult1789u651.jhtm>> Accessed on: 15 Sept. 2009.

MELLO, E. C. **Nassau**. São Paulo: Companhia das Letras, 2006. 320 p. (Coleção Perfis Brasileiros)

WAGENER, Z. **Zoobiblion**, livro de animais do Brasil. São Paulo: Editora Revista dos Tribunais, 1964. 435 p. (Brasiliensia Documenta, v. 4)

## 8. The mosaic of foods and homemade medications: slaves, Indians and whites

**B**razilian cuisine is known for being multiethnic. Elements from various cultures are mixed and produce a complex pattern of foods whose origins are not commonly or easily traced. The regional diversity of Brazilian cuisine largely reflects the influences of European and Portuguese customs, different religions, as well as African and indigenous peoples of the widest range of ethnicities. It is important to also remember that through times, this cuisine has been modified, enriched or impoverished, and has never remained static. It was modified by contact with other products and habits, and continues to be modified. In a broad and general manner, the cuisines in the Americas can be considered original, precisely because of the combination of products and ways of preparation from the four continents known at the time: Europe, Asia, Africa and the Americas. The variety rather than the unity is clear when one analyzes the eating habits of Brazil.

European maritime expansion, especially the Portuguese one in the sixteenth century, was motivated mainly by the search for spices having a high commercial value. The real reasons which



*Food products from various parts of the world came to be incorporated into the rich variety of food found in Brazil, enriching Brazilian cuisine.*

explain this search for spices are not clear, or at least there does not seem to have been a single reason which explains such a large effort. One of the versions says that they were used to preserve meat and fish. Another claims that tables which used them would be more distinguished and have greater originality – a question of status, like eating caviar! A third version talks about the knowledge of spicy Arabic cuisine acquired by the Europeans and the prestige it achieved in Europe.

More recently, the theory that spices were sought due to their therapeutic effects has gained strength, with this hypothesis being supported by ancient treatises on medicine which used these spices in accordance with Hippocratic ideas. So it is possible that this set of reasons, certainly supported by strong economic factors, explained the interest of the Portuguese in searching for spices. 🗑️

One traditional element which was part of the diet of the population in Brazil during the colonial period was the “mezinhas”. Mezinhas were mixtures of substances with therapeutic properties, used as medications and developed in a simple manner, based on knowledge on the part of the Portuguese, Indians and Africans, using plants, animals and minerals native to Brazil. The mezinhas were consumed as a function of the variations in the winds and the seasons of the year, in the belief that in this way the curative power of the foods would be intensified.

The Africans who were brought to Brazil were mainly from the Congo-Angolan region, whose linguistic root is Bantu, and from West Africa, whose languages were quite diverse. When brought to Brazil, they had to submit to new eating habits due to being slaves and also due to the fact that many products they were accustomed to were unavailable for them to consume in Brazil. But they did know how to prepare new foods and they introduced different culinary traits, strongly influencing the mosaic of Brazilian food.

The slaves believed the spirit was not separate from the body, and this was reflected to a large degree in their diet. For them, some foods weakened the spirit, whereas others could strengthen it. Thus, the slaves considered some products as forbidden, which would lead to their attempting to avoid situations where their consumption was imposed by their owners. At the same time, various elements, notably dendê oil, were introduced at their owners' tables, not directly by the slaves, who were transported in sub-human conditions, but rather by the slave traders and others who saw in the varieties of plants from Africa something interesting to bring to and produce in Brazil.



Beijus, one of the many products made from cassava.

One of the most consumed foods in the country during colonization was cassava, which was eaten baked or as flour by indigenous peoples. (See “The bread of the tropics”, in chapter 4.) For the flour, normally the variety known as mandioca-brava was used, which was poisonous and had to undergo a special process to lose its toxicity. Meat, however, would only come to be more frequently used in Brazilian cuisine from the eighteenth century onwards, when beef jerky from the South of the country became more available.

Neither the indigenous peoples nor the Africans had the habit of making desserts, but they did use honey. Sweets became important when the production of sugar increased (and its cost dropped) leading to various types of sweets being introduced to Brazil.

Corn, another widely appreciated food, was prepared in various ways and eaten either green or ripe. Recipes included the making of a food very similar to popcorn and also *acaniç* and



Economic map of Brazil in the eighteenth century. The settling of the interior, begun in the seventeenth century when cattle farming was also brought to the interior, intensified in the eighteenth century with the discovery of gold. Agricultural frontiers were expanded with this march. Plants from the sertão were integrated into production, broadening the range of food for the population. Miscegenation and the eating habits and customs of the natives, black slaves, Europeans and other peoples have molded the culture of Brazilians.

*pamuna*, the precursors of canjica and pamonha, respectively. Some native types of yams, taioba and cará, ground nuts, sweet potato, jerimuns (native pumpkins and squashes) and pine nuts were also used in indigenous cuisine, as well as some wild plants such as heart-of-palm, cashew nuts and others. In the Amazon, in order to obtain proteins, the Indians used açai, buriti and Brazil nuts, as well as foods of animal origin obtained from hunting and fishing of small animals.

Cannibalism was practiced among a few tribes where anthropophagy was an act of war, where there was also a strong influence of religion and tradition on the choice of food.



*Cannibalism ritual in illustration from the work of Hans Staden. Anthropophagy was practiced principally among the Tupi-Guarani.*

## The fathers of Medicine

Hippocrates, the Greek considered to be the Father of Medicine, was born in 460 BC, in Kos. He was a great observer and studied the human body. Hippocrates believed that diseases had physical and rational explanations. He was the first “doctor” to highlight the importance of the brain and not of the heart in the generation of ideas and feelings, and he also recognized the difference between people in relation to disease, noting that some were more susceptible while others were more resistant. However, Imhotep (2667–2648 BC), an Egyptian who lived in the third dynasty in the court of the Pharaoh Zoser, is also known as the God of Medicine. Imhotep was venerated as a god and doctor in the approximate period between 2850 BC and 525 BC, and as a full divinity between 525 BC and 550 AD. When the Egyptians crossed the Mediterranean, Imhotep’s teachings were absorbed by the Greeks. Greek temples in honor to Imhotep became teaching centers of medical science. Imhotep was forgotten by the Greeks for many centuries until the great Hippocrates two thousand years later. Defining who was the first in history is always hard, principally when the records are very limited and the information rather scant.

### Principal references of the chapter

BRASIL. Ministério da Educação e Cultura. **Atlas histórico e geográfico brasileiro**. [s.l.]: MEC, [1962?]. 47 p.

CASCUDO, L. C. **História da alimentação no Brasil**. São Paulo: Global Editora, 2004. 954 p.

EMBRAPA. **Terra e alimento**: panorama dos 500 anos no Brasil. Brasília, DF: Embrapa-ACS, 2000. 196 p.



## 9. Crops of Imperial Brazil: diversity in agriculture

**A**t the beginning of the nineteenth century, the Brazilian economy faced a period of decline. The management of cattle raising was facing difficulties, and the sugar trade was unable to overcome competition from the Dutch. Also, gold was no longer being found in its former abundance. In this context, a prosperous alternative to face these difficulties was investing in coffee growing, which found a very favorable environment for its cultivation in Brazil, principally in the regions where the soil was red (“roxa”), in Paraná and the interior of São Paulo.

However, it was not just coffee that became part of Brazilian agriculture; there were also other important agricultural species. The book “A Guia do Jardineiro Horticultor e Lavrador Brasileiro” (Guide for the Brazilian Grower Gardener and Farmer), of 1853, written by Custódio de Oliveira Lima, besides citing the plants grown during the Empire, also mentioned their application in the domestic economy. Some of the 64 plants, 133 garden plants and 35 orchard plants cited by the author are shown in the table that follows.



*Introduced to Brazil in 1727 by the Portuguese soldier Francisco de Mello Palheta, from French Guyana, coffee gained momentum during the Empire (coffee growing was the predominant economic activity during the imperial period) and Brazil became the world's largest producer of coffee, a ranking it held for more than 150 years.*

**Plants described in the book *A Guia do Jardineiro*, of 1853.**

Vegetables and Crops	Garden Plants	Orchard Plants
Potatoes	Cedar	Cherries
Eggplant	Lilies	Mulberry
Beetroot	Basil	Coffee
Lettuces	Marjoram	Cocoa
Rice	Daisies	Bananas
Beans	Amaryllis	Oranges
Pumpkins	Hydrangea	Lemons
Onions	Jasmine	Apples
Wheat	Pink-ball	Coconut palm
Tomatoes	Fleur-de-lis	Pomegranates
Kale	Cactus	Plums
Spinach	Vanilla	Pears
Barley	Sunflowers	Tangerines
Sugarcane	Yellow Roses	Peaches
Corn	Violets	Pistachio
Mustard	Carnations	Olives
Black peppercorns	Peonies	Quince
Strawberries	Poppies	Hazelnuts
Watermelons	Rue	Apricots
Vines	Saffron	Pine

Source: LIMA, C. O., 1853.

*Sugarcane lost its primacy to coffee during the imperial period, but sugar production continued to be the basis of the economy in the Northeast and in the state of Rio de Janeiro. In 1875, there were more than 200 sugar mills in the municipality of Campos dos Goytacazes, RJ. Brazil is now the world's largest producer of sugarcane, sugar and alcohol.*

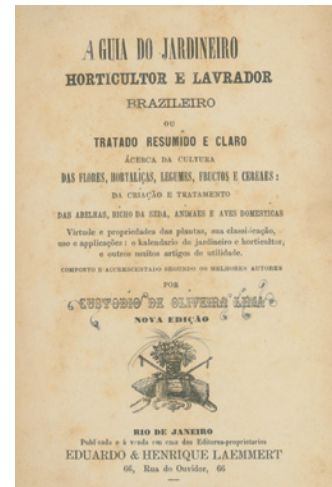




During Brazil's Imperial Age, there was thus a wide diversity of plants being grown. This record negates the supposition that there were only a few species grown in the country and that these were always in relation to the widespread crop cycles, such as pau-brasil, sugarcane and coffee.

### Principal reference of the chapter

LIMA, C. O. **A guia do jardineiro horticultor e lavrador brasileiro** ou tratado resumido e claro acerca da cultura das flores, hortaliças, legumes, fructos e cereaes: da criação e tratamento das abelhas, bicho da seda, animaes e aves domésticas. Rio de Janeiro: Eduardo & Henrique Laemmert, 1853. 470 p.



*Facsimile of the book cover by Custódio Lima of 1853, showing the diversity of plants grown in Imperial Brazil.*

## 10. The Farmer's Book of the Brazilian Republic

The proclamation of the Republic of Brazil took place on November 15, 1889 in Rio de Janeiro, which was at that time the capital of the country, with the toppling of the monarchy led by the Emperor Dom Pedro II. In this period of political changes, there were also important changes happening on the agricultural front. A good picture of what was happening with the growing of plants and with the identification of species grown in Brazil can be obtained in the "Livro do Lavrador" (Farmer's Book), written by Manoel Dutra and published in 1893. The book portrays in great detail the wide diversity of Brazilian agriculture in this initial period of the emerging republic.

### Plants described in the Farmer's Book of 1893.

Types of plants	Species
Orchard plants	Figs, passionfruit, apples, cherries, apricots, oranges, lemons, avocados, mulberries, plums, araçá, Surinam cherry, bullocks apple, banana, jujube, spiny andira, mango, papaya, jack-fruit, jambu.
Horticultural plants	Potato, broccoli, spinach, chicory, cará, turnip, chickpeas, lentils, garlic, mustard, cauliflower, water cress, tomatoes, pepper, cabbage, cucumber, carrots, onions, strawberries, melon.
Garden plants	Roses, fuchsia, tulips, chrysanthemums, lilies, orchids, jasmine, hydrangeas, poppies, geranium, sunflowers, azalea, begonia, lobelias, myrtle, rhododendron, violets, valerian, carnations, reseda, acacias, flamboyant, floss silk tree, yew.
Brazilian field crop plants	Coffee, tobacco, sugarcane, rice, corn, beans, cassava, cotton, cacao, rubber, matte.
Forage plants	Trevo, alpiste, milho forragem, ervilhaca, azevém, aveia, painço, sorgo, centeio, tremoços, alfafa.
Plantas industriais, oleaginosas, têxteis, de tintura e medicinais	Clover, millet, forage corn, vetch, rye grass, oats, switch grass, sorghum, rye, lupines, alfalfa.
Industrial, oil, textile, dye and medicinal plants	Rape oil seeds, sesame, sunflowers, castor oil, ground nuts, flax, hemp, cotton, urucu, licorice, melissa, sage, absinthe, chamomile.

The table below lists some of the 81 crop plants, 177 garden plants, 34 orchard plants, 11 field crop plants, 39 forage plants, 182 tree plants and 42 industrial, oil, textile, dye and medicinal plants described in the book.

It is worth pointing out that eucalyptus, which later came to be of great importance as an introduced species in Brazil, had already been introduced in the country some decades earlier, but is not listed in the “Farmer’s Book”.

### Principal reference of the chapter

DUTRA, M. **Livro do lavrador**: tratado completo de agricultura theorica e pratica. Rio de Janeiro: Livraria do Povo, 1899. 450 p.



*Facsimile of the book cover of the Livro do Lavrador, of 1899.*

## II. A godmother's influence: Eucalyptus in Brazil

**A**t the end of the nineteenth century there was a scarcity of raw materials for the maintenance and construction of railroads in São Paulo, which were very important for transporting coffee from the interior of the state. In order to fulfill the demand for timber for railroad ties and charcoal, the Companhia Paulista de Estradas de Ferro set up eighteen forestry gardens, in Rio Claro, Jundiaí, São Carlos and other cities in São Paulo. São Paulo native Edmundo Navarro de Andrade, born on January 2, 1881, was a great forestry researcher in Brazil, principally of eucalyptus. His personal story is very interesting. It was through his godfather



*Brazil is currently the world's largest producer of eucalyptus cellulose and owes much of this to the São Paulo researcher Edmundo Navarro.*

that Navarro had his first contact with life in the country. Later on, in 1896, he went to Coimbra in Portugal, studying at the Escola Nacional de Agricultura, where he stayed for six years.

In 1901, Edmundo suffered a heavy blow with the death of his godfather, Eduardo Prado. His godmother, Veridiana, started to finance his studies. After graduating, he returned to Brazil in September 1903. Through his godmother, he contacted conselheiro Antônio Prado, who told him about the Companhia Paulista de Estradas de Ferro project to stimulate forestry in the state along the railroad lines.

Thus, Navarro, who was not yet 23 years old, started practical work as an agronomist in 1904, beginning his experiments planting eucalyptus and many other species. In all he studied 95 species to find the one with the best economic return for the reforestation he intended to carry out. After five years of studies, Navarro arrived at the conclusion that no native species of flora would be able to reforest the already destroyed areas. On the other hand, eucalyptus stood out in such a way that after only a short time of study at the Rio Claro Forestry Garden, this became the species Navarro studied most.

