

ИССЛЕДОВАНИЯ

Making Tropical Agriculture: Science, Knowledge and Practice in Cuba, 1881–1906

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Franklin S. Earle was the first director of the Agricultural Experiment Station founded by the Cuban Government in 1904. He was the author of institutional scientific design that was the key to breaking the predominance of sugar in Cuban agricultural research. However, the Cuban Government's choice of Earle de-legitimized a group of agriculturists trained in colonial Cuba. In this paper, I explore the way in which Earle and a group of people conceived scientific agricultural knowledge in the years from 1881 to 1906. I analyze the complex and ambiguous relationships between the Cuban agriculturists and two imperial powers, firstly with Spain, traditionally ignored by agricultural science historiography and, later, with the United States; as well as when Cuba was a Republic. I also highlight the multiple interests and networks that influenced Earle's work, such as the United States Department of Agriculture (USDA) and, especially, the New York Botanical Garden (NYBG).

Keywords: Cuba, tropical agriculture, economic botanic, knowledge, Cuban Agricultural Experiment Station, United States Department of Agriculture (USDA), New York Botanical Garden (NYBG), Franklin S. Earle.

Franklin Sumner Earle died in Cuba in January 1929. Earle worked in the United States, Puerto Rico and Cuba. The American and Puerto Rican scientific press lamented the loss of the botanist, horticulturist, mycologist and specialist in tropical agriculture and scientific sugar cane cultivation (Chardon, 1929). Earle wrote one of the most important books about the history of sugar both on a global level and locally in the Caribbean (Earle, 1928).

The Cubans also lost the author of the scientific design and the first director of the Agricultural Experiment Station, 1904 to 1906. It had been founded by the newly established Cuban Republic:

“Prof. Earle's death is a huge loss for general science and for agriculture, especially for Cuban agriculture that recognised him as one of their greatest experts, one of their most enthusiastic defenders and who started the Agricultural Experiment Station, having laid the foundations on which rests the agricultural progress in Cuba” (Gravier, 1929, p. 59–60).

The Agricultural Experiment Station emerged at a complex political time when Cuba was being transferred between Empires, from the Spanish to the American. In 1902 it was a Nation-State but under the protectorate of the United States. Therefore, this scenario enables us to interconnect three important players in Cuba's scientific agriculture history at the turn of the 20th Century: the confluence of Spanish colonial scientific heritage with its traditions and local practices; the entrance onto the scene of the United States as a new imperial power with other knowledge, agents and scientific practices; and the construction of the Cuban Nation-State interested in establishing a singular institutional scientific infrastructure, in keeping with the symbolic speech of progress and civilization spread by the United States.

The United States established agricultural experiment stations in the old Spanish colonial possessions of Puerto Rico and the Philippines at the beginning of the 20th Century. Cuba, as a Republic under the protectorate of the United States, was not an exception. In November 1903, the Cuban Government approved the creation of an Agricultural Experiment Station managed by American Scientists. It was under these circumstances that Earle resigned from his position as Assistant Curator of the New York Botanical Garden (NYBG) to manage the Cuban Experiment Station.

The Agricultural Experiment Station, and particularly Earle, is a good case study for exploring the multiplicity of knowledge, practice and agents — both institutional and private, with their respective research agendas, careers and financial aid opportunities — that formed a part of the construction of scientific tropical agriculture. On one hand, Earle was pivotal in breaking the predominance of sugar in Cuban agricultural research. He instead supported agricultural diversification and sealed the influence of economic botany that distinguished the Agricultural Experiment Station's work in Cuba.

On the other hand, Earle's relations with various different Cuban and American sectors were illustrative of the ambiguous and complicated connections, networks, negotiations and interactions among different local knowledge and practices and national, imperial and scientific interests. I especially point out that Earle's scientific and agronomic work, from the management of the Experiment Station, is an excellent example to trace the complex and contradictory relationships between local agriculturists and two Imperial powers, first with Spain at the end of the 19th Century and then with the United States particularly at the beginning of the 20th Century when Cuba was a Republic and no longer a colony.

In the pages that follow, I study the way Earle and a group of people conceived the scientific agricultural knowledge in Cuba in colonial and postcolonial contexts from 1881 to 1906. In particular, I note the points of agreement and disagreement for the agronomic projects espoused by the different historical actors (local elites, the Spanish Government, the United States and the Cuban Government) and Earle's modernization project with the influence of economic botany. Likewise, I also highlight the complex and ambiguous relationship Earle had with the agriculturists, botanists and local farmers and also the networks and connections established by Earle managing the station with other agents and American scientists.

Traditionally, the history of Cuban agriculture has been written from the angle of agrarian or economic history. I adopted the approaches of new science and technology studies interested in analyzing the local knowledge generated in the colonies and former colonies to decentralize the knowledge construction beyond the traditional notion of centres and peripheries (Latour, 1987; Haraway, 1988, p. 575–599; Ophir, Shapin, 1991; Livingstone, 2003). My work illuminates at least three directions that are still subjects pending for Latin American and Caribbean science historians.

Firstly, I take the Caribbean, notably Cuba, as an example to emphasize the local character of scientific knowledge construction, a process that is well documented in the British colonial

world (Raj, 2007). Secondly, these new science studies insist that slaves and the Aboriginal communities produced traditional knowledge (Chambers, Gillespie, 2001; Turnbull, 2003). However, I note other types of knowledge, also traditional, done by agriculturists, scientists and farmers. The School of Agriculture of the Landowners' Circle (*Escuela de Agricultura del Círculo de Hacendados*) and the agricultural engineers trained there illustrate this type of knowledge. The School of Agriculture was founded in 1881 and was an important private colonial institution because it represented the agricultural modernization project of the sugar industry elites and local reformers, as well as training the first agricultural engineers in colonial Cuba. Last not least, my work draws out the relationships with different local and imperial scientific agricultural practices. In this regard, Cuba becomes an illustrative example of Cuban agricultural relations first with Spain, usually ignored by agricultural science historiography and, later, with the United States, especially when Cuba was a Republic.