He dedicated the following years to in-depth studies of eucalyptus, carrying out acclimatization tests, studying various ways of seeding and the behavior of the seedlings in nurseries, as well as creating collections of species, gathering 150 of these, evaluating the behavior of each one according to the type of soil. He also observed changes in temperature and drought resistance.

In 1910, he made a journey to study forestry services for seven months in the United States of America and various countries in Europe. Later on, in Sydney, Australia, the country where eucalyptus originated, he met Joseph Henry Maiden, director of the Botanical Garden, who was the world's top eucalyptus specialist. Navarro was given a precious herbarium by Maiden containing seeds of 150 different eucalyptus species which would be used in his future experiments.

In 1925, Navarro returned to the United States of America to learn about the fabrication of paper pulp from eucalyptus wood. On this trip, he took four trunks of eucalyptus, two of each species with fifteen years of growth. The experiments were carried out at the Forest Products Laboratory in Madison, Wisconsin, with the collaboration of all the scientists there. The results were satisfactory, and various types of paper were manufactured, all with excellent

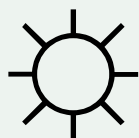
quality. One of them was used for printing part of the December 30, 1925 edition of the Wisconsin State Journal.

From the start of his work leading the Forestry Service of the Companhia Paulista de Estradas de Ferro, Navarro de Andrade suffered criticism from people who called themselves nationalists, indignant at the planting of exotic trees (eucalyptus) on large tracts of land, replacing native species. Eucalyptus was blamed for drying surface waters in the area where it was planted, as well as for other harmful effects.

Navarro dedicated himself to other areas of agriculture, publishing work on coffee, jute and rubber. He also became involved in citrus growing, planting orange trees in Araras, where he had a farm. Edmundo Navarro de Andrade died on December 1, 1941 at the age of sixty, after having undergone prostate surgery. His research into eucalyptus was so important that after his death, the Eucalyptus Museum was set up at the Rio Claro Forestry Garden, named after him, keeping all his published works there and the results of his research. As we have seen, sometimes it is important to have a godfather or godmother to help us out.

### **Principal reference of the chapter**

MARTINI, A. J. **O plantador de eucaliptos**: a questão da preservação florestal no Brasil e o resgate documental do legado de Edmundo Navarro de Andrade. 2004. 322 f. Dissertação (Mestrado em História Social) – Universidade de São Paulo, São Paulo, 2004.



## The explosion of tropical agriculture





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# 1. Introduction

The twentieth century was undoubtedly marked by a great technological revolution which led to a large number of people having access to sophisticated technical innovations at low cost – the popularization of technology. Between 1900 and 1999, Brazilian society witnessed and benefited from the invasion of technology in the cities and in the countryside. Cars, trucks, aircraft, radios, telephones, televisions, cell phones, refrigerators, stoves, antibiotics, pesticides, center pivot irrigation, combined harvesters and computers, among other inventions, came to be common elements in people's everyday lives.

This revolution was preceded and driven by the industrial and chemical revolution of the nineteenth century, which also led to social changes, although these were at a slower pace and less wide ranging as to the cohort of people benefiting from them. At the top of the pyramid of these changes, at the end of the last century, are surely information technology and the spread of the internet.

Brazilian agriculture did not remain immune to these changes. Investments from the private and public sectors in technology enabled the expansion of the use of its still abundant natural resources. Huge areas were made available for agricultural and industrial production. Similar investment was made in the mass training and education of technical personnel and in cutting-edge research to resolve the bottlenecks of agricultural production in the tropics.

Other public policies such as subsidized credit (both for agriculture and for the setting up of agribusiness), tax breaks, facilities for importing machines and raw materials, building of storage structures and centers for the sale of production, installation of technical support and rural extension services, support for cooperatives, minimum price guarantees for the sale of production etc., came together to increase effective production and supply, with the consequent expansion of consumption and demand.

It is true and it should also be noted that various factors caused irreparable environmental damage and a rise in rural exodus, with consequent reflections in the disordered and even chaotic occupation of the peripheries of large urban centers,

aggravating already serious social problems even further. This has perhaps been the greatest cost of the rapid changes in the countryside. These changes are still being processed thanks to the innovations that continue to spring from the farms, research centers and universities which have provided and continue to provide support for what is known these days as Tropical Agriculture, with Brazil being one of the leading benchmarks.

## Hoehne: a great Brazilian naturalist

Frederico Carlos Hoehne was born on February 1, 1882 in Juiz de Fora, Minas Gerais, the son of Germans who had arrived in Brazil in 1856. His father worked in agriculture, carpentry and industrial machine assembly on a smallholding on the outskirts of Juiz de Fora in a region of the Atlantic Tropical Rainforest. To improve the family's income, he kept an orchid nursery, which attracted buyers and visitors. At the age of 8, Frederico Hoehne started his own orchidarium in another part of the smallholding. At the age of 17 he finished school and, unable to go to college, began to study on his own through books ordered from Rio de Janeiro. His great wish was to be able to identify and classify plants, especially orchids, in order to be able to discover new species. Soon his collection was larger than that of his father, and he became the expert on the matter in the region.

In 1907, at the age of 25, an extraordinary event happened in his life. With the help of the president of the Local Council of Juiz de Fora, who was a friend of the family, this young self-taught man was named Head Gardener of the National Museum in Rio de Janeiro, which was then the largest scientific institution in the country. Shortly afterwards, in 1908, he was invited to take part in an expedition of naturalists from the National Museum accompanying Cândido Mariano da Silva Rondon on a trip to Mato Grosso. In 1909, he returned from the state which was still remote and unknown at that time with two thousand plants which were incorporated into the herbarium of the National Museum. This was the first of many trips to every corner of Brazil.

From this professional experience, his career as a researcher, scientist and administrator took off. He wrote books, reports and more than 600 scientific and popular articles. His books on orchids quickly became rarities coveted by collectors of antique books. He published the book "Botany and Agriculture in Brazil in the Sixteenth Century," in which he recovers and interprets other precious old writings, such as the work of Gabriel Soares de Sousa, Father Manuel da Nóbrega, Father José de Anchieta, André Thevet, Jean de Léry, Pero de Magalhães de Gandavo, Brother Vicente do Salvador and Sebastião da Rocha Pitta.

Hoehne can be considered an indirect heir of the numerous naturalist travelers who explored Brazil in the previous centuries, with some notable differences: he was born a Brazilian; he always lived in Brazil, unlike the other naturalist travelers, who in general were Europeans; he formed botanical collections which stayed in Brazil and were used in studies by other Brazilians; he worked as a researcher and administrator at a time of scarce resources for Brazilian science. In 1929 he was awarded an honorary doctorate from the University of Göttingen in Germany.

## The Goiás National Agricultural Colony: Ceres

Bandeirantes, short-lived towns in mining areas, extensive expansion of cattle farms, and subsistence holdings took up the first four hundred years of what is now the state of Goiás. It was in the 1930s that the sleepy state of Goiás woke up. The start of construction of Goiânia in 1933, the extension of the railroad to Anápolis in 1935 and the installation of the Goiás National Agricultural Colony (CANG) starting in 1942, an important landmark in the emerging “March Westwards,” were critical pillars in the development of the state.

These historical facts of regional significance had a strong impact on the development of the region, with significant changes for the population of Goiás. The changes were irreversible. This was the time of the administration of Pedro Ludovico in the state, during the famous Vargas Era (1930–1945).

The project to create agricultural colonies was developed and implemented during the Estado Novo (1937–1945) of Getúlio Vargas with one simple and direct objective: occupying land, especially on the border, as well as creating or strengthening production and the domestic market. The Goiás National Agricultural Colony was part of this large project, with a high impact on the region of Mata de São Patrício – a typically Irish name!\* CANG was established under Law-Decree no. 6.882, in 1941, and in 1943 was elevated to the status of district, becoming the municipality of Ceres in 1953. In the period between 1953 and 1959 the municipal and federal administrations worked together. Bernardo Sayão, an agronomist from the city of Rio de Janeiro who was designated by Vargas to run the first Agricultural Colony in Brazil, relived the times of the bandeirante heroes. Sayão adopted the discourse of Getúlio Vargas and put it into practice in the São Patrício Valley, opening up the area by 1950 when his leadership of the Colony ended.



*Ceres, Goiás, in 2010.*

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“The region including Ceres, Jaraguá and other towns of the middle-north of the state of Goiás is called the São Patrício Valley. This name comes from the São Patrício river which was given this name in 1733 by two Portuguese Franciscan monks (Brother João de Jesus e Maria and Brother Domingos Santiago) who lived in Pirenópolis. There has been speculation over the naming of the region, such as why it was not named São Francisco after the order of the monks, or given the name of some other Portuguese saint. The explanation usually offered by the clerics of the region is that there is a Jesuit seminary in Portugal which had been named after São Patrício at the time when the “Penal Laws” were being applied in Ireland by the English, forcing many Catholics to study outside Ireland, and many of these students were taken in by Portugal. It was not just the river but also the whole region that took the name in honor of the Irish saint. In the book of death records in Pilar de Goiás, an old gold mining area in the period of 1850–1864, there is a reference to a hamlet called São Patrício, situated close to the river in the region which is now the municipality of Itapaci. The hamlet is said to have been abandoned by its inhabitants soon after the Paraguayan War, when family members received the news of the death of their sons. The hamlet came to an end and its inhabitants returned to the city of Pilar.” (SILVA, 2002, p. 66-67.)

## Amazon Forest 1, Henry Ford 0

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Henry Ford (1863–1947) was born on a farm in the state of Michigan, in the United States of America, and he was a great innovator of modern capitalism as founder of the Ford Motor Company in 1903. Ford believed in the value of simple, repetitive and methodical work, and applied this system of work in his factory, adopting the mass production line and other measures to minimize costs and maximize production. He was obsessed with organizing production and with mastering all the stages of the production chain. Ford Motor Company extracted the iron ore from its own mines, transformed the ore into steel in its own steelworks and so on. In order to fully control all stages of car production the one thing lacking was the rubber for the tires. Thus was born his adventure in the Amazon Forest: Fordlândia.

The project was set up in 1928 on an area of one million hectares leased from the government of Pará on the banks of the Tapajós river, a day and a half's travel by boat from Santarém. The main objective of Fordlândia in Pará was the rational and extensive cultivation of rubber trees for the production of latex in order to supply Ford's factories in the United States. The golden age of rubber in the Amazon had already ended more than 25 years earlier, between 1870 and 1900, and Brazilian production of latex was small. The world market had been dominated by Malaysia, where the seeds of the Brazilian rubber trees had been transported, via England. The page to the right reproduces the first clause of the concession.

Henry Ford's idea was to apply in Brazil's Fordlândia the same principles of mass production that had transformed Ford into the world's largest car producer. In the middle of the forest on the banks of the Tapajós river an organized city was created, in the American mold, with hundreds of pre-fabricated houses, a hospital, stores, shops, a church and even a movie theater. More than 300,000 rubber trees were planted in an orderly and rational way, in accordance with guidance from the best American specialists.

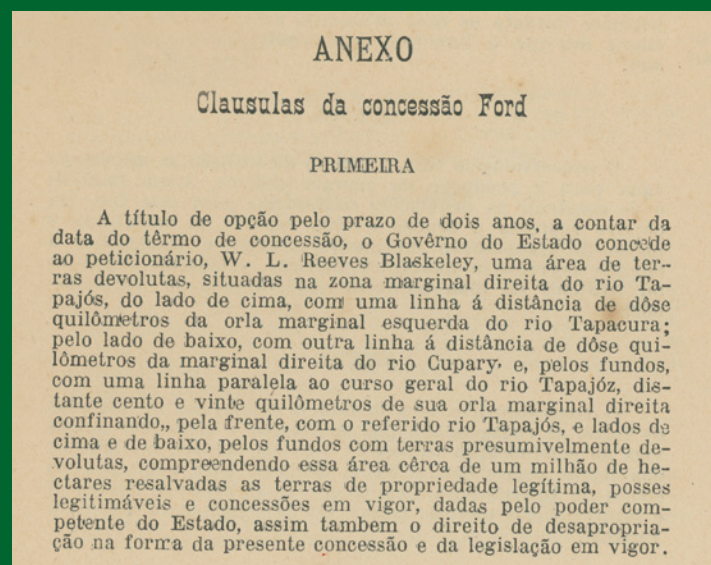
*The Fordlândia Project and the Jari Project opened immense clearings in the Amazon Forest to set up megalomaniacal rubber and cellulose production projects, but both had melancholic endings. Nature, having been wounded, imposed heavy losses and lessons on the adventurers. At least the lesson was useful to the researchers and scientists, who came to treat the forest with greater respect. Unfortunately, unrestrained devastation has prevailed, by greedy people who have advanced into the forest in search of immediate profits.*



Some years after the start of cultivation of the rubber trees, the plants began showing signs of a serious problem: an attack on the leaves by a fungus (*Microcyclus ulei*), which caused the leaves to fall and ended up killing the plants. The disease caused by this fungus on the rubber trees became an unsolvable problem using the agricultural techniques available at the time, and thus the project was simply abandoned. The Amazon Forest had beaten the most powerful capitalist and businessman of the time, who thought he could dominate nature using technology. The epidemiology of plant diseases – phytopathology – which could have saved Fordlândia from failure, only started to be developed after 1963, with the publication of the book “Plant Diseases: Epidemics and Control” by the South African J. E. Vanderplank.

The rubber tree (*Hevea brasiliensis*) is a plant native to the Brazilian Amazon, where it is distributed apparently at random in the middle of hundreds, perhaps thousands of other species of plants, normally in low density, of ten plants per hectare. In this natural condition prevalent at the time of the Rubber Cycle, the fungus attacked only some leaves of the rubber trees and thus did not kill the plants: a condition of ecological balance.

Unfortunately, this lesson, which is as old as the history of agriculture itself, has not yet been learned by mankind. Many years later, in 1967, the American millionaire Daniel K. Ludwig bought an area of 6,475 km<sup>2</sup> for three million dollars to set up an ambitious project close to the Jari river, one of the tributaries of the Amazon. The idea of the project was similar to that of Fordlândia, with the construction of a full infrastructure to exploit the area for the production of wood pulp from a single species of tree (*Gmelina arborea*). A settlement, with houses, schools and hospitals was built to house hundreds of workers. At its peak, the Jari Project had 35,000 workers. Platforms were built in Japan to generate power and for processing the pulp. The project suffered many setbacks, from the lack of adaptation of the planted trees to Amazon, to attacks by pests and malaria epidemics among the workers, among others. In 1981, after diversifying the project into eucalyptus, pine and rice, cattle and kaolin, Ludwig gave up on the Jari Project and transferred the whole of the property and buildings to a consortium of Brazilian businessmen in 1982.



## 2. Research and teaching: growing pains

**O**n June 13, 1808 the Rio de Janeiro Botanical Garden was created on the initiative of Dom João VI. Although other botanical gardens had been created before, in various documents this date is considered to be the initial landmark of agronomical science in Brazil. Despite this, the advance of this science was practically zero throughout the colonial period and the first decades of the Empire, even more so when compared to the great strides made in Europe during the nineteenth century.

Fifty years after setting up the Rio de Janeiro Botanical Garden, the first crises in the economy occurred, due to the fall in prices of the principal products exported and the advance of the process of freeing the slaves. In this context, five Imperial Institutes of Agriculture were set up in 1859, located in Bahia, Rio de Janeiro, Pernambuco, Sergipe and Rio Grande do Sul, as well as the Imperial Agronomical Station in Campinas.

The results of the research carried out at these institutes afforded increases in the productivity of land and labor, due to mechanization and more advanced production techniques and the improvement and conservation of agricultural products, and in this way resolved the crops crisis. However, the institutes at Pernambuco, Sergipe and Rio Grande do Sul had a short life or else did not get to function properly. The ones in Rio de Janeiro and Bahia survived for a few decades and the latter became the Escola Agrícola da Bahia, now the Agronomical School of the Federal University of Bahia, in Cruz das Almas. The Agronomical Station at Campinas soon became a state entity and later became the Agronomical Institute of Campinas.

The Imperial Bahia Institute of Agriculture was created on November 1, 1859, on the occasion of the visit of Dom Pedro II to Bahia. This was motivated by the crisis that affected principally the large sugarcane crop, of interest to the élite in the Northeast. The year after the institute was set up, the director asked the emperor to expand its activities to enable creating an agricultural school. So on February 15, 1877, the Course in Agronomy of the Imperial Agricultural School of Bahia was installed, the first university-level course in agricultural sciences in Brazil.

The end of the nineteenth century was marked by rapid and deep changes throughout society, and especially by “the transition

of the workforce consisting mostly of negro slaves to freedmen and people predominantly of European origins; the introduction of equipment, such as the plow, the coffee processing machine and turbines for hydroelectric power stations, the modernization of communications, with the refurbishment and expansion of highways, the introduction of trains, of the steamship, the telegraph and the telephone, which enabled the emergence of industries and urbanization which consequently led to the expansion of the middle and working classes.” (MOLINA, 2009).

These changes also put new demands on education, and the state of São Paulo saw the creation of three large institutions in less than five years. The first were the laboratories, at the time called high studies, of the Imperial Agronomical Station of Campinas in 1887. Later the university course in agricultural engineering at the Polytechnic School was created in the capital, and the secondary level course in technical agriculture at the Luiz de Queiroz Practical School of Agriculture in 1901. The Agronomical Station of Campinas kept the word “imperial” in its name only for a short while, then became part of the state of São Paulo in 1892, being renamed the Agronomical Institute of Campinas (IAC). From the start, this institution made efforts to inform farmers of the results of its research and provided services such as soil analysis, fertilizer, seeds, forage, raw materials and industrial products. To this day, IAC is a respected research institution, making major contributions to agriculture in São Paulo and Brazil.

From 1877, when the first university level course in agricultural sciences was set up in Brazil, until 1910, when the



*Façade of the Dom Pedro II building of the Agronomical Institute of Campinas.*

first official regulations for this type of teaching were established, eight Agriculture courses were being run. Although the statutes of the Imperial Agricultural School of Bahia (1875) provided for the Agriculture course as well as the courses of Agricultural Engineering, Forestry and Veterinary Science, the first course in Veterinary Medicine was only inaugurated in 1913 in Rio de Janeiro. In 1960, the first course in Forestry Engineering was created (in Viçosa, Minas Gerais); in 1966, the first in Animal Sciences (in Uruguaiana, Rio Grande do Sul) and in 1973, the first in Agricultural Engineering (in Pelotas, Rio Grande do Sul). In March 1961, the first post-graduate course in Brazil was inaugurated at the then Rural University of the State of Minas Gerais, now the Federal University of Viçosa.

With the establishment of the Republic, from 1889, the institutes were abandoned, except for the Agronomical Institute of Campinas, which was by then solidly structured by the state government. The Ministry of Agriculture, after 32 years of existence, became a mere directorate within the Ministry of Transport. In the place of the Ministry of Agriculture, the National Society of Agriculture was founded in 1897. The Ministry of Agriculture was only re-instituted in 1909, when it once again took on the responsibilities of agricultural teaching, research and experimentation through experimental institutes and stations.

“The experimental stations were the first attempt by the Ministry of Agriculture to systematically develop agricultural research at the beginning of the century. The pioneering landmark of this new approach was the creation of the sugarcane experimental station in Campos, Rio de Janeiro in 1910. Then came the sugarcane experimental station in Escada, Pernambuco (1911), the silk growing stations of Bento Gonçalves, Rio Grande do Sul and Barbacena, Minas Gerais (1912), and the cotton experimental station in Coroatá, Maranhão (1913). Without a doubt, the station that stood out most for the quality of its contribution to Brazilian agriculture was the station at Campos, whose work of improving sugarcane resulted in varieties with the prefix CB (Campos Brasil), which are grown in various regions of the country and even abroad, for example in Iran, South Africa, Mexico, Sudan and Taiwan.” (RODRIGUES, 1987a, p.131).



*Introduction and evaluation of sunflowers at the Butantan Institute in São Paulo at the beginning of the twentieth century.*

The implementation of the Estado Novo (under the Getúlio Vargas administration) strengthened the interventionist policy which had been in place since the Revolution of 1930. The creation of the National Agronomical Teaching and Research Center (CNEPA) in 1938 was the major landmark of state interventionism in the field of scientific research. The CNEPA consolidated the connections

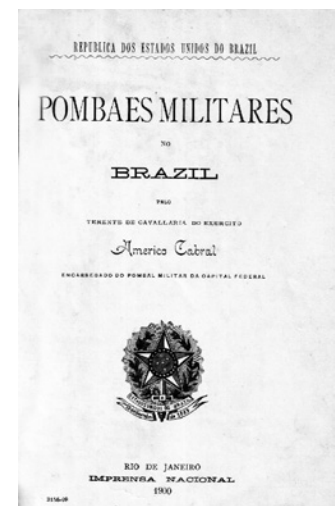


between agricultural research and experimentation and the teaching of agriculture at its various levels of specialization, now coordinated by a single organization. In 1943, CNEPA was reorganized into central organizations (Rural University and National Agronomical Research Service – the SNPA). The SNPA consisted of a university campus in Seropédica, RJ, at km 47 of the Rio – São Paulo highway, and coordinated and directed agronomical research in the country.

On February 20, 1957, at a time when the cocoa economy was in the middle of a serious crisis, the Executive Commission for Planning of Cocoa Farming (CEPLAC) was created, with the specific objective of re-establishing the economic balancing of the cocoa sector, which had been hit by successive crises due to the decline of production and price instability. CEPLAC is now a department of the Ministry of Agriculture, Livestock and Food Supply (MAPA) and is active in six states (Bahia, Espírito Santo, Pará, Amazonas, Rondônia and Mato Grosso), with the mission of promoting the competitiveness and sustainability of the agricultural, forestry and agribusiness segment for the development of the cocoa producing regions.

Despite the significant results obtained by the SNPA, the evolution of agricultural research was still slow and took place in a disconnected manner, as the animal and veterinary sciences were linked to the National Plant Production Department, instead of being integrated into the SNPA under a single central coordination. This disconnect was only eliminated in 1962 by means of a new administrative reform at the Ministry of Agriculture, which also abolished the SNPA, establishing in its place the Agricultural Research and Experimentation Department (DPEA). It should be noted that even with scarce financial resources, the SNPA successfully consolidated the federal research system by means of centralized administration. The DPEA, in turn, established food crops as its research priority and did not change the institutional model adopted by the SNPA.

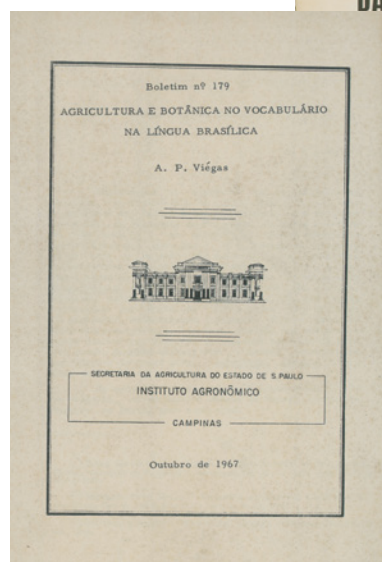
With the political-military coup, the so-called revolution of 1964, the country opted for conservative modernization, focused on the internationalization of the economy and external dependence. For agriculture, this led to the search for technological efficiency in order to provide better productivity of land and labor and thus greater profitability on capital. Decree no. 68.593, of May 6, 1971, once again modified the structure of the Ministry of Agriculture and established the National Agricultural Research Department (DNPEA). The reform enabled the implementation of new central divisions of Animal Pathology, Animal Science and Rural Engineering, as well as creating the Agricultural and Foods Technology Center (CTAA).



*Agricultural production techniques are used principally to increase production, productivity, resilience and more recently sustainability of agriculture. Some techniques have had a military application, such as the use of pigeons to transport messages in the pre-radio and -internet eras, as shown in the book *Pombaes Militares*, of 1900 (facsimile above). More recently, pepper spray, which is based on the substance capsaicin, responsible for pepper's pungency or burning, has been used by police to repress street protests. 🐼*

DNPEA was the central body directing agricultural research and had the function of planning, scheduling, coordinating, controlling and evaluating research activities in pedology, phytotechnical studies, animal pathology, rural engineering and applied technology, as well as transferring technologies generated by the organizations through its decentralized structure, which included ten institutes.

In 1972, DNPEA presented the Special Agricultural Research Programs (PEPA) with the objective of promoting work on rice, beans, corn, sorghum, soybeans and cattle farming. In parallel, the economist Edward Schuh, assistant to the Ford Foundation in Brazil since the early 1970s, unveiled a “new model”



*Journals and technical bulletins, published by public and private institutions for research, teaching and rural extension, have been expanding the horizons of knowledge and helping improve Brazil's agricultural production and productivity indexes since the beginning of the last century.*

of research, and with the weight of his international reputation, questioned the need for research into basic areas and stressed the importance of product research. In this context, the Brazilian Agricultural Research System was created (SBPA) in 1972, along with the Brazilian Agricultural Research Corporation (Embrapa) on April 26, 1973.

Embrapa inherited its researchers from DNPEA, as well as 11 institutes, 70 experimental stations, more than 1,040 research projects underway and 130 agreements with public and private organizations. This corporation thus arose to centralize agricultural research throughout the country. At the same time, the planning,



*Embrapa, the largest public agricultural research organization in Brazil, with 44 research and service units and more than 2,000 researchers in 2010, most of them with doctorates, coordinates the National Agricultural Research System and works with teams of researchers in virtual laboratories abroad (Labex), in partnership with research centers and universities from various countries. To the left, in the top photo, the Embrapa headquarters in Brasília, and in the bottom photo, the Embrapa Genetic Resources and Biotechnology herbarium, also in Brasília.*



*Genetic or germplasm variability of pepper (Capsicum). Genetic resources (germplasm) are the basis of the work carried out by research institutions. Germplasm banks are collections that preserve this valuable genetic material for use by this and future generations.*

organization and execution of research through Embrapa have substantially changed. The focus is no longer just on subject areas but also on products and eco-regions, in a systemic perspective combining modern chemical, biological and mechanical products with the production environment (land, climate, farmers' knowledge) in order to obtain the best production system for each product.

Over these almost forty years, Embrapa, together with the state agricultural research organizations (OEPAs) and other institutions, has supported the development of Brazilian agriculture, offering various products, technologies and services adapted to the various biomes. Initially, efforts were concentrated principally on increasing productivity and on incorporating characteristics to strengthen the resilience of crops and livestock in a tropical environment. In the last two decades, this focus on increasing productivity has been allied with the concern for the quality of the product, as well as environmental, social and economic sustainability, causing the portfolio of projects to become more balanced between production-oriented and conservation-oriented research programs. Embrapa has grown and the number of its research and services centers has risen considerably since it was created, but they all continue to have as their primary objective supporting the Brazilian private sector, including its social sub-sector, so that better products of agricultural origin can have a positive influence on the quality of life for an ever greater number of Brazilians.

### 3. Improving rural organization: Rural extension and the Cooperatives

The imperial agricultural institutes created in the mid-nineteenth century concentrated their efforts on research and teaching, but also invested in the diffusion of knowledge generated and/or adapted in their experimental stations by means of publications, demonstrations of the use of technical innovations and the provision of technical support and rural extension services.

In Decree no. 2.681, of November 3 1860, concerning the approval of the Statutes of the Rio de Janeiro State Imperial Agricultural Institute, the guidance is clear in this regard:

*Art. 2: The Institute shall, in accordance with its resources: 1, facilitate the substitution of manual labor needed on the farm by appropriate machines and instruments, promoting the introduction and adoption of those whose utility has been demonstrated in practice, as well as studying and testing the national and foreign colonization systems found to be most useful;*

[...]

*6, promote the annual exhibition of the products of Agriculture, and encourage it through the use of prizes, and facilitate the transport and sale of said products.*

[...]

*8, create and maintain a journal in which the work of the institute and of the regular Establishments is published, as well as articles, memoirs, translations and news of recognized usefulness to our Agriculture, and showing in language fitting to the intelligence of the majority of farmers the improvements worthy of being adopted in each process of Agriculture, and the principles of rural economy essential to the judicious use of the provinces, good administration of farms, and the utilization of their products;*

*9, create in the regular Establishments, when circumstances so permit, Schools of Agriculture where general principles and notions of species are learned, essential for the work to become more facilitated, useful and advantageous. Until such time as these Schools are created, which shall be dependent on a special Regulation, there shall be Professional Farmers in the Normal Establishments, to provide instructions as requested, and who when possible shall also visit the private Establishments.*

[...]

It would seem natural that research institutions should have an obvious concern that the results they generate not be confined to the annual reports or to publications. That being said, it must be admitted that the efforts to spread agricultural technology have always fallen short. One often hears the comment, "if at least half of the current technical knowledge were incorporated into the production system, the present production level in the field could be doubled."

The secondary role sometimes given to technology dissemination, promotion and incentives thus has a high cost, although this cost cannot be measured precisely. However, it must also be recognized that part of the level reached by Brazilian agriculture is the result of the work by public and private technical assistance and rural extension organizations, including non-profits, engaged in taking technical innovations to rural areas and in training farmers in their use, as well as guiding them in the application of rural credit, in the organization of production and farming administration processes, in social organization and cooperativism and also in aspects related to health and environmental education in partnership with other institutions. The technology that is passed on through the interchange of experiences between producers and their families is also significant.