In the first part of the text, I study Spain's and the local elites' participation in institutionalizing colonial scientific agriculture. In this way, I explore the relationships and tensions between local agriculturists and the Spanish Empire. To do this, I analyze the agronomic project championed by the School of Agriculture, as well as mentioning those agriculturists and botanists who were later linked to Earle's work. In the second section, I examine the close relationship Earle had with the New York Botanical Garden (NYBG) because I believe that this decisively influenced the value claimed by economic botany within the institutional model and scientific practices introduced by Earle in the Agricultural Experiment Station. Likewise, I also highlight the multiple interests and networks that influenced Earle's work. Finally, in the third section I analyze the ambiguities and tensions generated among Earle, the Cuban Government, the Cuban agriculturalists and botanists, other local agents and the United States.

The Spanish Empire, Local Elites and Scientific Agriculture

The spreading of scientific agriculture was the key strategy for Empires, colonies and ex-colonies in the tropical crop modernization aimed at the international market at the turn of the 20th Century. The expansion of agriculture on a scientific basis required institutions and the training of experts with a new vision of both economic botany and chemical agriculture to solve the ecological and economic problems of tropical agriculture. For example, the decrease in agricultural productivity, so-called exhausted soil and the degeneration of cultivated varieties.

The founding of scientific agricultural institutions and the training of specialists was a principal part of the modernization projects of the local elites and the Spanish Empire in colonial Cuba. The agricultural development projects were discussed around the ideas of developing the "Big Cuba or Cuba sugar"; the main export product, or advocating "Little Cuba"; which was more diversified by promoting, for example, the introduction and experimentation of new commercial varieties such as henequen and tropical fruit crops. Francisco Javier Balmaseda was the model agronomist of the agricultural diversification projects because of his many publications from the mid-19th Century onwards (Balmaseda, 1890). There also were tropical fruit agribusinesses but these were not accompanied by institutions that consolidated this ideal (Dolz, 2002). "Cuba sugar" had more prominent agriculturists, including Álvaro Reynoso author of an essay on scientific sugar cane cultivation widely circulated and applied in other production centres such as Java and Brazil but initially not in Cuba (Reynoso, 1862).

There is no consensus about how to define knowledge generated by a community in any given location. For some, especially from the English-speaking academic world, this has been defined as “indigenous knowledge”, “traditional knowledge” or “local knowledge”. In addition to this traditional knowledge, there is another less studied source of knowledge on the construction of agricultural science produced by other agents: non-indigenous farmers, landowners and scientists. The introduction of science applied in Cuban sugar agriculture was the response of landowners, agriculturists, naturalists, scientists and settlers to solving the economic problems arising not just from sugar-beet competition, industrial restructuring, the abolition of slavery and low agricultural yields at the end of the 19th Century but also of ecological problems (exhausted soil, sugar cane degeneration etc.).

To deal with these new times, Cuba had to create and/or apply new scientific knowledge and to establish new professions. In this sense, the colonial socio-economic agents organized their own scientific institutions in order to start up their research agendas. The School of Agriculture was founded in 1881 and was the last and most important step in the private work of the *Círculo de Hacendados* (Landowners’ Circle) to institutionalize agricultural science in colonial Cuba (Fernandez Prieto, 2008). The Circle represented different sugar sectors, especially the sugar planters, and was an active participant in the creation of institutions and publications to circulate scientific agriculture. For example, the Chemistry Laboratory was founded in 1883 and the *Revista de Agricultura* (Journal of Agriculture), a publication that served as a platform to propagate the changes both in the industry and in the field and it reflected the different expectations of the various interested parties involved in reorganizing the Cuban sugar industry.

The main sponsor of the school was the landowner José Eugenio Moré. For this reason it became known as the School of Agriculture or Moré’s School. The person responsible for the institutional scientific design was the doctor and sugar planter, Francisco de Zayas. But Moré and Zayas were only the visible figures of a group of landowners, naturalists, doctors, agriculturists, settlers, etc. who participated in financing and carrying out the duties of the School.

The main objective of the School of Agriculture was the training in Cuba of a critical mass of agricultural engineers and also the training of a workforce which would provide a human capital which, until the mid-19th Century had not been important because work had depended on the slave labour force. Therefore, once slavery was abolished it was necessary to reassess human capital as a factor of production. Accordingly, the School of Agriculture established two sections, one to train agricultural engineers and the other for more elementary teaching to train agricultural technicians.

The School of Agriculture is also an ideal space to explore the tensions generated among landowners, agricultural engineers and the reformers over the model and operation of the tropical agriculture modernization project. Some groups declared that the School of Agriculture would train them professionally as “administrador de ingenios” (“sugar mill managers”), figures that should introduce, adopt and implement new scientific procedures only in sugar manufacturing. Other groups in Cuba were favourable to training specialist staff through higher education since the estate managers suffered from a lack of the necessary agricultural knowledge.

The teachers of the School of Agriculture in theory defended agricultural diversification, spreading scientific knowledge among farmers through experimental demonstrations, etc. However, in practice, the main experimental activity was solving the sugar crop problems. For example, the work of teachers like the aforementioned Francisco de Zayas and also the agriculturist and chemist Carlos Theye, trained in Paris and who was conducting experiments with different types of fertilizer. Zayas also began experimenting with a new system of planting sugar

cane that increased the distance between the strains allowing for the use of mechanical instruments and the application of fertilizers.

The agricultural reformers attributed the decreasing agricultural yields and sugar cane degeneration in the oldest plantations to the loss of fertility. Since the mid-19th Century, sugar planters had converted the plantations into test fields of chemical or organic fertilizers in order to improve performance (de la Sagra, 1863; Fernandez Prieto, 2005). The School of Agriculture paid particular attention to chemical agriculture and proved that the use of fertilizers increased productivity, achieving higher sucrose cane and that tired plantations recovered fertility.

The School of Agriculture graduated agricultural engineers until 1891, the year when it disappeared due to the death of Jose Eugenio Moré, its main source of finance. The diplomas were not recognized by Spain. In Spain, the higher agricultural education was concentrated in the Alfonso XII Agricultural Institute in Madrid where young people from overseas possessions also studied. This situation changed in the case of Cuba upon the creation of the School of Agriculture which is the reason why Spain's Association of Agricultural Engineers always objected to it. Mariano de Castro, heading the Association of Agricultural Engineers of the Peninsula, asked the Government to prohibit the issuance of agricultural engineers' titles to Moré's School. Castro feared that the agricultural engineers who graduated in Spain would be displaced by the agricultural engineers trained in Moré's school. Spain rejected the official or academic worth of some of the graduates in Cuba, except for those who wanted to employ the services of their students.