The writings on the diffusion of technology and rural extension in Brazil in general do not record the work of the imperial institutes of agriculture and tend to consider that this service was begun only in 1948 in Minas Gerais, with the creation of the Rural Assistance and Credit Association of Minas Gerais (ACAR-MG). The initiative was supported by the American Nelson Rockefeller, after a pilot experiment in cooperative work in the municipalities of Santa Rita do Passa Quatro and São José do Rio Pardo in São Paulo.

Back in the 1940s, before the creation of ACAR-MG, the Ministry of Agriculture promoted what was called Rural Weeks in conjunction with the state agriculture secretariats, which consisted of workshops and demonstrations of agricultural practices held by groups of technicians in the municipalities. Also at this time, the Ministry set up Agricultural Posts or small demonstration farms on the use of agricultural machines, conservation of the soil, crops and livestock raising. These and other initiatives did not do well because of the high costs and the influence of local politics, which led to the favoring of a privileged few (COSTA, 2001)

It was the creation of ACAR-MG that drove the implementation of the technical assistance and rural extension public service in almost all the states of Brazil, and along with it the Supervised Rural Credit (later Guided Rural Credit), financing agriculture and domestic economy projects. In 1956, the Brazilian Credit and Rural Assistance Association was founded (ABCAR), which coordinated the state associations nationally. In 1974, the government re-structured the service, setting up the Brazilian Rural Extension System (SIBRATER) and the Brazilian Rural Extension Corporation (EMBRATER) to coordinate such work.

The ACAR in each state came to be called the State Technical Assistance and Rural Extension Company (EMATER). But in 1990 EMBRATER was abolished by the government of that time under a federal re-structuring of the public service program, along with various state companies. Some survived with changes of name, organization and working mode with each change in government in their respective state. In general, where they are still in operation, they continue to contribute to raising agricultural production standards and improving the quality of the life of the rural population, interacting with research and teaching institutions and other public and private organizations.

The public and private farmer support services – whether small, medium or large sized – are constantly undergoing changes that in part reflect government policies, the domestic and foreign markets, as well as the evolution in information technology, such as the arrival of the internet. There are still large gaps in the support to small farmers who form the great majority in this country.

The individual decision to work together towards the common good is worth emphasizing. Cooperation is a fundamental ancient principle by which human beings get together in some way to obtain mutual benefits. In Brazil, tribes and quilombos, for

example, were organized with cooperative structures where the members had one or more specific responsibilities.

In an industrial context, cooperativism is a movement, a philosophy of life and a socioeconomic model that involves economic development and social well-being and which has as its main values democratic participation, solidarity, independence and autonomy. It is a system based on values such as mutual aid; equity, with fair distribution of the surplus produced; equality, where all associates have equal rights and duties; democracy, where the management of the cooperative is through collective decisions; solidarity directed toward the needs of the group; and the search for joint prosperity. In a simple manner, it represents the union between people geared toward the same objective, with a strong economic base.

The date of December 21, 1844 is considered as the landmark of the start of cooperativism, when a group of 28 weavers got together to jointly buy food in Rochdale, a suburb of Manchester, the famous industrial city in England. The movement arose as an alternative to the exploitation of the working classes at a time when England was undergoing the Industrial Revolution. Each of the 28 weavers paid one pound to join the society and after one year the capital reached 180 pounds. In ten years, it had 1,400 associates.

The experiment soon spread to other European countries in the form of working cooperatives in France, and credit cooperatives in Germany and Italy. By 1881, there were 1,000 cooperatives throughout the world.



*Group of Italian women doing heavy work in the countryside. Italian immigrants and many of other nationalities and ethnicities contributed greatly to the development of Brazilian agriculture.*

In Brazil, various movements based on the cooperativist spirit arose, principally among the various groups of immigrants who came here. The most important pre-cooperativist movement in Brazil was perhaps that of French immigrants, who in 1847, led by doctor Jean Maurice Faivre, founded the Thereza Cristina Colony on the banks of the Ivaí river, now in the municipality of Cândido de Abreu in Paraná.

From 1890 onwards, various other cooperatives were founded in Paraná. In the agricultural sector it is possible to highlight the arrival of 459 Dutch people in 1911 in the municipality of Carambeí, where they founded one of the most prosperous immigrant colonies. In 1925, they founded the Batavo Dutch Dairy Products Cooperative Society, considered an exemplary cooperative and a well known brand of dairy products in Brazil.



The history of cooperativism in Brazil is marked by periods of rise and decline and is now undergoing less accentuated oscillations. Some declines took place due to economic crises which cooperatives did not know how to or were unable to face. But perhaps it was the lack of professional management that was the main cause of ruin of many cooperatives. This led to widespread discredit among farmers themselves, which explains the oscillatory movement, as it is always hard to reorganize people around objectives that have been frustrated in unsuccessful experiences. The powerful and active Cotia Agricultural Cooperative is an excellent example of a one-time giant.

There were however, very successful experiences such as the example of Batavo mentioned. COAMO, in Campos Mourão, Paraná, founded in 1970 as Cooperativa Agropecuaria Mourãoense Ltda. with just 79 farmers, now has more than 22,000 cooperative members, approximately 5,000 staff and a total revenue of almost R\$ 5 billion, collecting more than R\$ 200 million in taxes, with net assets of R\$ 1.9 billion, storage of four million tons and outposts in 53 municipalities in Paraná, Santa Catarina and Mato Grosso do Sul. It also has its own banking structure, factories, technical support and rural extension services, as well as other services, making COAMO the largest agricultural cooperative in the country.

The work of raising awareness on the part of the pioneer farmers who founded COAMO led them not only to value collective effort and the initial gains obtained, but also allowed them to understand the importance of continuing to reinvest in the expansion of their gains, without which it would not be possible to grow and capitalize on what they had and what they had been able to achieve. This is an excellent example of social capital gain.

New information technologies and knowledge sharing, new forms of organization and cooperation, new production technologies, competitive access to credit, public programs focused on the neediest or weakest areas are essential elements in support of Brazilian farmers and their families, who will have to be more and more competitive and at the same time attentive to environmental, social and sustainability aspects to benefit current and future generations. The challenge is to construct Brazilian rural social capital.

### **Cooperativism by the numbers in Brazil**

- 6% of Brazilian GDP;
- US\$ 2,253 billion in exports;
- 199,680 jobs;
- 6.791 million associates;
- 7,518 cooperatives;
- 81 central cooperatives.

## Cooperatives: a report from 1931

The report from the Ministry of Agriculture on the situation of cooperatives in 1931 is a very interesting document, also because of its applicability to the contemporary situation. Some parts in relation to the activities of the Sociedade Cooperativa União Rural Ltda., in Pelotas, Rio Grande do Sul, are mentioned here.

*The Sociedade Cooperativa União Rural Limitada (União dos Agricultores do Sul do Estado) was founded on March 31, 1931, beginning its initial phase of internal organization and work on July 26 of the same year. Founded in the colony of the Municipality of Pelotas (Campos Colony, 7<sup>th</sup> district), it was supported by the Pelotas Colonial Unions Center, a powerful organization disseminated throughout the State of Rio Grande do Sul and which brought together about 1,200 small farmers in the Municipality.*

*As with all class organizations, the Cooperativa União Rural arose from the urgent need of the settlers to improve their principal agricultural product – potatoes – which was being sold at prices one could describe as miserable, as the sale price failed to cover the costs of planting.*

*In fact, in the harvest of the summer of 1931, the prices from the local buyers was 2\$000 per 50 kilos sack, unclassified, which became even more ruinous for the farmer. Knowing that a sack of potatoes produces on average 6 for 1, it is easy to understand the perspectives of ruin hovering over the farmers. The situation was so awful that many farmers had already decided to abandon their crops and dedicate themselves to the cutting down of their woodland, as they were unable to obtain fair prices for any of their other products, such as beans, lupines, etc.*

*Objectives – The Cooperativa União Rural, in general lines, is aimed at defending the agricultural-colonial production of the Municipality of Pelotas and neighboring areas [...]*

*Organization – The Cooperativa União Rural is organized as an agricultural cooperative for production, sale and consumption, of limited liability and in the legal form of a corporation, in the terms of Decree no. 1.637, of January 5, 1907 [...]*

*Everything thus indicates to us that cooperation is a fact which has gone beyond the experimental and which for the farmers is the only solution able to resolve the problem of producing, selecting and selling, always within the fairest and most compensatory of principles and in a manner able to avoid the antagonism between farmers and consumers, doing away with the intermediary, who is no more than a parasite between these two single live forces of the economy.*



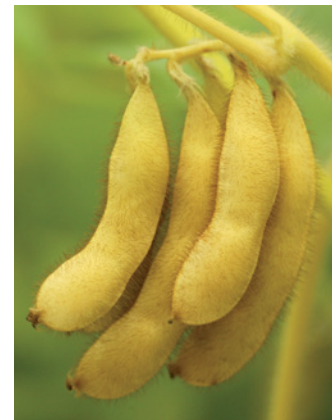
## 4. Soybeans: the Brazilian greengold

**S**oybeans originated from China, where they were domesticated and used initially as a medication and green fertilizer. Their expansion beyond Chinese territory was slow and gradual, first to other Asian countries starting in 1500, such as Japan, India, Thailand, Indonesia, the Philippines, and then after 1700, to Europe and the United States of America. At first, soybeans did not attract much attention as a crop of agricultural importance, being used in the West as forage for animals and green fertilizer, as it is a quite robust nitrogen-fixing legume.

In Brazil, its introduction was by Gustavo Dutra, in Bahia in 1882, and by Daffert in 1892, at the Agronomical Institute of Campinas in São Paulo. The Japanese also brought some varieties of soybeans when they emigrated to Brazil from 1908. The first record of soybeans being grown as a crop in Brazil dates from 1914 in the municipality of Santa Rosa in Rio Grande do Sul. But it was only from the 1940s that the crop came to be of economic importance.

From the 1960s onwards, driven by the policy of wheat subsidies aiming for self-sufficiency, soybeans became established as an economically important crop which revolutionized farming in Rio Grande do Sul. This was primarily because the varieties imported from the United States adapted well to the climate and soil conditions in the south of Brazil, since their flowering depended on the photoperiod and air temperature. A new era in farming in Rio Grande do Sul had begun with the twin crops of soybeans in the summer and wheat in the winter, which brought with it a series of technical innovations and enriched the state. Soybeans demanded a complete technological package for their production, with fertilizers, breeding, pest and disease management and other farming practices, leading to increased demand for research and increased sales of modern inputs such as chemical fertilizers and pesticides, as well as agricultural machines such as tractors and harvesters.

In Rio Grande do Sul, small farmers, with areas of up to 50 hectares, were responsible for more than 80% of the production of soybeans and have started to have access to a new world of technological advances. The cooperatives in the main producer regions have prospered and are being transformed into real giants.



*Soybeans are now one of the principal commodities in the array of Brazilian agriculture export products, surpassed only by coffee, oranges and sugarcane.*

For example, the Cooperativa Triticola Serrana Ltda. (Cotrijui) was set up in 1957 to “bring together wheat farmers of the region to defend their economic interests [...], and overcome the difficulties in the sale of the wheat harvest [...],” which is a problem that persists to this day, with production and price instability.

In the 1970s, with the intensification of soybean cultivation in the northeastern region of Rio Grande do Sul, Cotrijui had units in various other municipalities (Santo Augusto, Tenente Portela, Jóia, Coronel Bicaco, Chiapetta, Ajuricaba, Augusto Pestana). In 1972, Cotrijui inaugurated a grain terminal at the port of Rio Grande, 500 km away, through which 80% of the exports of soybeans from Rio Grande do Sul passed. Cotrijui later changed its name to Cooperativa Agropecuaria & Industrial Ltda., and now has 16,000 cooperative members and has diversified its activities to add value to the products of the region, now active in the fabrication of animal feeds, the manufacture of cereals, milling and refrigeration.

With the rise of soybean cultivation, radio stations in the interior of Rio Grande do Sul started to broadcast the prices of soybeans on the Chicago exchange three or four times a day in between the news of deaths and the games of teams from the interior. The local economy took an immense leap forward: trade flourished, the agricultural industry developed, teaching improved, and a real bonanza swept the countryside of Rio Grande do Sul. In a short time, the price of land exploded and the local currency



*Vast fields of soybeans can now be seen in all regions of Brazil. Brazil is the world's second largest producer and the leading exporter of soybeans among all countries.*

came to be “sacks of soybeans.” The most important goods such as land, real estate, cars, agricultural machines were quoted in this regional currency. At that time, small farmers began to face a new problem: large families and scarcity of land for planting soybeans.

With the technical experience acquired with soybeans, with capital and generally with large families, the migration to the north began slowly in the beginning: first, to the west of Santa Catarina and Paraná and Paraguay, then to the region of the Cerrado, principally Mato Grosso do Sul, Mato Grosso, Minas Gerais, Goiás and the west of Bahia and southern Maranhão. Rio Grande do Sul became an exporter of experienced and trained farmers who occupied large areas in Paraná, Mato Grosso, Minas Gerais, Goiás and Bahia, and also of small family farmers in search of new opportunities, including in the Amazon. Nowadays, Brazil stands out as the leading exporter and the second-ranked producer of soybeans worldwide.

## Eating a Big Mac® in Manaus

One of the most outstanding characteristics of the present moment in the world’s economic development is globalization. The same material progress bringing benefits to a greater number of people can at the same time suffocate millennial cultures and impose a model of development that is totally foreign to the natural condition of many places. When someone travels to a city such as Manaus and decides to eat a Big Mac®, they cannot imagine the complex logistics that enables the various ingredients to get there, from the crispier American type of lettuce, to the meat hamburger. Would it not be simpler to eat a typical Brazilian fish from the Amazon, such as tambaqui, accompanied by cassava flour made from ingredients available throughout the region?

The pressure to produce locally only some plant species also has a high environmental cost, such as for example the cutting down of extensive areas of tropical forests, rich in biodiversity and as yet unexplored from the point of view of their potential, to make way for a single crop of cattle pastures. Would it not be more reasonable to raise fish? The climate and the suitability of the soil should always be taken into consideration in farming practices, but for the Amazon this basic rule seems to have been ignored.

On the other hand, it is fundamental to value and recover regional habits and culture, such as the rich cuisine of the Amazon which is the result of the interaction of the natives with the immigrants and the local nature for hundreds of years. After all, a Big Mac® is the same, standardized, and can be found in practically all big cities throughout the world. But a steaming pirarucu accompanied by pirão and tapereba ice-cream for dessert, eaten on the banks of a tributary of the Negro river, cannot be found anywhere else.