The experiment stations were put up as the model par excellence for agricultural development in the mid-19th Century. Opposing the School of Agriculture, Spain ordered agricultural experiment stations to be officially established in the overseas Islands to develop the main local plantation crops. In 1886, two Agricultural Experiment Stations were founded in Cuba, one in Pinar del Rio, specializing for the first time in tobacco cultivation, and another in Santa Clara for the study of sugar cane cultivation. Spain agreed only to employ the agricultural engineers who graduated at the Agricultural Institute in Madrid's Alfonso XII. The labour of the agricultural stations was more experimental than research, mostly conducting trials with different fertilizers applied to sugar cane and tobacco. For the local elites and reformers, however, they did not train the skilled personnel required by the landowners to carry out the reorganization of the sugar agro-industry. In 1892, the two stations also disappeared due to lack of funding.

The influence of sugar did not fully prevent economic botany from being aided by other institutions with broader scientific objectives. This was the case of the Havana Royal Academy of Medical Sciences, Physics and Natural Sciences (1861–1898), an association that united the scientific community in Cuba (Pruna, 2001). This association brought together European and Creole naturalists and botanists who then supported Earle and the Americans' work at the beginning of the 20th Century. For example, the Academy hosted the Herbarium by the Cuban-American botanist Adolfo Sauvalle from the collections created by his brother-in-law José Blain and the American naturalist Charles Wright. The Academy also witnessed the first scientific theoretical and experimental study in Cuba on an economic pest affecting coconut plantations, a locally important crop which initially highlighted figures such as the naturalist Carlos de la Torre y Huerta (Fernandez Prieto, 2011).

The School of Agriculture engineers who lived through Cuba's transit from colony to Republic thought that they were the right people to modernize Cuban agriculture. Instead however, the new Government elected Franklin Sumner Earle to head the Agricultural Experiment Station founded in 1904.

Cuba, the United States and Franklin S. Earle: Agriculture and Tropical Botany

In 1898, the intervention of the United States in the war to liberate Cuba from Spain resulted in the island being transferred from one Empire (the Spanish) to another (the American) and the Republic's Constitution (1902) was done under the protectorate of the United States. To establish the Republic, Cuba had to prove their capacity for self-government. This fact is pivotal to understanding the Cuban Government's decision to choose an American scientist to be in charge of the Agricultural Experiment Station, and therefore it also enables me to explore the participation of Cuban agriculturists trained in Spanish colonial times. Additionally, I highlight Earle's and the New York Botanical Garden's contribution to developing economic botany in Cuba.

The United States created ties for securing formal and informal economic and political subjugation during the four years of military intervention in Cuba, from 1898 to 1902. In 1899, in the agricultural sphere, the United States ordered a census to be drawn up in order to understand the situation of Cuban agriculture and to explore other opportunities for American agro-industrial business on the island.¹ Moreover, the military Government inspector took advantage of old colonial institutions for the economic Cuban reconstruction work and local agriculture knowledge, such as for example, the Provincial Agriculture Juntas, whose influence was ignored under the Spanish Government.

These four years of military occupation were positive for agricultural engineers trained during the colony times, whether in European centres or in the School of Agriculture. Some were involved in the Census preparation and managing the provincial Juntas. Other graduates of the School of Agriculture alternated between institutional work and work as agents of trans-national chemical fertilizer companies as was the case of Francisco B. Cruz, who also directed the Pinar del Río Provincial Agriculture Junta, Pinar del Río being the Cuban tobacco region par excellence.

Cuba was the main objective of American economic expansion with the introduction of trans-national companies such as the United Fruit Company, created in 1899, or those founding agricultural colonies (Zanetti, García, 1976; Deere, 1998). For tobacco cultivation, the Cuban Land and Leaf Tobacco Company was responsible for controlling an important part of Cuban tobacco cultivation (Muñiz, 1964; Stubbs, 1985). The United States offered security for the American capital in Cuba. Some favourable economic measures were the creation of land markets, as only the western part of Cuba was cultivated during the Spanish domination. The Census of 1899 indicated that 13,000 hectares of forested areas remaining to be cultivated in the East of the territory. In addition, the railway expansion was controlled by the Cuban Company (Santamarina, 1995, 2004).

At the political level, the Cuban Republic was founded in May 1902, mediated by the constitutional appendix of the Platt Amendment which authorized the United States to intervene militarily if it deemed Cuban self-government non-viable. A year later, in 1903, Cuba and the United States signed the Commercial Reciprocity Treaty. This Treaty secured control of the island's market for American products and, in return, guaranteed Cubans a 20 % reduction in the sugar and tobacco tax, their two main crops, on entry to the United States (Lecuona, 1998; Pérez, 1983, 1986, 2003).

The United States' favourable economic dispositions and Cuba's ambiguous political situation resulted in a total capital of \$80,000,000 being invested by the Americans between 1902 and 1906 (Jenks, 1928, p. 151; Deere, 1998, p. 735). Of that, \$6,000,000, that is to say 7.5%, was

¹Annual report ..., 1899; Departamento de Guerra. 1900; Annual Report ..., 1902.

invested in tropical fruit crops. In 1903, there were 37 American farms dedicated to developing tropical fruits. Three years later, in 1906, 13,000 American settlers had established themselves, coming to the “promised land” with the idea that it belonged to the United States. The American settlers were important for Cuban agriculture because they strengthened the markets of tropical fruit and horticultural crops both known and unknown in the colony. The cultivation and marketing of tomatoes, for example, was one of them.

The trans-national Agribusiness companies and the American settlers were historical actors interested in the work of the Agricultural Experiment Station specialists, the most important centre for agricultural issues founded Cuba in the early Republican years. The expansion of the United States in the newly-acquired territories and former Spanish colonies provided a vast arena for disseminating the institutional model of agricultural experiment stations run by American scientists. Stuart McCook notes that many of these stations specialized in developing plantation crops (coffee, sugar, tobacco) and others were interested in a more general development, which would complement the American market, this for some countries represented a break with single crop farming dominance (McCook, 2002, 2009). The agricultural experiment stations provided these territories with the training of American scientific personnel who specialised in tropical botany and agriculture.