## s. Juazeiro Petrolina Center: Fruits for Brazil and for the world

**B**ecause of the semi-arid conditions, agriculture in the Northeast region during the last century was basically for the subsistence living of the population. Thus, trade became the principal economic activity of the region.

Although it is more a problem of a political or ideological nature than an ecological one, lack of water has been a limiting factor to the growth of the Northeast. However, in the mid-1970s this picture changed and public policies were directed toward the modernization of agriculture and the creation of various research organizations in order to promote the region's agricultural development.

The creation of the Northeast Development Superintendency (SUDENE) in 1959 had great prominence, as its mission was to improve problematic aspects of the region's natural environment in while providing socio-economic growth. One of its aspects was the Integrated Water Resources Usage Plan, which consisted of a diagnosis of the water potential and availability of water in the Northeast based on hydrogeological and hydrometeorological studies, which had a decisive role in the drilling of wells and the building of dams.

The transition to irrigated agriculture was responsible for the transformation of this portion of the country. From research by SUDENE in conjunction with FAO (United Nations Food and Agriculture Organization), potential areas were defined for the introduction of irrigated agriculture in the Northeast. The municipality of Petrolina in Pernambuco was one of the first selected for implementation of the irrigation projects because of its favorable natural conditions, such as: soil with appropriate physical characteristics; an ideal climate with the temperature of around 26°C; average relative humidity of 50%; average annual rainfall of 450 mm; and principally the proximity to the São Francisco river. Another important factor was the annual sunshine of three thousand hours, equivalent to 300 days of sun, which is a critical aspect for the production of high quality fruits.

With the implementation of the irrigation projects, the traditional methods used beforehand such as catchment of water at the river bank using water wheels were replaced by more sophisticated methods such as motor pumps and electrical pumps. Flooding techniques were also changed to conventional spraying, central pivot sprinkler, micro-spraying and fertigation. Nowadays, the São Francisco river irrigates an area of approximately 110,000 hectares, enabling the region to gather 2.5 harvests per year, with high productivity.

Another important change was the transition from production of species with lower commercial value to others with a higher commercial value. This happened because of the need to obtain higher profits to pay for the high level of investment made in setting up the irrigated agriculture infrastructure. Thus traditional crops in the region were replaced with fruit crops intended for export.

Petrolina is currently a large tropical fruit producing center and is the main exporting region of fresh fruits in the country, being responsible for about 30% of the US\$ 350 million generated by the exporting of Brazilian fruits. The production of bananas, guavas, coconuts and especially mangoes and grapes has become important in the region, the latter also being for wine and grape juices, and is the most significant example of the modernizing impact of irrigated agriculture in the Northeast. The economy of the region has made great progress due to modern production



*With the implementation of irrigation projects, Brazil's Northeast has been transformed into a large producer and exporter of tropical fruits.*

techniques, but is still very dependent on oscillations of demand from the foreign market, where most of the production is sent, and production is dominated by large companies.

In more recent discussions, alternatives have been thought up to minimize the problem of drought in other parts of the Brazil's Northeast, such as the transposition of the São Francisco river, which is quite controversial because of the high socio-economic and environmental impacts this may entail, as well as not knowing exactly who will benefit from it.



## 6. Development only through devastation? The Amazon and Cerrados

The history of Brazil since its discovery demonstrates that development has taken place at the cost of devastation. Important areas of the Brazilian biomes, such as the Atlantic Rainforest, have been reduced to less than 10% of their original area, and the same tendency is being repeated for the Cerrado and for the Amazon.

The expansion of agriculture requires extensive areas of native vegetation to be converted into agricultural areas. However, the occurrence of agricultural areas entering a process of productive decline is common, such as the Alegrete desert in the southern part of Rio Grande do Sul, where lack of knowledge about the location's suitability for agriculture and misuse of the natural resources have led to poverty and devastation. These stories do not have to happen again and there is a unique opportunity that the development of the Amazon and the development of the Cerrado – despite the latter being substantially more degraded – could be historic success stories not associated with devastation.

The occupation of the Amazon occurred at a faster pace at the end of the nineteenth century, at a time when Brazil started exporting large amounts of rubber to England, which was at the height of the industrial revolution. This burst of development lasted until the start of the 1900s, when England stopped buying from Brazil and began purchasing the product at a lower price from Asia.

During the Second World War, Brazil once again became a large exporter of rubber, because the Japanese had taken control of production in Asia, which was a large producer and exporter of the product. Getúlio Vargas, President of Brazil at that time, made an agreement with the United States, and in exchange for investments, Brazil was to produce and export rubber to the US. This period was marked by intense nationalism, supported by Vargas, who encouraged the march westwards and the settling of the Amazon region. It was people from the Northeast who migrated in greatest numbers to the region, attracted by seductive proposals of wealth from the extraction and sale of rubber. However, most of them became victims of tropical diseases and the few who managed to survive did not see the riches they dreamt of.

DECRETO-LEI N. 5.225 — DE 1 DE FEVEREIRO DE 1943

*Dispõe sobre a situação militar dos trabalhadores nacionais encaminhados para a extração e exploração de borracha no Vale Amazônico e dá outras providências.*

O Presidente da República, usando da atribuição que lhe confere o artigo 180 da Constituição e considerando que a produção da borracha é essencial ao esforço de guerra e à defesa militar do país, decreta :

Art. 1.º — Os trabalhadores nacionais encaminhados ao Vale Amazônico para a extração e exploração da borracha e os que já ali estiverem trabalhando, devidamente contratados, nessas atividades, são considerados de incorporação adiada até à terminação do contrato de trabalho, ou enquanto se dedicarem àquelas atividades.

Art. 2.º — Para efeito do adiamento da incorporação mencionada no artigo anterior, os órgãos oficiais do Governo Brasileiro remeterão ao Comandante da Região Militar as relações nominais dos trabalhadores convocados para o serviço ativo. Dessas relações devem constar nome, filiação, classe (ano de nascimento), categoria de reservista (1a., 2a. ou 3a.) e Circunscrição de Recrutamento que fez a convocação.

Top right, reproduction of Law-Decree no. 5.225, on the military situation of the rubber workers, the "rubber soldiers." (Taken from the "Caderneta de Seringueiro," a kind of Employment Card of the time, issued by the Workers Administrative Commission for the Amazon.) The photo shows the process of smoking the rubber latex, now much less used, by which the "balls" of rubber of up to 50 kg are made. The "rubber boom," which included the last two decades of the nineteenth century and the first decade of the twentieth century, drove the economy of the Amazon region, but essentially benefited only the economic élites of the region. The resumption of production during the Second World War generated more problems than benefits for rubber workers and for the majority of the regional population.



Getúlio had geopolitical concerns and saw the forest as having special importance, especially because of the borders. Once again, the age of wealth lasted only a short time. Once the war was over, the United States of America suspended its investments and Amazonia went back into economic decline.

The start of the military government also left its marks on the occupation of the Amazon region. With a nationalist discourse, the military preached the unification of the country under the slogan “integrar para não entregar” (“integrate, don’t abdicate”). Also at this time, the big highway projects towards the Amazon were started. The Transamazonica highway was inaugurated in 1972 and two years later, the Belém–Brasília highway was ready. A few years earlier the Manaus Duty-Free Zone had also been set up to encourage the industrialization of the region. Through the Amazonia Development Superintendency (SUDAM), the government offered a series of incentives to those interested in producing in the region. However, these incentives only went into the hands of the large farmers who held most of the land. In this period, illegal occupation of land became more intense as well as conflicts between the small and large landowners of the region, which led to a high number of murders due to disputes linked to land ownership questions.

After years of incentives for the production and occupation of the Amazon region, the signs of destruction became even more clear. In 1978, when the world was beginning to become concerned about the destruction of natural resources, the deforested area of this biome amounted to 14 million hectares.



*The Amazon biome, the largest forestry reserve in the world, is still little studied, and considerable native areas have been lost to deforestation and conversion to cattle farming.*

After the discovery by Frank Rowland and Mario Molina that the substances used in aerosols, the so-called CFCs, destroyed the ozone layer, the effect of deforestation on the ozone layer also came to be questioned. The discussions on the environment began to change in the 1980s, and the murder of the union leader Chico Mendes in 1988 is considered a watershed in the history of the Amazon. After this crime, the Brazilian government began to be pressured, also from abroad, in relation to their policies for the Amazon. The government reacted with various initiatives, but their actions were only the beginning.

The holding of the United Nations Environment and Development Conference, Eco-92, in Rio de Janeiro placed the environmental question and that of the Amazon firmly on the agenda of the world's most important discussions. The idea that the forests had to be preserved won over the popular imagination. At the same time, soybeans arrived in the Amazon region and this crop, which since the 1970s had occupied a large part of the Cerrado, was transformed into one of the villains responsible for deforestation. The production attracted a new wave of immigrants, this time from the South and Southeast.

During the 1990s, the total deforested area jumped once again and reached 41 million hectares. In recent years, studies on the impacts of mankind on the Amazon Forest have become more consistent. The study carried out by the non-

*The guaraná crop, a plant whose natural habitat is in the Amazon, is expanding in the Amazon region, in the south of Bahia, in Mato Grosso and in Espírito Santo, favored by the rise in demand for guaraná in the country and abroad. Guaraná is best known and consumed as a soda drink, but is also used in the fabrication of syrups, juices, essences used in the cosmetics industry and for its proven medicinal properties in the fabrication of tonics, stimulants, sedatives, antidepressants and other pharmaceutical products.*



profit organization Imazon in 2002 indicated that 47% of the Amazon region was under some type of pressure from human activities.

Cattle farming came to be responsible for deforesting huge areas. Between 1990 and 2003, the cattle herd within Legal Amazonia grew by 240% and reached 64 million head of cattle. Even after various attempts made by the government to legalize land ownership in Amazonia, it is estimated that half of the properties have some type of ownership irregularity.

From 2003 to 2009, the government released 81 million hectares of federal lands for land distribution settlements, environmental preservation or indigenous projects. Even so, 67 million hectares of federal lands continue to be officially under federal responsibility. In February 2009, President Luiz Inácio Lula da Silva sent Provisional Measure 458 to Congress providing for the transfer of these lands. In June of the same year, the Measure was signed by the president and became law, and the deforested area of the Amazon region reached 70 million hectares.

As with the Amazon region, the Cerrado was also occupied gradually. The occupation started with gold mining in the eighteenth century and, with its decline, the people in the region turned to cattle raising and subsistence farming. Until the early 1940s, land in the Cerrado was among the cheapest in the country. With the creation of Goiânia in 1933 and the



*Dendê is no longer known just as an exotic product of Bahia cuisine and is being transformed into a strategic product of the economy. Dendê oil (extracted from the pulp of the fruit and from the nuts) is widely used in the fabrication of cooking oil, mayonnaise, ice creams, cookies, cakes, soap, glycerin, candles, skin creams, fuel and in steel-making. The dendê palm also provides products used in the fabrication of animal feeds, fertilizers, activated charcoal and brake fibers. Because of its high productivity (4-6 t/ha of oil), the dendê palm is indicated as one of the principal sources for obtaining biodiesel.*

transfer of the federal capital to the Central Plateau after 1958, the occupation of the Cerrado began to pick up speed, attracting waves of migrants in search of work.

On the agricultural front, large-scale governmental investments in the Central-West region began only in the 1960s when the policies of integration and regional development were drawn up. In 1967, the Superintendency for the Development of the Central-West (SUDECO) was set up, which was to research the economic potential of the region and define areas appropriate for the installation of growth centers.

At the end of the 1970s, a partnership signed between the Brazilian government and the Japanese government created the Japan-Brazil Cooperation Program for Development of the Cerrados (PRODECER). With this partnership, Embrapa was able to carry out research which enabled unprecedented levels of soybean productivity in the Cerrado region.

Despite economic success, the agricultural modernization of the Central-West region took place at the cost of great losses in biodiversity. Studies carried out show that in the central region of the Cerrado, whose original area corresponded to 1.58 million km<sup>2</sup>, 54.9% has been deforested. In fifty years, the biome lost more than half of its original vegetation cover and has undergone

*The topography, soil and climate characteristics of the Cerrado biome, combined with modern production technology and entrepreneurialism, enabled a huge expansion of Brazilian agribusiness. Unfortunately, this advance in some areas has not respected the balance of production versus conservation.*



an extensive process of fragmentation. This picture shows the need for urgent action by the government in favor of conserving the Cerrado region.

The production-oriented model should open up new alternatives targeting conservation and sustainable use of local resources. It's not about condemning modern farmers, or rejecting the dominant cattle raising model, but rather conferring greater environmental rationality to agribusiness. Planning productive activities becomes essential the moment new programs are introduced to the region, such as biofuels. The development of sugarcane and other energy plant species cannot take place at the cost of further deforestation of the Cerrado region and expansion of the agricultural frontier into the remains of the biome.

## The great “treasure”

“The three-story steam-powered boats known as ‘gaiolas’ [...] This fleet is now the largest on the southern continent, and is only comparable with the one in the North which dominates the world’s other great river, the Mississippi. Around 10,000 miles are navigated by these beautiful and bold types of boats which transport the great treasure of the Amazon jungle – rubber – gathering it at a multiplicity of rubber plantations spread elsewhere to the ports of Manaus and Belém, which export the rubber to the world’s markets [...]” (DIAS, 1904, p. 91).



*Docking at the “Escadaria dos Remédios”, in Manaus, Amazonas, at the ebb tide of the Negro river which bathes the city. Dozens of these three-story steam-powered boats known as “gaiolas” leave daily from this and from other docks, forming the principal means of transport of people and of cargoes in almost the entire Amazon region.*

## Goyaz enjoys the happiness of the forgotten

“There is not much to be said about the State of Goyaz. It is one of the few which has no railroad, the only one which has no steamships [...] Enclosed in the interior of the country with no maritime frontiers to place it in contact with its more advanced brothers - Goyaz enjoys the happiness of the forgotten [...] Exports from Goyaz in 1902 [...] cattle 60,216 (head), tobacco 156,367 kg and bacon 107,385 kg [...] one can see that development awaits the day when the railroad means that such obstacles disappear [...]” (DIAS, 1904, p. 491). (Note from the authors: roads rather than the railroads ended up eliminating the obstacles.)



## 7. The “wonder” drink: alcohol, Pro-Alcool and Canavialis

**A**t the end of the nineteenth century, sugarcane, which had been one of the symbols of the country, began to lose market share, and products such as coffee, cotton, cocoa and rubber came to form the basis of the Brazilian economy. However, contrary to what might be supposed, this did not mean a decrease in the sugar crop; the decreasing relative share merely masked production, which was growing daily.

In the 1920s in the state of São Paulo, over-production of coffee along with the 1929 crash led to the decline of the coffee producing economy, further driving the increase in areas occupied by sugarcane. Subsequently the surge in mills and refineries occurred, motivated by the need to modernize the production complex to meet the growth in exports and the favorable exchange rate policy. At this time, the infestation of sugarcane plantations by mosaic (a disease caused by a virus) intensified the research at some institutions, such as the Agronomical Institute of Campinas (IAC), which was responsible for the development of new resistant varieties, that were rapidly incorporated into the production system.

The expansion of sugarcane production also took place in the Northeast. The mills there, principally in the states of Pernambuco and Alagoas, were responsible for a large part of the Brazilian exports. In this growth scenario, the Sugar and Alcohol Institute was set up (IAA) by the Vargas government in 1933 with the objective of controlling sugarcane production and mitigating the risks of possible over-production. The IAA supervised the mills after production levels were set defining the amount of sugarcane and alcohol to be produced by each mill, as well as encouraging consumption. The introduction of new equipment and other modifications was also regulated by means of authorizations from the IAA.

During the Second World War (1939–1945), production of alcohol fuel and sugar was encouraged in the country in the attempt to minimize the difficulties of gasoline distribution and supply, which resulted in the growth of the sector in the São Paulo region. Later on, motivated by the low price of sugar and mainly by the oil crisis, which led to a trade balance deficit, the country sought an alternative source of energy with the production of alcohol to

reduce the economy's dependence on fossil fuels. (The downturn in the economy with the sharp rise in oil prices represented an increase from 22.7% to 44.5% in the cost of oil imports.)

It was then that the National Alcohol Program, Pró-Álcool, was set up, to stimulate the production of alcohol from any raw material and to meet the demand of the domestic and overseas market and automotive vehicle fuels policy. Sugarcane was the species chosen because of its high return per planted hectare. But cassava and sweet sorghum were also evaluated, among other species. The high point of the program was in the 1980s when, driven by the second oil crisis, the country's production reached 12.3 billion liters and the sale of small cars fueled by alcohol reached the level of 95.8% of total sales of vehicles in the domestic market. However, in 1986 this situation was drastically altered when the price for a barrel of oil fell abruptly on the international market, resulting in stagnation of the Pró-Álcool program.

The fall in the amount paid to the alcohol producers along with the fall in the price of oil put a stop to the increase in domestic production of the product. However, although there was a disincentive to produce alcohol, the demand for ethanol was rising due to the lower tax on alcohol-powered vehicles in comparison with those fueled by gasoline. This combination generated a supply crisis between the harvests of 1989–1990, with a redefinition of the project being necessary in the subsequent years. That redefinition



*Alcohol production factory. Brazil is currently the world's largest producer of ethanol obtained from sugarcane.*

took place thanks to the introduction of the MEG mixture into the market, which was 60% hydrated ethanol, 34% methanol and 6% gasoline, which replaced hydrated alcohol, thus supplying the market over the coming years.

In this period, the IAA was abolished and a period of deregulation of the sector began, with the loosening of rules about exports and prices of sugar and of alcohol. Thus, the sugarcane sector came to be self-regulated, and later organizations such as the Bolsa Brasileira de Álcool Ltda. (BBA) were set up, consisting principally of the private sector.

The sugar-alcohol sector is currently undergoing a time of great expansion, principally due to the search for alternatives to petroleum-based fuels, which has again become intense. Sugarcane crops occupy an area of more than 5,400 million hectares and annual production is more than 375 million tons, thus making Brazil the world's largest producer of alcohol.

Given this situation, one can see the extreme importance of continuing to invest in research. In this scenario, two companies came into being, Alellyx, focused on genome research and more specifically in bioengineering of sugarcane, eucalyptus and oranges, and CanaVialis, which is set to become the world's largest private company working on sugarcane improvement.

The first company, Alellyx was founded in 2002 by researchers from universities in São Paulo state, with part of the shares also being held by Votorantim Ventures, now known as Votorantim Novos Negócios. Its initial focus was on the development of knowledge generated by the genetic mapping of the bacteria *Xylella fastidiosa*, which causes the disease known as "amarelinho" which attacks orange orchards. (The name Alellyx was created from the word *Xylella* read back to front.) This event, celebrated as the "greatest Brazilian achievement in recent times", was the result of research as part of the Genome Project, financed by the Federal government and by the São Paulo state government through the São Paulo State Research Support Foundation (FAPESP).

The second company, CanaVialis, was founded in March 2003 by a group of researchers from the Sugarcane Genetic Improvement Program from the Federal University of São Carlos, also with investment from the Votorantim group, and similarly with state and federal financial backing, with the objective of becoming the largest provider of genetic solutions to the global sugar and alcohol sector.

Both companies thus had their beginnings in public research with strong governmental subsidy in the form of non-refundable investment, as these are Brazilian companies involved in research of strategic national interest. Research and Project Financing (FINEP) and the National Economic and Social Development Bank (BNDES) continue to financially support the research projects of the two companies after they were consolidated. This was no barrier to their later being acquired by Votorantim Novos Negócios, which is a capital risk fund of the Votorantim group.

Then in November 2008, the US company Monsanto paid about US\$ 290 million for the operations of the two companies, Alellyx and CanaVialis. The deal allowed the multinational to diversify its agricultural portfolio and also, according to the company, took into account the potential of sugarcane for ethanol production.

There is nothing new about the interest shown by countries such as the USA in Brazilian technology for large scale alcohol production from sugarcane and in obtaining transgenic cultivars of sugarcane adapted to the climatic conditions. This explains the purchase of Alellyx and CanaVialis by Monsanto, a deal which started and was made public in 2007, when the Votorantim group announced a “technology partnership” with the multinational.

The current research carried out by the two companies may have ceased to be subsidized by the state after the acquisition by Monsanto, but the fact is that two companies created through enterprising efforts by Brazilians and with assistance from the Federal and São Paulo State governments, with activities in strategic areas for the country’s scientific and technological development, and holding innovative knowledge, ended up changing owners and are now the property of a foreign multinational known for its aggressiveness in the transgenic business.

## “Wonder drink”

interpretation by Inezita Barroso, composition by Ochelsis Laureano

Inezita Barroso, singer, folklorist actress and presenter of programs and shows, was born in 1925 in São Paulo. A lover of national culture and Brazilian music, Inezita started to sing and play the guitar and viola at the age of seven. She became a professional singer in the 1950s and to this day is one of the greatest singers of our genuinely hillbilly music. The song “Marvada Pinga,” whose lyrics are transcribed below, is a song richly interpreted by Inezita, a true monument in Brazilian music.

With the wonder drink  
 I come unstuck  
 I go to the store and give my dime  
 Take the cup and don't leave  
 I drink it right there  
 And right there I fall down  
 Only to be carried do I give any trouble  
 Oy la  
 I come from town and come singing  
 Bringing a bottle, sipping  
 I come by the paths, come stumbling, bumping  
 into the sides, come falling over  
 And in the place where I fall I stay snoring  
 Oy la  
 My husband told me, said to me: “leave the drink,  
 I ask you please”  
 I never gave weight to men's talk  
 I drink with hot sweat to cool the heat  
 And I drink of a night to make me sweat  
 Oy la  
 Each time I fall, I fall differently  
 Stumble backwards and fall forwards, fall slowly,  
 fall  
 suddenly, in a whirl, go directly  
 But with rum, I fall contently

Oy la  
 I take the bottle and shake it to see  
 if it's really full  
 I don't drink at one go 'cuz I think that's ugly  
 At the first gulp I get halfway  
 An' at the second swig that's when I empty  
 Oy la  
 I drink the rum 'cuz I likes it  
 I drink the white, drink the yellor  
 Drink from a cup, drink from a tumbler  
 And I drink spiced with clove and cinnamon  
 Whatever the time, it's rum down the hatch  
 Oy la  
 S'wonder drink!  
 I went to a party on the River Tietê  
 I went arriving at dawn  
 They gave me some rum for me to drink  
 They gave me some rum for me to drink and  
 t'wasn't hot  
 I drank too much and got drunk  
 I fell on the floor and stayed lyin' down  
 And then I went home arm in arm  
 Arm in arm, there with two soldiers  
 Ay thank you very much!



## 8. Precision in agriculture: high technology to produce and preserve the environment

The advances in the various basic and applied sciences in the last 150 years have enabled greater knowledge of the soils, plants and environment, and as a consequence there have been radical leaps forward in the development of agriculture.

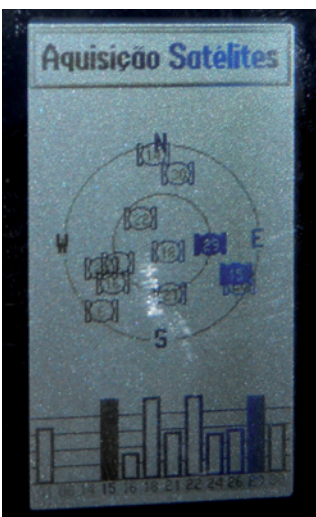
Possibly three of these leaps are associated with the development and better understanding of chemical fertilizers, with plant and animal improvement that creates new strains and types, and with pesticides, which when used rationally can be efficient weapons in fighting pests and diseases.

More recently, the understanding of the workings of the smallest particles of our genetic code, the genes, has enabled detailed knowledge of the genetic inheritance of plants and animals.

Biotechnology, as a set of tools that supports the development of agriculture, is here to stay: molecular markers help the development of new strains; immunological techniques such as ELISA (“Enzyme Linked Immuno Sorbent Assay”), an immunoenzymatic test, help pathologists detect the presence of pathogens in animals and plants; tissue culture is used with various crops, from garlic to eucalyptus, for the multiplication of plants in vitro.

GPS, Global Positioning Systems, are used with combine harvesters to map the productivity of areas of farm land, allowing more rational fertilization, reducing excess use, avoiding unnecessary waste and doing less harm to the environment.

Artificial intelligence programs are used to diagnose problems in animal and plant production. Numerous meteorological satellites sweep the globe, helping improve the understanding of the weather and of the climatic risks to production. Minimization of risk for the producer by means of agricultural zoning studies, where the suitability of the properties and range of biological options define what to produce, where and when, are an important goal pursued by small, medium and large-sized farmers.



*GPS device capturing satellite signals. In the photo below, amplified images from the device's display.*

High technology and the speed of information flow in this twenty-first century are very impressive: Brazil now has almost one cell phone per inhabitant! This high technology, when coupled with the generation and use of high quality information, allows producing more using less, which preserves the environment that has been so mistreated during the centuries of colonization. Being efficient means producing more with less: less fertilizer, less water, less labor, less area.

With the advance of science and of technology it is impossible to foresee which new products, instruments, methods and machines will be helping agriculture to be more and more precise in the use of resources that are scarce today and will be even more critical to the survival of humanity tomorrow. Producing sustainably is the obligation of this generation towards future generations. This is not an option; it's mandatory.



*Meeting of the waters of the Negro and Solimões rivers in a satellite image.*

## GPS, satellite, sensors, zoning and public policies

An important set of technical innovations has been made available in recent years with a positive and increasing impact on agricultural development. GPSs with sub-meter precision, satellites sensors allowing the acquisition of precise, frequent and almost instantaneous information about large areas of the planet, the combination and the superimposing of information allowing the definition of the most suitable areas for a given end, with minimization of risks – so-called zoning – are technologies, products and knowledge available to everyone, or almost everyone, mainly via the internet.

The satellites used can be grouped in different ways, for example by resolution (spatial, spectral and temporal) and by application (positioning, meteorological, for natural resources etc.). SPOT (Satellite Pour l'Observation de la Terre) and LANDSAT, the EROS, GOES, GALILEO satellites and so many others (<http://www.sat.cnpq.embrapa.br/>) with a huge number of sensors come together in an ever increasing set of acronyms that give an idea of the progress of the sector: Thematic Mapper (TM); Advanced Very High Resolution Radiometer (AVHRR); Moderate Resolution Imaging Spectroradiometer (MODIS); Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER); Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM); Synthetic Aperture Radar (SAR); Phased Array type L-band SAR (PALSAR); Tropical Rainfall Measuring Mission (TRMM); Global Precipitation Measurement (GPM); Advanced Microwave Scanning Radiometer (AMSR-AND); and Atmospheric Infrared Sounder (AIRS).

However, it's the technologies that do not depend directly on biology or on electronics which really make the big and lasting changes in a region or country. Better educated, better organized societies, with respected rights and laws applied with justice make up part of a set of social and organizational "technologies" that enable a society to progress.

Coherent public policies which are fair, transparent and efficient are essential for staying on the proper course, reducing inequalities of any kind, creating and strengthening a modern and democratic society. There are many public policies for the agricultural sector favoring development in poorer areas such as in the Northeast, supporting the preservation of the environment in the Amazon, protecting consumers by guaranteeing the quality of products, minimizing risks to the producer by means of zoning, where agricultural suitability and the range of biological options define what to produce, where and when – linking public credit to agri-ecological zoning etc. Sometimes public policies have an unexpected effect, and actually backfire. Nevertheless, that should not serve to discredit public policies, but rather to adjust them as soon as possible and, in the worst of cases, to serve as a demonstration of a historical mistake not to be repeated in the future.

The "authorization" given by the top authority in Brazil of the nineteenth century, Dom João VI, with the royal letter of instruction ("Carta Régia") dated November 5, 1808, of the decision to go to war against the indigenous people is a good example of an absurd public policy which should never, ever, be forgotten. Among other topics, this document stated: "[...] the worthy results also being likewise present of the measures against the Botocudos, and it becoming ever clearer to me that there is no way of civilizing barbarous peoples other than putting them into a severe school [...]; [...] from the moment in which this Carta Régia is received, thou shalt consider as the beginning of war against these barbarous Indians [...]" A tragedy that has not yet terminated; a part of history that we have not yet learned, despite the 200 years since [...]



## 9. From the Law of the Minimum to sustainability

**A** Starting in the 1960s, various movements arose promoting a return to a more natural agriculture, as practiced before the nineteenth century, with less dependence on pesticides and in some cases less equipment. There are many reasons to explain this “return”, from environmental concerns to beliefs of a personal nature.

The German chemist Justus von Liebig is considered to be the father of agricultural chemistry and the fertilizer industry. Among his most notable discoveries are important conclusions about the sources and roles played by nutrients in the plant, fertilizer recommendations based on chemical analysis of plants, and the Law of the Minimum. After his discoveries, the chemical fertilizer industry began to develop and had a direct effect on the way foods are produced. To this day, all farmers recognize the letters NPK on the sacks of chemical fertilizers, discovered by Liebig.

In Brazil, this change can also be seen in the gradual evolution of the agricultural techniques described in horticulture manuals published between 1820 and 1930, especially in chapters devoted to fertilizing and to pest and disease management. One good example is the book “Manual do Horticultor,” by L. Granato, published in 1928, which can be seen as a landmark in the transition from organic to conventional horticulture.