In 1902, the Secretary of Agriculture and sugar planter Emilio Terry proposed to the Cuban Government the reconstruction of the local agriculture, beginning with installing a network of agronomic stations to be directed by specialized personnel preferably American men of science.² However, the agricultural engineer Carlos A. Fernández was against the idea of Cuba hiring foreigners who were unaware of the problems of local agriculture, opposing “importing doctrines, systems and men from countries which barely resemble ours physically and morally in general aspect and social customs”.³

In 1903, the then Secretary of Agriculture Manuel Luciano Díaz presented another project to modernize Cuban agriculture. He insisted that a network of stations focussing on the territory’s local conditions be established. The agriculture stations of Pinar del Río and Matanzas would study all crops, while those of Santa Clara and Puerto Príncipe would have a section on livestock research and that of Santiago de Cuba would be of a more general character.⁴ Díaz proposed to the Cuban Government that the central station be established at the former Escuela de Oficios de Santiago de las Vegas (Trade School of Santiago de las Vegas). The Cuban President Tomás Estrada Palma had agreed to the request by the Agrarian League, the association of sugar planters, for the aforementioned Francisco de Zayas to study and prove his sugarcane cultivation method in these areas.

In November 1903 the Cuban Congress approved the establishment of the Agricultural Experiment Station and endowed it with \$75,000 in the hope that it would become the centre of agricultural research par excellence (de Quesada, 1905).⁵ The Government’s objective for the Agricultural Experiment Station consisted of:

“arriving at a perfect knowledge of its territory, its adaptability to agriculture and that systems be applied for improving the plants at present under cultivation, and only in this way will the island of Cuba modify its present extensive system of planting to change to an intensive system” (de Quesada, 1905, p. 68).

² Secretaria de Agricultura, Comercio y Trabajo, 1904. P. 132.

³ *El Azúcar*. 1902. Vol. 7. P. 214.

⁴ Secretaria de Agricultura, Comercio y Trabajo, 1904. P. 135.

⁵ See also: President Palm’s Message // *The New York Times*. 1902. May, 20. P. 2; de Quesada, 1905.

Following the American model guaranteed success both for agricultural modernization and also the introduction of civilizing and economic progress. This ideal had more chance of achievement if the director of the Agricultural Experiment Station was an American. Therefore, none of the agriculturists trained during the colonial time were chosen by the new Cuban Government to lead the Agricultural Experiment Station. On the contrary, Cuba was the first “independent” country to request specialist staff from the United States in order to organize a network of agricultural experiment stations and to carry out the agricultural and botanical study of the entire territory helping to detect new sources of economy. The Cuban Government chose Franklin Sumner Earle.

In the spring of 1904, Earle arrived at Havana preceded by his solid scientific reputation forged in the Agricultural Institute of Alabama and in the United States Department of Agriculture (USDA) due to his interest in horticulture, his studies on tropical agricultural diseases and as a sugar agriculture specialist. This extensive experience was viewed well both by the American and Cuban sugar sector and also by trans-national corporations, such as, the United Fruit Company and also by American colonists who settled in the Cuban territory and were interested in the island becoming the winter vegetable garden of the United States.

Earle was born in Dwight, Illinois in 1856 into a family of horticulturalists and botanists (Jercinovic, 2007). He began his studies of biology and botany at the University of Illinois but did not finish them. Collaborating with the pathologist and botanist Thomas Jonathan Burrill in his research into the relationship between the causes of some plant diseases and certain bacteria was a decisive step for his start in the mycology field. Earle won renown as a biologist and mycologist at the Alabama Polytechnic Institute; from 1892 to 1895, he worked as the Superintendent of the Mississippi Agriculture Experiment Station and in this last year the USDA appointed him Assistant Pathologist of the National Herbarium. From 1896 to 1900, he served as biologist and horticulturist at the Alabama Agriculture Experiment Station, where Earle made contact with and worked with several scientists throughout his life, including Lucien M. Underwood and the entomologist and botanist Charles Fuller Baker (Underwood, Earle, 1897; Chardon, 1929, p. 301–302). The Alabama Agriculture Experiment Station gave Earle an MS degree for his remarkable scientific research, especially as a specialist in the study of plant diseases.

Some historians consider that Earle was suggested by James Wilson, the Agricultural American Secretary, to the Cuban Government, because of his expertise in sugar cane cultivation. In particular, Earle was qualified as a sugar expert from the Louisiana Experiment Station (McCook, 2009, p. 50; Viera, 2004). Frank C. Carpenter, a photographer who documented the American economic expansion, noted that Earle gave up the position at the agricultural station of Mayagüez, Puerto Rico, to lead the Cuban one (Carpenter, 1905). Wilson was the one to suggest Earle but, and as I note, Nathaniel Lord Britton also recommended him. I can

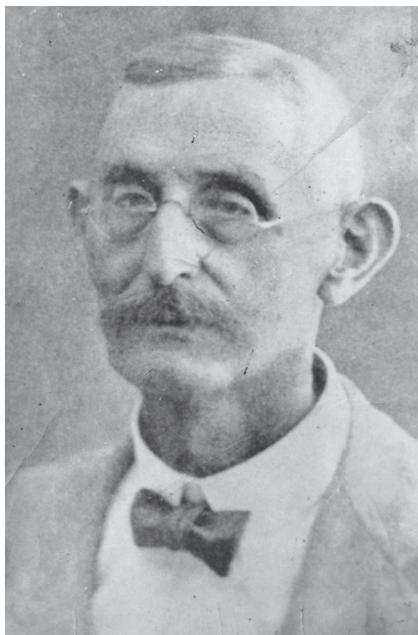


Fig. 1. Franklin Sumner Earle, first director of the Agronomic Experimental Station of Cuba, 1904–1906. Courtesy of the Archive of the Fundamental Research Institute of Tropical Agriculture “Alejandro de Humboldt”, Cuba

say that Earle was the figure of consensus within the agricultural diversification objectives defended by sectors of the USDA. This coincided with the ideal of a winter vegetable garden for the United States and for the New York Botanical Garden botanists to create and name new collections for the Herbarium and to train a specialist tropical botany staff, this time, with the official support of the Cuban Government.