The change in the production of vegetables, which was once based mostly on empirical methods, with organic fertilization using various types of manure to production with chemical fertilizers, took place basically because of the need to increase production to supply the city of São Paulo, already in full growth. Until then, the production of vegetables had been organic (without actually using this name), due to the lack of chemical means now used in conventional farming, such as chemical fertilizers, pesticides and growth regulators, as well as hybrid seeds and other modern growing techniques.

In the introductory chapter (Chapter II – “Summary and Importance of Horticulture in São Paulo”), Granato describes how

in the 1920s, São Paulo was already a large consumer center of vegetables, importing garlic, onions, preserved vegetables and tomato paste through the port of Santos. As there was no efficient means of storage or refrigeration, preserves were fundamental in order to have vegetables throughout the whole year. The city also imported grapes, pears, apples, nuts, hazelnuts, almonds, walnuts and “other unspecified dried and fresh fruits.” Much of the production was in the “greenbelts” around the city, which according to the author, “reached hundreds of hectares.” Thus, says Granato:

*The price of fruits and greens is extremely high in São Paulo, so much so that workers can hardly afford cheaper greens as they can in other countries.*

[...]

*Also enormous, extremely enormous, is the importing of table fruits, which increases by the day. It is not beyond the scope of this book to talk about this matter, because the fruit growing and horticulture of a country go hand in hand, which is to say the progress of one stimulates the evolution of the other.*

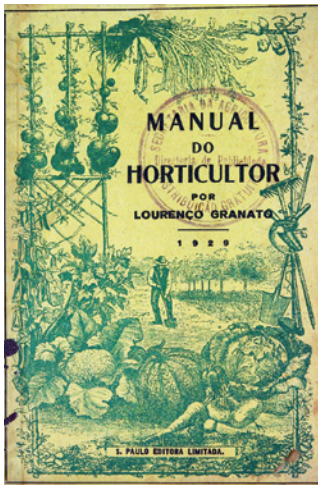
[...]

*The large consumer centers of vegetables are no longer satisfied with the production of common vegetables. They demand horticulture carried out on a large scale and thus arises the need for large scale horticulture, industrial horticulture where many thousands of cabbages, kale, peppers, tomatoes, garlic, onions and many other species are grown.*

In Chapter X – “Fertilizers and Fertilizing the Market Garden,” the same author begins by saying that:

*Farmers think that manures are the only kind of fertilizer, and this type of fertilizer should only be used when they do not accept garbage which, as we have mentioned other times, must be excluded from the practice of fertilization when it can not be suitably sterilized.*

*Thus well cured manure is precious in fertilization, but the exclusive use of this fertilizer does not afford the farmer the greater profits to which he aspires.*



Book from 1929 teaching farming practices before the chemical fertilizers and pesticides that are now widely used in agriculture became available. At that time, however, organic farming was not yet spoken of, which is a more recent concept, although its practice was predominant.

*To comprehend that manure by itself does not satisfy the requirements of the plants, it should be sufficient to cite the chemical composition of some vegetables.*

*Quite rightly manure is the ideal fertilizer for vegetables because of its richness in organic matter, but mineral fertilizers are of very essential effect to complete the fertilization formulas advisable in the growing of various species of vegetables.*

It is also worth highlighting chapter XV of the book – “Friends and Enemies of the Farmer” – in which various techniques now known as organic farming were already in current use. The farmer’s “friends” of that time were the insect eating birds, the tailless amphibians, bats and all those insects that invade the vegetable gardens. The troubles and parasites of the plants were controlled with preventive measures such as destroying and burning attacked plants, not using the seeds of attacked plants, and rotating crops, among others. Fungicides and insecticides were already being sold, but the indication was to prepare the fungicide liquids domestically, such as the Bordeaux mixture, the Bologna mixture and other copper-based preparations. The most used insecticides were kerosene emulsion, rainwater, and pieces of soap, with the due precautions because of the toxicity to shoots and sprouts; nicotine mixtures obtained from the residues of tobacco factories; unslaked lime for slugs and snails; and ashes.

## **Sustainability: an old theme still in fashion**

The concern with sustainability is nothing new. In the Old World, Marcus Terentius Varro (1<sup>st</sup> century BC), in *Re-rum Rusticarum*, wrote to his wife that “agriculture is a science which teaches us which species must be planted in which type of soil and which operations must be carried out so that the earth produces the maximum of fruits in perpetuity.” (In Latin: *Agri cultura est scientiae, quae sint in quoque agro serenda ac facienda, quo terra maximos perpetuo reddat fructus.*) Perpetual production of fruits in different environments has in practice been a dream of mankind to this very day. Whole civilizations have disappeared precisely because they have not taken due care of the basis that guarantees this sustainable production: soil, water and other natural resources.

In Brazil, one of the oldest references to environmental degradation, if not the oldest, was by F. Cardim in his “*Narrativa Epistolar*” (1585–1590), when describing what happened in São Vicente, São Paulo: “S. Vicente is a province [...] it was rich, and now is poor in having closed the sea port and the old sandbar, where Martim Affonso de Souza entered with his fleet, and also in the lands being worn out [...]” (CARDIM, 1847). The environmental and economic damage, whether due to silting or the extraction and non-replacement of nutrients in the soil, is a very good example in this narrative of the little that was done, and of the little that is still being done, regarding the proper use of natural resources in order to guarantee the sustainability of production for future generations of Brazilians.

## Destruction for construction? The soil as a perpetual natural resource

The exploitation of the soil in Brazil since the time of colonization has largely sustained the country's development. This exploitation, however, was almost always predatory. That is to say it exhausted the productive capacity of the soil with little or no concern about preserving its physical and chemical structure, its minerals and organic matter. This loss was also almost always ignored in the accounting of production costs, with harmful consequences for the sustainability of farming activities. A current example will help in understanding the problem better, as follows.

João Augusto is a farmer who produces 10 tons of corn on each hectare he grows. For each hectare planted, João has a cost, which is the sum of the amount spent on labor, fertilizers, seeds, pesticides and fuel (variable costs) and also on the amount spent on taxes, insurance, depreciation of machines and buildings (fixed costs). Thus, if João spent R\$ 10,000 (sum of the fixed and variable costs) to produce one hectare and he was able to sell the 10 tons of his product for R\$ 20,000 (gross revenue), his profit was of R\$ 10,000. However, because of inappropriate farming practices, his area became unproductive after each two years of growing, and in order to carry out the planting the next year, João opens up a new area, occupied by native vegetation and which when cultivated using the same unsuitable techniques, will also be productive for just two years.

This means that João does not calculate or pay for all of the costs of the resources he has effectively used to produce the 10 tons of corn, since the land is degraded as it produces. The resources that were in fact consumed in production are greater. In this case, a portion of the production costs – the portion pertaining to the fertility of the soil that was consumed – is not paid for, and thus João, the businessman, accumulates more resources to invest in the growth and technological development of his farm only for a certain amount of time.

Similarly, at the start, the great cycles of sugarcane and coffee in Brazil kept using up the natural fertility of the soils of the forests and farmers migrated to new areas when this natural fertility was exhausted. In the colonial period, the traditional system of coffee production in Brazil included clearing the forest, burning timber and planting the deforested areas. The natural fertility of the soil was exploited for twenty or thirty years and after this period, the productivity generally declined below what was considered useful, and the areas were then abandoned and left as pastures and for cattle. At that time, the practice of "clearing and burning" had consumed most of the virgin forest of the state of São Paulo.

Seen from this angle, the degradation of the soil seems to be beneficial. However, the costs deriving from the exploitation of the soil over the long term are paid by everyone, whether directly through the loss of fertile soils or indirectly through the possible influence of environmental imbalances, although the profit obtained from the exploitation, in general, is restricted to a small portion of the population. This becomes even more serious when one considers that the fertility of the soils is a finite resource and that as it takes thousands of years for it to be built up; it is basically a non-renewable resource, which means that the consequences of its consumption may affect future generations.

The loss of soil fertility after the conversion of the native eco-system to agriculture is directly linked to the loss of the soil's organic matter, which is one of the most important indicators used to measure the quality of the soil. The whole Earth stores approximately 1,500 Pg (1.0 Pg =  $10^{15}$  g) of carbon (C) in the organic matter of the soil down to one meter in depth, and another 600 Pg in vegetation, which when added together are equivalent to 3 times the amount of carbon contained in the atmosphere. Thus, the releasing of C from the vegetation and/or from the soil may be one of the sources of greenhouse affect gases into the atmosphere, such as CO<sub>2</sub> (carbon dioxide) and CH<sub>4</sub> (methane). However, there are techniques which can be adopted to maintain or even increment soil fertility, such as direct planting, crop rotation and green fertilizers, among others. Thus, using knowledge of the ecological bases and applying conservationist techniques, agriculture may continue to develop without compromising the possibility of meeting the needs of the coming generations.

## 10. A new portrait of Brazil: From the countryside to the city?

**7**he urbanization process in Brazil began soon after its discovery, with the foundation of the village of São Vicente on the coast of São Paulo in 1532. Salvador, the first Brazilian city, was founded in 1549. In the following centuries, small settlements were founded at various spots on Brazilian territory, whenever there was any economic activity in the region.



*Retirantes [Fugitives from the Droughts]. Painting by Candido Portinari. (Oil paint on wood, 1958)*

The mining cycle in the eighteenth century led to the first spurt of urbanization. Mining was the reason for the transfer of the capital of the colony – at that time belonging to Portugal – from Salvador to Rio de Janeiro in 1763, and for the displacement of the productive center from the sugar producing Northeast to the gold-bearing Southeast, which gave rise to countless villages and towns, such as Vila Rica, Mariana, São João d’El Rei, Diamantina, Cuiabá and others. It can be said that this movement promoted economic expansion for the interior of Brazil.

The urbanization process intensified starting in the twentieth century, with various major internal migratory movements and influxes of immigrants from various countries (Japan, Italy, Holland, Germany, Arabic countries), which contributed to integrating the work market. Rapid urban growth was seen from 1920 onwards, when the urbanization rate was 16%.

In 1940, only 31% of Brazilians lived in cities, versus 69% who lived in rural areas, being dependent primarily on farming. From the 1950s onwards (see table), the process of urbanization gained strength with the industrialization and modernization of farming activities. In 1960, the rate of urbanization had risen to 45%, and by 1980, 67.5% of Brazilians were living in cities and just 32.5% in rural areas. In the 1990s, Brazil’s regions had the following urbanization rates: Southeast, 88%; Central-West, 81%; South, 74.1%; Northeast, 60.6%; North, 57.8%. In 2005, 85% of the Brazilian population lived in urban centers.

Unlike Europe, which became urbanized starting from the nineteenth century driven by the industrial revolution, Brazil only became an urban country in the second half of the twentieth century, when more than 50% of its population came to live in the cities. The acceleration of this urbanization process was motivated by various factors, notably the intensification of the industrialization process in Brazil after 1956, as a consequence of the “developmentalist policy” of the Juscelino Kubitschek government. With the moving of the capital from Rio de Janeiro to Brasília, the axis of urbanization also underwent a considerable displacement towards the central region of the country.

As expected, this process accentuated the exodus of rural populations to the urban centers, a movement which had already begun with the mechanization of the countryside and the expansion of commodities production (mainly soybeans and meat). As a consequence, there is also a process that is still underway involving the reorganization of physical

### Rate of urbanization (%) of the regions in Brazil.

Region	1950	1970	2000
Southeast	44.5	72.7	90.5
Central-west	24.4	48.0	86.7
South	29.5	44.3	80.9
North	31.5	45.1	69.9
Northeast	26.4	41.8	69.1
<b>Brazil</b>	<b>36.2</b>	<b>55.9</b>	<b>81.2</b>

production space, the urban occupation of areas that were previously dedicated to farming, the expansion of agricultural frontiers, with arable land becoming more expensive closer to urban centers, the reduction of permanent labor in the countryside, the increase in numbers of temporary workers used on farms (recruited in the cities principally during the harvest periods), and the worsening of social problems, notably on the peripheries of cities and in the areas of healthcare, education and transportation infrastructure.

The revaluation of the small property and its products, the increased number of settlements, the rediscovery of the value of life in the countryside, the idyll of the countryside versus the city, and many other social and economic factors will redraw our countryside of tomorrow. In a hundred years, a new socio-economic distribution of the rural space will be a reality. Certainly, it will be a new perspective on this rich history of agriculture in Brazil.

## Principal references of Part II

A CEPLAC. Available at: <<http://www.ceplac.gov.br/paginas/ceplac/ceplac.asp>>. Accessed on: 29 Nov. 2009.

ALBUQUERQUE, R. H.; ORTEGA, A. C.; REYDON, B. P. O setor público de pesquisa agrícola no Estado de São Paulo: parte I. **Cadernos de Difusão de Tecnologia**. Brasília: Embrapa, v. 3, n. 1, p. 79-132, Jan./Apr. 1986.

AMARAL, L. **Historia geral da agricultura brasileira**. São Paulo: Companhia Editora Nacional, 1939. 2 v.

BATISTELLA, M.; CRISCUOLO, C.; BOLFE, E. L. Satélites de recursos naturais como suporte à gestão ambiental. In: BATISTELLA, M.; MORAN, E. F. (Org.). **Geoinformação e monitoramento ambiental na América Latina**. São Paulo: SENAC, 2008. p. 21-52.

CAPDEVILLE, G. O ensino superior agrícola no Brasil. **Revista Brasileira de Estudos Pedagógicos**. Brasília, v. 72, n. 172, p. 229-231, Sept./Dec. 1991.

CARDIM, F. **Narrativa epistolar de uma viagem e missão jesuítica**. pela Bahia, Ilheos, Porto Seguro, Pernambuco, Espírito Santo, Rio de Janeiro, S. Vicente (São Paulo) etc. Lisboa: Imprensa Nacional, 1847. 123 p.

CERRI, C. E. P.; FEIGL, B. J.; CERRI, C. C. Dinâmica da matéria orgânica do solo na Amazônia. In: SANTOS, G. A.; SILVA, L. S.; CANELLAS, L. P.; CAMARGO, F. A. O. **Fundamentos da matéria orgânica do solo: ecossistemas tropicais e subtropicais**. Porto Alegre: Metrópole, 2008. chap. 20, p. 325-358.

COSTA, A. L. Extensão rural e meio ambiente. In: **Revista Eletrônica do Mestrado em Educação Ambiental**. Fundação Universidade Federal do Rio Grande, v. 7, Oct./Nov./Dec. 2001. Available at: <<http://www.remea.furg.br/mea/remea/vol7/adriane2.pdf>> Accessed on: 12 May 2010.

DIAS, A. **O Brazil Actual**: informações geográficas, políticas e comerciais. Rio de Janeiro: Imprensa Nacional, 1904. 501 p.

FRANCO, J. L. A. **Proteção à natureza e identidade nacional: 1930-1940**. 2002. 52 f. Tese (Doutorado em História) – Universidade de Brasília, Brasília, DF, 2002.



FRANCO, J. L. A.; DRUMMOND, J. A. Frederico Carlos Hoehne: a atualidade de um pioneiro no campo da proteção à natureza no Brasil. **Ambiente & Sociedade**, v. 8, n. 1, p. 1-27, Jan./Jun. 2005.

GRANATO, L. **Manual do horticultor**. São Paulo: São Paulo Editora, 1929. 276 p.

HOEHNE, F. C. **Botânica e agricultura no Brasil no Século XVI**. São Paulo: Companhia Editora Nacional, 1937. 410 p.

LOPES, A. S.; GUILHERME, L. R. G. Fertilidade do solo e produtividade agrícola. In: NOVAIS, R. F.; ALVAREZ, V. H.; BARROS, N. F.; FONTES, R. L. F.; CANTARUTTI, R. B.; NEVES, J. C. L. (Ed.). **Fertilidade do solo**. Viçosa: Sociedade Brasileira de Ciência do Solo, 2007. chap. 1, p. 1-64.

MINISTÉRIODAAGRICULTURA. **O cooperativismo e a actuação da diretoria do serviço de inspecção e fomentos agrícolas**. Rio de Janeiro: Typographia do Ministério da Agricultura, 1932. 134 p. ➡

MIRANDA, A. T. **Conseqüências e características das cidades**. Available at: <<http://educacao.uol.com.br/geografia/ult1701u57.jhtm>>. Accessed on: 12 Dec. 2009.

MOLINA, R. S. História da educação agrícola paulista: os projetos privado e estatal para a Escola Prática de Agricultura de Piracicaba (ESALQ/USP), 1891 a 1910. In: SEMINÁRIO NACIONAL DE ESTUDOS E PESQUISAS "HISTÓRIA, SOCIEDADE E EDUCAÇÃO NO BRASIL," 8., 2009, Campinas, SP. **Anais...** Campinas, SP: FE/UNICAMP; HISTEDBR, 2009. p. 113.

OCB. Organização das Cooperativas Brasileiras. Available at: <[http://www.ocb.org.br/site/brasil\\_cooperativo/index.asp](http://www.ocb.org.br/site/brasil_cooperativo/index.asp)>. Accessed on: 12 Dec. 2009.

OLINGER, G. **Ascensão e decadência da extensão rural no Brasil**. Florianópolis: EPAGRI, 1996. 523 p.

PROÁLCOOL. **Arquivo Veja**. Available at: <[http://veja.abril.com.br/arquivo\\_veja/proalcool-alcool-etanol-geisel-petroleo-carros-flex-economia-exportacao-cana-de-acucar.shtml](http://veja.abril.com.br/arquivo_veja/proalcool-alcool-etanol-geisel-petroleo-carros-flex-economia-exportacao-cana-de-acucar.shtml)> Accessed on: 11 Oct. 2009.

PROÁLCOOL – História da indústria sucroalcooeira. **Revista Biodieselbr**. Available at: <<http://www.biodieselbr.com/proalcool/>>

historia/proalcool-industria-sucroalcooeira.htm> Accessed on: 10 Oct. 2009.

PROÁLCOOL – Programa Brasileiro de Álcool. **Revista Biodieselbr**. Available at: <<http://www.biodieselbr.com/proalcool/pro-alcool.htm>> Accessed on: 10 Oct. 2009.

RODRIGUES, C. M. A pesquisa agropecuária federal no período compreendido entre a República Velha e o Estado Novo. **Cadernos de Difusão de Tecnologia**. Brasília, Embrapa, v. 4, n. 2, p.129-153, May/Aug. 1987a.

RODRIGUES, C. M. A pesquisa agropecuária no período pós-guerra. **Cadernos de Difusão de Tecnologia**. Brasília, v. 4, n. 3, p. 205-254, Sept./Dec. 1987b.

RODRIGUES, C. M. Gênese e evolução da pesquisa agropecuária no Brasil: da instalação da corte portuguesa ao início da república. **Cadernos de Difusão de Tecnologia**. Brasília, Embrapa, v. 4, n. 1, p. 21-38, Jan./Apr. 1987c.

SEBRAE. **Catálogo das indicações geográficas brasileiras**. Brasília: SEBRAE, 2010. 60 p.

SERRA, A. C. Q. **Fruticultura irrigada nos estados de Pernambuco, Bahia e norte de Minas Gerais**. Fortaleza: Banco do Nordeste, 1999. 86 p. (Série de Estudos Setoriais, 7). Available at: <[http://www.bnb.gov.br/content/Aplicacao/ETENE/Rede\\_Irigacao/Docs/Fruticultura%20irrigada%20nos%20estados%20de%20PE%20BA%20e%20MG.PDF](http://www.bnb.gov.br/content/Aplicacao/ETENE/Rede_Irigacao/Docs/Fruticultura%20irrigada%20nos%20estados%20de%20PE%20BA%20e%20MG.PDF)> Accessed on: 5 Oct. 2009.

SILVA, S. D. Um outro olhar sobre o lugar: a Cang no tempo da fronteira. **Sociedade e Cultura**, v. 5, n. 1, p. 65-79, 2002.

SOJA no Brasil. In: EMBRAPA SOJA. Available at: <<http://www.cnpso.embrapa.br/producaosoja/SojanoBrasil.htm>> Accessed on: 24 Nov. 2009.

### A new vision?

One of the objectives of this book has been to highlight the importance of the history of agriculture in today's food production and consumption patterns, recovering parts of this history which are not easily found or which have been forgotten or neglected, but which have had a large impact on what we are today. With the reading of the book, or of some of its chapters, our hope is that you, the reader, will now have a new outlook. Could that be the case?

Recognizing the richness of our agricultural history, the coming and going of development, the influences we have received from so many native and foreign groups, the things we got wrong and the things we got right – and are still getting – all this has ended up turning Brazil into a global agricultural powerhouse. A critical appreciation of the history presented in this publication also helps us to think about tomorrow.

The cycles that came and went, such as that of rubber, indicate that the current cycle of soybeans, cattle and sugarcane will one also come to an end. What will our agriculture be like in fifty years, or in a hundred years? What will the leading products be? Will agriculture have the importance it has today and it has had in the past?

The answer to many of these questions depends on internal and external factors, many of which will be beyond our control. Public policies, global warming, globalization, agricultural subsidies and population growth are some of the elements that will leave strong marks on the agriculture of tomorrow.

The historical aspects reported in this book clearly show that many people built the agriculture of twenty-first century Brazil. Indians, Europeans, Africans, farmers, traders, religious people, researchers, politicians, consumers, the curious – all have shared and continue to share some of historical responsibility. We believe that the reader of today will also share some. For this reason, it is essential that the contribution which each of us can make – on the farm, in school, at the market, in business, at the university, in

government, at home – must really be done in such a way as to build a better world.

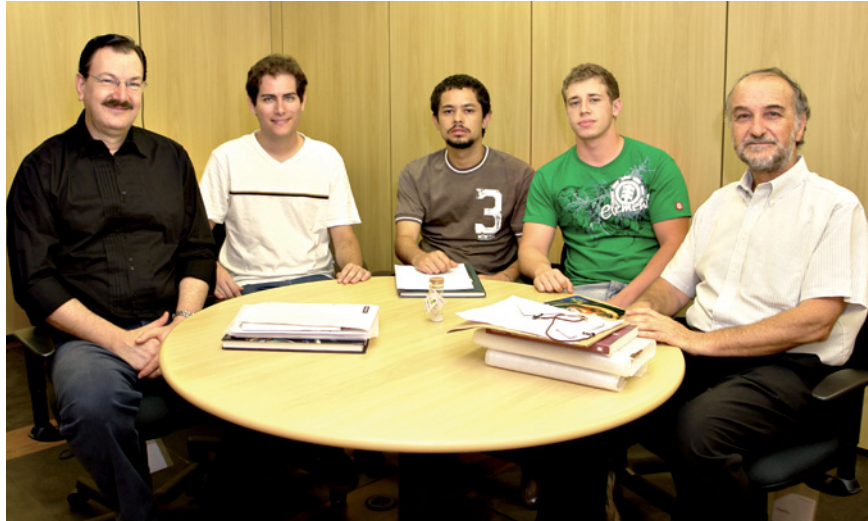
Start today to write your contribution to the future history. Do not ask yourself, *what does this have to do with me?* Make it happen. Make your new vision into a reality.

The authors.



**Timeline of events related to the history of agriculture in Brazil**

# Authors



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I was born in São Paulo state, raised in Rio and Brasiliense at heart. I graduated in Agriculture, against the will of my father, from the University of Brasília (1975), later concluding my doctorate in Phytopathology at the University of Wisconsin, Madison (1979). I have worked mainly with phytopathology and plant breeding, concentrating my efforts on the development of disease resistant vegetables. As a result of working on a team of dedicated professionals, I have launched a variety of vegetable strains and hybrids and published books and various articles in Brazil and abroad. I founded the journal *Horticultura Brasileira* and was the first president of the journal's Editorial Commission, a post I held for several years until I passed the baton to the co-author of this book, Dr. Gilmar P. Henz. I have always been interested in the professional training of the coming generations of technicians and scientists and have therefore taught and guided students from various universities in Brazil and abroad (University of Brasília, Cornell University and others). In 2001, I coordinated the production of a book on chilies and peppers ("*Capsicum*; pimentas e pimentões do Brasil"), which was awarded the prestigious Jabuti Prize. Years earlier, I received the highest recognition from Embrapa for my contribution to the development

of Brazilian agriculture, the Frederico de Menezes Veiga Prize, which left a profound impression on me. In 2009, I received the “Dr. Alvaro Santos Costa Boot” prize, from the Brazilian Phytopathology Society. Besides technical and scientific contributions, I have been involved in research management practically since the start of my career. At Embrapa, I was technical director and director general head of the National Vegetables Research Center. From 1991 to 1995, I worked in Rome at the Investment Center of the FAO/World Bank Cooperation Program. And from 2001 until April 2007, I was director (CEO) of the Consultative Group on International Agricultural Research (<http://www.cgiar.org>), at the World Bank in Washington, DC, USA. I decided to return to Brazil in 2007 and once again work directly in research and in student supervision at Embrapa, as well as contributing as adviser to the director-president of Embrapa and special adviser to the Minister at MAPA. I take special satisfaction in leading pepper breeding projects (*Capsicum*), financed by CNPq, Embrapa and the private sector, and in exploring new formulas of work and new products, such as this book.



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I was born in Chiapetta, which at the time was a small village in the municipality of Santo Ângelo, in the Missões region in Rio Grande do Sul. I went to school and high school in Ijuí, Rio Grande do Sul, where I also worked as a youth trainee at the Banco do Brasil. I studied Agronomy at the Federal University of Rio Grande do Sul (UFRGS) in Porto Alegre, Rio Grande do Sul, and did my master's and doctorate in Phytopathology at the University of Brasília (UnB). The move to the Federal District in 1983 and the ties to the UnB and to Embrapa have had a great impact on my professional life in a period where I have spent time with excellent professors and researchers. I worked as a researcher at Embrapa Vegetables from 1989 to 2010, where I dedicated myself to the study of diseases caused by fungi and bacteria in vegetables, and I have taken part in research projects in the areas of phytopathology, genetic improvement, post-harvest and food security. I have taken part in technical training at reputed institutions in Hungary, Peru, South Korea, Japan and Taiwan. I have taken part in international missions with the Brazilian Cooperation Agency (ABC) in Bolivia, Angola and Mozambique. I have experience in management, as assistant head of Communications and Business at Embrapa Vegetables (2004–2008) and management training from the Dom Cabral Foundation in Belo Horizonte, Minas Gerais. I have also dedicated myself to the area of technical and scientific publications, as chief editor of the journal *Horticultura Brasileira* (1994–1997), associate editor (2004–2010) and president of the Embrapa Vegetables Local Publications Committee (2004–2008). I am very interested in knowledge management and I have given various courses and talks on scientific writing. I have published five books, 18 book chapters and 40 scientific articles, either as editor or author. In 2010, I took on a new challenge in my professional career, as agricultural attaché to the Brazilian Embassy in Pretoria, South Africa, a post recently created by the Ministry of Agriculture, Livestock and Food Supply, where I have dedicated myself to matters of bilateral negotiations between agribusiness and technical cooperation agencies.



**Carlos Francisco Ragassi**

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I am from Jundiaí in São Paulo state and graduated in Agriculture (2006) from the “Luiz de Queiroz” Higher School of Agriculture, which is part of the University of São Paulo. During the course, I opted for subjects linked to biotechnology and, with a scholarship from the National Scientific and Technological Council (CNPq) for three years, I began my scientific research into functional genomics of sugarcane, the biological interactions between micro-organisms, and genetic transformation of citrus plants aiming provide resistance to diseases, with this latter topic being the focus of my end of course monograph. Soon after graduating, I got my master’s degree in Phytotechnics at the same school, where I worked on potato crops with scholarship from the Federal Agency for Support and Evaluation of Graduate Education (CAPES) and from the São Paulo State Research Support Foundation (FAPESP). Since December 2008, I have been working at Embrapa Vegetables in Brasília, DF, where I apply molecular markers to assist in the work of genetic improvement of vegetables.



**Uander Gonçalves dos Anjos**

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I was born in Mara Rosa, Goiás, but spent all of my childhood and part of my youth on a rural smallholding in the municipality of Formoso, northern Goiás, where I learned about the difficulties of living and surviving on the production of a smallholding. Life on the farm and the interaction with many people from the region meant that I learned about the richness of the Cerrado biome and principally about its usefulness. I developed a critical understanding about my environment, development factors and society. I did my basic schooling in Estrela do Norte, Goiás, and then went to Ceres, Goiás, to study at the then EAFCe, which is now the Ceres Campus of the Goiânia Federal Institute, where I did a technical course on Agribusiness and later on the Environment. In pursuit of professional growth, I applied for and was selected as trainee at Embrapa Vegetables, in Brasília, DF, where I have worked in research projects management. In parallel, I have studied with the objective of going to university. I am currently doing my second semester in Geography at the Federal University of Goiás, Goiânia, because of my interest in geography and public policies. I intend to specialize in this area so as to be able to help bring about change in the country so that we may all have a better Brazil.





**Rodrigo Montalvão Ferraz**

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I was born in Brasília, Distrito Federal, the city where I intend to live for the rest of my life. I have also lived in Killington, Vermont, in the United States, a period that was very important in my choice of profession. There I worked in various areas, from hotel management to catering service. I am studying Agronomical Engineering at the University of Brasília, a course which I chose without any great conviction at the time, but I am now fully satisfied with the choice I made. As an intern at Embrapa Vegetables, I work on the genetic improvement of plants, with an emphasis on chili peppers of the *Capsicum* genus. I intend to specialize in this area, doing my master's and doctorate.



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