Earle was the first mycologist to work at the New York Botanical Garden under the command of Nathaniel Lord Britton from 1901 to 1904 and it was to be his last work as an official employee in United States. As Sharon Kingsland argues, the creation of the New York Garden, and especially the work of its first director Nathaniel Lord Britton conceiving the “American code” - a new code to review the practices of European nomenclature — was crucial for the botanical revolution which distinguished American science debates of late 19th and early 20th Century to displace the influence of European Science (Kingsland, 2005, p. 40–41, 84–86 and Mickulas, 2007; especially, p. 1–8 and 41–60; Raby, 2013, especially, p. 54–67). Britton and botanists of the NYBG were fundamental for the institutional development of economic botany in the tropics, particularly in the English and Spanish Caribbean, from their main objective of making botanical explorations to collect and name specimens for the *Herbarium* that competed excellently with the taxonomic museums in Europe (Kingsland, 2005, p. 62).

The New York Botanical Garden is a little-known institution within science and imperialism studies, these have highlighted the role played by institutions such as the Department of Agriculture and the Smithsonian Institution for training specialist tropical agriculture staff at the service of expansion (Toro, 2006). To Nathaniel Lord Britton, his wife Elizabeth G. Britton, also a botanist whose childhood was spent in a sugar mill in Cuba, and his team of botanists, the start of the American imperial expansion opened up a tropical world to catalogue and inventory under the new American nomenclature and also the possibility of forming a community of tropical botany experts. Britton organized and financed a series of botanical explorations to the Antillean Caribbean (the archipelago of the Bahamas, Saint Thomas and neighbouring islands, Jamaica, as well as to the islands of the Spanish Caribbean Santo Domingo, Puerto Rico and Cuba) to collect specimens of live plants and to name and complete collections of the Garden’s Herbarium; a collection, as happened in other empires, that served to identify export agriculture and showed the exuberant tropical flora which could be put to the service of agents and various institutions but also aided his work in studying the plants of the Antillean flora in their habitat. In 1904 Britton, in collaboration with the British Government, founded the first tropical laboratory in Jamaica as part of a network of tropical agriculture laboratories.

Earle formed part of these goals through the botanical explorations carried out by the Garden in the Caribbean, including Cuba, which specialized in collecting fungi and new species for the Herbarium of the aforementioned botanical institution. It is no wonder that Earle prioritized organizing and designing the Agricultural Experiment Station; creating a Herbarium; agricultural diversification ranging from introducing and propagating new varieties with commercial and nutritional value; introducing plant-breeding techniques and the study of diseases and agricultural pests.

It should be remembered that Earle worked in various agricultural stations and carried out agro-botanical studies in the Caribbean at the service of the USDA, whose objective, according to the American press at the time, was to follow an agricultural policy based on “benevolent paternalism” in the Spanish Caribbean.⁶ This policy was, they stated, to help the Caribbean

⁶ Encouraging Agriculturalist in Island of Puerto Rico: What United States Government Has Done to Assist Planters and Develop the Resources of New Territory. Some Scientific Experiments // The New York Times. 1903. Jan 14. P. 28.

planters identify and develop their natural resources so as to diversify agriculture and break with monocultures. In 1902, as an expert mycologist, Earle was intended for the USDA and the NYBG for studying crop diseases in Jamaica. In Puerto Rico in May 1903, he studied the damage to coffee, potato, tomatoes and orange plantations, which appeared to have been caused by fungi. The USDA warned Earle, however, that the priority was to identify all the possibilities of extending commercial cultivation of tropical plants.⁷

In 1903, Earle accompanied the Brittons and other NYBG botanists on the first scientific exploration to Cuba.⁸ During this trip, Earle met his former colleague in Alabama, the botanist Lucien M. Underwood, then one of the main defenders of the code devised by Britton, and also his successor as Professor of Botany at Columbia University (Kingsland, 2005, p. 66–67, 87). Earle, Underwood and the botanist E.D.W. Holway, of the University of Iowa, explored the East of Cuba in order to collect new specimens of plants and fungi and also to study the disease, that since the end of the 19th Century had been harming the coconut plantations in Baracoa, but which nobody had been able to eradicate. In parallel, Britton, Percy Wilson and John Adolph Shafer collected in the vicinity of Matanzas and Santa Clara, eminently sugar areas.

Earle additionally participated in racial ideas defended by some scientists and American botanists in those years (Kingsland, 2005, p. 87–95; Raby, 2013, p. 125–127). Under the heading of “Botanist explores Cuba”, Earle expressed his impressions of the trip to Cuba in the pages of the *Journal of the New York Botanical Garden*, and at the same time, in the *New York Times*.⁹ Earle described admiration for Baracoa’s exuberant vegetation, highlighting the Royal Palm and ferns, as well as the untapped natural resources. But Earle also spoke of the Cuban workers whom he described as the worst “specimen” of all he had worked with in the course of his explorations, even compared to the Afro-Americans in the Southern United States when he resided and worked in Alabama. Earle criticized the eating habits of the Cuban workers, their pitiful physical state and their propensity to renege on obligations for any festivity or opportunity that arose to them. He could not imagine that, just a year later, he would decide to take up residence after the Cuban Government chose him to manage the Agricultural Experiment Station.

The Cuban Government founded the Agricultural Experiment Station on the 1st of April, 1904 in the village of Santiago de las Vegas, twelve miles from Havana on a 170-acre estate (Earle, 1904). Earle followed a similar organization to that of the agricultural stations of the United States in order to respond to the expectations of Cuba. Earle defended the study of modern methods of cultivation, the proper use of mechanical implements, the study of the conditions of working land, the use of appropriate fertilizers, the selection of optimal crop varieties and the control of insects and plant diseases through economic entomology principles with bulletins and circulars published by the Agricultural Experiment Station. This broad project emphasized the selection of new varieties to ensure agricultural diversification and the development of economic entomology in Cuba.

Earle organized the Agricultural Experiment Station into three applied science departments (General Agriculture, Horticulture and Industrial Livestock Production) and three oth-

⁷ Diseases in Vegetables. Dr. F. S. Earle Goes to Porto Rico to Study Them // The New York Times. 1903. May, 13. P. 1–3.

⁸ Britton, 1903, p. 95–99; Kallunki, 1980; Dr. Earle’s new position. Assistant Curator of Botanical Garden Resigns to Take Place in Cuba // Journal of the New York Botanical Garden. 1904. Vol. 54. June. P. 107.

⁹ Botanist Explore Cuba. Assistant Curator of New York Botanical Museum Has a Higher Opinion of the Flora of the Country than of the Native Laborers // The New York Times. 1903. May, 10. P. 3–5.



Fig. 2. Entrance of the Agronomic Experimental Station of Cuba. Courtesy of the Archive of the Fundamental Research Institute of Tropical Agriculture “Alejandro de Humboldt”, Cuba

ers dedicated to scientific tropical agriculture research (Chemistry and Physics of the Land, Botany and Plant Pathology). He supported uniting experimental technical work with scientific research. Furthermore, in order to meet the expectations of the sugar industry sectors, Earle proposed to the Cuban Government that the department of agriculture be directed by one of the Cuban graduates of the Louisiana Experiment Station. Cuba chose Francisco B. Cruz instead, a graduate of the School of Agriculture and scientific tobacco cultivation expert who was the only Cuban who joined the Experiment Station’s working group.

Earle preferred American botanists and scientists to head other departments. For the Botany department, Earle appointed his old friend and collaborator in Alabama, Charles F. Baker. The correspondence between Earle and Baker illustrates both the man employed by the Cuban Government and the link with the NYBG and the USDA for developing tropical entomology and botany. In March 1904, Earle assured Baker that in Cuba all political parties were united to demand a strong Experiment Station because “Everyone realizes that Agriculture is the one great business interest of the Island and all are anxious to do everything possible for its advancement”.¹⁰ That is why North American agriculturists and botanists could rely on the support of the Cuban Government.

Earle moreover emphasized to Baker the importance of the connection with the New York Botanical Garden and the USDA for their work in Cuba:

“I need not tell you what an enticing field Cuba is for the botanist for that you already knows. We are promised the heartiest support by the New York Botanical Garden and by the National Herbarium at Washington in working up our collections”.¹¹

¹⁰ Secretaria de Agricultura, Industria y Comercio, Estación Experimental Agronómica. Correspondencias de toda clase de la dirección. Legajo 1756. 1904, March, 9. P. 1–3.

¹¹ *Ibid.* P. 2.

But Earle also reflected on the complex link with the work of the NYBG and his commitment to Cuba with the Department of Botany's research lines:

"The duty of the Department of Botany will be to study the natural vegetation of Cuba in all of its phases. This will include a comparison with the flora of the mainland and of the neighboring islands. The different floral regions and plant formations of the island should be carefully studied and mapped as knowledge of the natural vegetation throws much light on soil conditions and the adaptability of the different floral regions special food crops. There are many valuable medicinal plants and many others of possible value for rubber, gums or fibers now growing wild in Cuba. These should be specially studied and brought under cultivation in order to test their merits and in cooperation with the agriculturist and horticulturist the production of new varieties by hybridization and selection".¹²

Earle proposed to Baker that the department it were equipped with a specialized library, as well as money to buy a Herbarium (*herbariums* cases) and to travel throughout Cuba. Baker's salary was to be 2,000 dollars.

Baker accepted Earle's proposal and was the main person responsible for forming tropical economic botany by way of introducing the Experiment Station to plant breeding techniques unknown in Cuba (hybridization, selection of seeds and appropriate cultivation). These were to be the most innovative and modern botanical research applied to Cuban agriculture. Baker created the Agricultural Station's Herbarium, one of the most important on the island as much for new specimens as for the Herbarium of the Havana Academy of Sciences which, in turn, was restored. In fact, Earle asked the Academy of Sciences to hand over the Herbarium to start the Station's work. Baker donated a collection of Cuban plants to Professor Manuel Gómez de la Maza for the Herbarium at the University of Havana; he also worked with the aforementioned botanist Percy Wilson. Already by 1905, the Station's Department of Botany contained about 20,000 species of Cuban plants and flowers. Baker later worked in Brazil and in the Philippines where he became noted as a collector of insects until his death in 1927.

Earle noted that Cuba had not yet developed tropical disease studies and, in part, he was right because only a few botanists and local naturalists in the Havana Academy of Sciences had studied the coconut palm plague in Baracoa. As a mycologist, Earle paid particular attention to plant pathology and economic entomology because of the constant pests and diseases that damaged large-scale cultivated commercial plants. He chose American plant pathologist and microbiologist Melville T. Cook, of Indiana, to lead and, later, the plant pathologist William T. Horne, of Nebraska, who was his own brother-in-law. Cook supported Earle's plans to find varieties that were more productive and resistant to pests through hybridization, including trials with the sugarcane hybrid discovered in Java and Barbados (Galloway, 1996; Muñoz, 1997; Drayton, 2000).

For the first time ever in Cuba, Earle institutionally developed horticulture in order to diversify local agriculture but also to satisfy the ideal that the island would be the United States' winter vegetable garden. Earle elected the botanist C. F. Austin, formerly of the Maryland Agricultural Experiment Station, to be the head of the Department of Horticulture, whom he had known when he worked in Alabama. In 1907, Earle and Austin set up the Cuban Horticultural Society. His personal interest in horticulture was also developed at his house and experiment estate in Herradura, one of the American colonies in Pinar del Rio.

¹² Secretaria de Agricultura, Industria y Comercio. 1904. March, 9. P. 2.

The three departments of Botany, Horticulture and Plant Pathology proposed by Earle were significant to the development of economic botany and tropical agriculture in Cuba. In addition, in September 1904 Earle said:

“An available tropical laboratory has long been the dream of the American botanist. Within the last few months this dream has been realized by the arrangement between the Jamaican government and the New York Botanical Garden for the use of the Cinchona plantations. It is now possible to offer the use of a second tropical laboratory” (Earle, 1904, p. 444–445).

Franklin S. Earle, the NYBG and the Local Population

Earle's work at the Agricultural Experiment Station reflected the connections with the NYBG and other American institutions and actors, but moreover his complex relationships as an employee of the Cuban Government with botanists, agriculturists, farmers and settlers. Earle converted the Agricultural Experiment Station into a base of operations for the New York Garden's work on the botanical explorations and increased the herbarium's collections. In 1905, for example, the mycologist and botanist M.A. Murrill's botanical exploration in Cuba, who was Earle's successor in the post of Assistant Curator of the Garden, showed the consolidation of the presence and institutional link between the Garden and the Agricultural Experiment Station. The scientific report that Murrill published on his return to New York is revealing of the existing imperial gaze among some North American scientists and agriculturists in the Garden, presenting Cuba as pivotal to the United States' interests because of its land, productivity and geo-strategic position (Murrill, 1905). Murrill, in fact, predicted that within five years the Americans would own three quarters of the territory which could be bought on the island and would control a large amount of its businesses, in particular those related to agriculture, so he was in favour of deforestation to facilitate cultivation.

Earle defended the wide-range of business opportunities for American investors in Cuba in *The Cuba Review*, albeit less forcefully probably because of his initial institutional role. Murrill witnessed the governmental visit and inspection of the Experiment Station by the then Cuban Secretary of Agriculture, General Rafael Montalvo, and by Luis Marx, a tobacconist and businessman, who were interested in the work developed by Earle and his team of scientists.

Also in 1905, Earle made clear to the Cuban Government the importance of training student assistants following the United States' model, i.e. agriculture graduate students who afterwards would do quality practice on the post graduate course. Earle had defended this aspect since the beginning of his institutional work in Cuba because it was the only way, according to him, to train the technical staff capable of managing agricultural experiment stations and stated: “the country can not nor should not be content that there are always foreigners who come to fill certain posts of this kind”¹³. Earle alluded to his and the rest of the Americans' work, but suggested that the Cubans were not sufficiently well trained in keeping with the style of the Americans, which was true.

The Cuban Government also called for his work as a mycologist. In 1906, the new Cuban Secretary of Agriculture, Gabriel Casuso proposed a monetary prize for anyone who could eradicate the pest that was harming the coconut plantations in Baracoa. At the same time he appointed Earle as the Agricultural Experiment Station director and as a tropical disease expert, and the naturalist and botanist Carlos de la Torre y Huerta to explore the causes of the pest and

¹³ Secretaria de Agricultura, Industria y Comercio, 21 de abril de 1905. P. 1–2.

the means to eradicate it. Earle had started to become interested in this pest during his trip to Jamaica in 1902. For its part, de la Torre participated actively in the discussions on the study of the disease in the Havana Academy of Sciences. Some Cuban scientists believed that the origin of the disease was a fungus. Other scientists argued that an insect was the cause of disease (Pruna 2001 y Fernández 2011). Earle confirmed the existence of an insect (*Myndus crudus*) as a vector agent, although he thought that the origin of disease was a bacterium or a fungus (today we know that the disease is caused by a *Phytoplasma*). The plague in Cuba was studied in those years by researchers of the USDA, the United Fruit Company, which owned coconut and banana plantations and also by plantation owners (Fernandez, 2011). All the researchers agreed on burning affected coconut plants to avoid its spread.

The Cuban botanists and other scientists in Cuba considered the Americans, especially Britton, as notable scientists and discoverers of Cuban flora. “Brother Leon”, a French botanist established on the island, recalled that he, Britton, and Percy Wilson were preparing the publication of a new catalogue of Cuban flora “with his analytical keys, synonymy and other data <...> that has always been greatly desired” (León, 1917–1918, p. 202). The work of the three botanists was not fulfilled due to the death of Britton in 1934. For “Brother Leon”, the explorations of Britton and the NYBG botanists contributed to doubling the main existing collections of the American Charles Wright and the Cuban Francisco Adolfo Sauvalle with over four hundred new species and about 40,000 specimens of Cuban plants being acclimatized in the NYBG. Among these specimens were Earle’s contributions to the discovery of new fungi in Cuba, one of the subjects still pending among the Cuban botanists and scientists. For example, in 1906, Earle discovered and named the fungus *Shtropharia cubensis* (today known as *Psilocybe cubensis*), well known for its hallucinogenic properties. Earle also relied on the help of his wife Esther J. Skehan Earle for illustrations.¹⁴

The good reception of the botanists contrasted with the complex relationships of Earle with agriculturists trained in colonial Cuba. The choice of Earle by the Cuban Government, for the supposed superiority of American scientific education, de-legitimized the Cuban agriculturists. So it was not strange that this group mostly rejected the American scientists’ work. In 1905, Francisco Javier Balmaseda, mentioned by me as the main defender of “Little Cuba” and a reference for agricultural diversification, published his response letter to Earle’s questionnaire that included questions about the American scientists’ participation in the progress of Cuban agriculture in general (Balmaseda, 1905, p. 88–90). Balmaseda took the opportunity to question the civilizing agriculture talk that intended to legitimize the Americans in managing the Cuban Nation’s socio-economic and political affairs. But Balmaseda undoubtedly agreed with Earle in his ideal of agricultural diversification and that the island could turn into the United States’ winter garden because of its climate and geographical location.

That same year in 1905, the Cuban-Hispanic agronomist Gastón Alonso Cuadrado, head of the Station’s department of chemistry, warned of the Experiment Station’s danger of being known by other countries as part of the United States. Earle also criticized the little attention being paid to the problems of sugar cane cultivation. It is true that Earle broke the predominance of the sugar industry in scientific research but he was not unaware that it was the main Cuban export product. He had to additionally respond to the expectations of the Cuban sugar sectors. The most important criticism of Earle’s scientific work in Cuba came from the aforementioned Francisco de Zayas, author of the School of Agriculture’s scientific design.

¹⁴The New York Botanical Garden, Archives and Manuscripts Collections (RG4). Franklin Sumner Earle Records of the Herbarium (1896–1907); William Alphonso Records of Herbarium, (1903–1957), Series 6 Artwork; Hitchcock, 1909.

In 1902, the Cuban Government authorized the Agrarian League, the institution which replaced the Circle of Landowners, so Zayas tested his system of sugar cane planting on the land where he later founded the Agricultural Experiment Station. In 1905, the Agrarian League published Zayas work so that the Cubans could use it as the official cultivation system (Zayas y Jiménez, 1904). Earle disagreed. In a letter to Francisco Y Vildósola, director of the Agrarian League, Earle proved that at the Experiment Station, sugarcane production by Zayas' system averaged 4486 arrobas contrasting to 6120 arrobas of sugar per hectare on land cultivated with the system proposed by Álvaro Reynoso. Earle therefore claimed that Zayas' system did not give such good results on tired land and proposed the return to Reynoso's system for maximum production. It was not surprising that Zayas protested to the Cuban Government for granting Earle authority, "a foreign scientist" and for calling him the "master of the Republic".¹⁵

The Cuban farmers and American settlers were more receptive to working with Earle. The Agricultural Experiment Station correspondence reveals that they asked to be sent newsletters, tips on new plantings, combating disease and pests of their crops, etc. These interactions also benefited Earle supplying him with data and evidence for developing his studies and experiments. For example, the sugar planter Eduardo Ferrer sent Earle all his results with the scientific sugar cultivation system, later published in the Agricultural Experiment Station circulars.

The second American occupation of Cuba began in 1906. Earle, under these circumstances, resigned from the management of the Agricultural Experiment Station and in his place the American scientist and sugar expert J. Crawley was named. Crawley was proposed by John Wiley and the Agrarian League, the Guild of the Cuban sugar-refiners.

Afterwards, Earle went on to work as a consultant and specialist in sugarcane diseases in sugar corporations, for the USDA and the Tropical Foundation. In 1928, he published one of the major sugar works which brought together the tests carried out by him on different varieties and hybrids of sugarcane in Puerto Rico and Cuba in order to eradicate the sugar cane mosaic disease which had destroyed the Caribbean sugar industry (Earle, 1928; Chardon, 1929, p. 303). But Earle continued his personal interest in horticulture and botanical explorations on his estate in la Herradura.

In 1909, the Agricultural Experiment Station went on to be directed by Cuban agriculturists trained at the School of Agriculture. Some time later, in 1929, Francisco B. Cruz's management of the Experiment Station coincided with Earle's death. Cruz legitimized Earle's and American scientists' important work on developing Cuban agriculture. Moreover, in 1932, the New York Botanical Garden continued collaborating with training the Station's Department of Botany managers such as, for example, Julián Acuña y Baldomero, who had been one of the assistant students trained at the Experiment Station.

Conclusion

The construction of tropical scientific agriculture in Cuba in the colonial and postcolonial context, especially from 1881 to 1906, involved different historical actors (colonial local elites, Spain, the United States and the Cuban Government) with their own knowledge, practices and research agendas, institutional or private, expectations and funding sources. The analysis of agricultural projects espoused by these historical actors located in the Caribbean, particu-

¹⁵ de Zayas, 1904, p. 15; Secretaria de Agricultura, Industria y Comercio, 1 de abril 1905; Earle, 1905; Fernández Prieto, 2005, p. 177–187.

larly Cuba, in the studies concerned with decentralizing and illuminating the complexity of the knowledge construction beyond the traditional notion of centres and peripheries.

The School of Agriculture (1881–1891) was a private colonial institution, whose study emphasized, on one hand, the active participation of elites and local reformers to set up their own research agenda in colonial Cuba. I noted that the knowledge produced by sugar planters, naturalists, agriculturists, scientists, etc., is another source of traditional knowledge that requires more attention from Latin American and Caribbean agricultural science historians. On the other hand, the School of Agriculture reflected the tensions generated between local elites and the Spanish Empire in developing scientific agriculture tropical, also pending for the history of Latin American and Caribbean agricultural science.

Agricultural engineers graduating from the School of Agriculture had a great influence on research and chemical experiments applied to sugar cultivation, for scientifically reorganizing its main industry at the end of the 19th Century. These agriculturists were witnesses and actors in the complex and ambiguous political situation in Cuba in the transit from the Spanish to the American Empire (1898) and then in the construction of the Cuban Republic (1902). For this reason likewise, they were an illustrative example of the tensions and relationships among various scientific, national and two imperial agricultural practices (first with Spain, then with the United States and especially with the Cuban Government when Cuba was a Republic).

The founding of the Agricultural Experiment Station, in 1904, was the most important step in consolidating scientific agriculture for the Government of the nascent Cuban Republic. Cuba's choice was to elect the American Franklin Sumner Earle to head the Agricultural Experiment Station, enabling us to explore the training of American botanists and tropical agriculture specialists in official institutions at the beginning of the 20th Century; a process studied in private agricultural and botanical institutions.

The New York Botanical Garden, through Nathaniel Lord Britton and his aides, followed the British imperial and scientific experience by creating a network of stations and laboratories interested in institutionalizing the new economic botany. The Central Agronomic Station in Cuba formed part of it under the management of Earle. It is important to stress that this scientist became the middleman for various sources of transmitting knowledge and funding, such as, the Cuban State, USDA, the sugar trans-national companies and the American colonists. His work also generated a different response among Cuban agronomists and botanists. Furthermore, he never left Cuba nor abandoned his personal and scientific interest in mycology and horticulture. Britton, for his part, maintained a relationship with the Cuban people but his main field of interest was the study of the flora and agriculture in Puerto Rico.

The Station was the platform for circulation and exchange between scientists, both inside and outside the Caribbean, as shown by the creation of the Herbarium and the collections of specimens of plants. It was also a channel between the scientists and the farmers; in quality assessment and, above all, for the practical agricultural it depended on, to test out its research and to count on having enough for its collections material. It also agreed to train personal technical assistants and to publish circulars and bulletins that differentiated it from the experimental stations created by Spain.

Acknowledgements

This work is part of the research project HAR2012-37455-C03-01 (MINECO) and of the project RYC2009-04030.

The author would like to say thanks for the comments and suggestions to Sharon Kingland, Peter Lavelle, Anastasia Fedotova and Robert Jan-Wille. I also appreciate the recommendations of Stuart McCook and Loles Gonzalez-Ripoll.

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Создавая тропическую агрономию: наука, знание и практика на Кубе, 1881–1906

ЛЕЙДА ФЕРНАНДЕС ПРИЕТО

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Франклин Эрл был первым директором первой Кубинской государственной сельскохозяйственной опытной станции, основанной в 1904 г. Подход Эрла к организации агрономических исследований стал ключом к «освобождению» кубинской агрономии от «сахарной монополии». Тем не менее выбор кубинского правительства, павший на Эрла, как ведущего исследователя в национальной агрономии, лишил легитимности группу агрономов, получивших образование в колониальной Кубе. В данной статье обсуждаются взгляды Эрла и других агрономов на задачи сельскохозяйственных исследований в 1881–1906 гг. В статье анализируются неоднозначные отношения кубинских агрономов и специалистов двух империй: сначала с испанскими (что традиционно игнорируется историографией агрономии), а затем, в годы независимости — с американскими. Специальное внимание уделяется различным исследовательским сетям и учреждениям, повлиявшим на работы Эрла, среди которых Департамент сельского хозяйства США и, особенно, Нью-Йоркский ботанический сад.

Ключевые слова: Куба, тропическая агрономия, прикладная ботаника, кубинские опытные станции, Министерство сельского хозяйства США, Нью-Йоркский ботанический сад, Франклин Эрл.