



Yield of dreams: Marching west and the politics of scientific knowledge in the Brazilian Agricultural Research Corporation (Embrapa)



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ABSTRACT

Over the past forty years, Brazilian agriculture has rapidly industrialized elevating the country as the world's first tropical agricultural giant. Much of the credit for this transformation has gone to the Brazilian Agricultural Research Corporation (Embrapa) for their work in the center-west region of the country. This area, known as the Cerrado, industrialized rapidly starting in the early 1970s with the introduction of chemical fertilizers to fix its acidic soils and the development of new seed varieties adapted to the tropics. This paper historicizes the political and social relations behind the industrial transformation of the Cerrado by focusing on the establishment of Embrapa. I argue that US political relations and corporate interests helped to lay the scientific and institutional groundwork for public research in Brazil to ensure long-term industrialization of the Cerrado. The case of Embrapa, and their work in the Cerrado, expands the geographical, political and economic understanding of the deployment of US scientific experts and expertise during the Green Revolution. I show how US and Brazilian scientists, technocrats and investors collaborated in the making of “the Miracle of the Cerrado” in the post-WWII era. This research is based on interviews conducted at Embrapa headquarters and field research sites in Brazil as well as historical archives in both Brazil and the US.

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1. Introduction

“The true meaning of Brazilianness is the March west”

President Getúlio Vargas, Guanabara Palace at midnight, December 31st, 1937

Brazilian agriculture has undergone a revolution in the past several decades, elevating it as the world's first tropical food-giant. In the 1940s, the country was a net food importer that relied on only a few agricultural commodities. Today, Brazil is one of the world's largest producers and exporters of a range of agricultural products such as soybeans, corn, cotton, oranges, coffee and beef. Grains, in particular, witnessed the most rapid productivity growth due to geographical expansion in the center-west region of the country, an area is known as the *Cerrado*. According to the Brazilian government, it was the acidic soils of the Cerrado where ‘empty’, or ‘underused’ could be transformed into an agroindustrial production zone for export (Graziano da Silva, 1993; Graziano da Silva, 1995).

Because of its ecological and social diversity, the Cerrado is sometimes referred to as the “Cerrado Complex” (Oliveria and

Marquis, 2001: 1; see also Jepson, 2005). It is characterized by large plateaus (*chapadas*), wooded hills and valleys (*cerradão*), scrub savanna plains (*campo sujo*), grasslands (*campo limpo*) and is atop Brazil's most important aquifer. For the purposes of this paper, the roughly 115 million acre biome will be simply referred to as the Cerrado to encompass its diversity. The vision set forth to develop the region was based on the use of modern science and technology to quickly colonize its land that has a relatively low slope, identified as ideal for industrial agriculture (Borlaug and Dowswell, 1997). From 1970 to 2006, grain production in the Cerrado expanded from 8 million tons to over 48 million tons (Santana and Nascimento, 2012: 23) and soybean production alone expanded from an area of just under one million hectares to over 23 million, while productivity per hectare increased threefold (Hosono and Hongo, 2016).

At the center of this transformation is the Brazilian Agricultural Research Corporation, known by its acronym Embrapa (*Empresa Brasileira de Pesquisa Agropecuária*). Embrapa is a public research institution headquartered in Brasília that, according to a former Embrapa president, “is increasing the human capacity to research, learn, oversee, predict and grasp a holistic vision of the world” (IFPRI Forum, 2010). This vision emanates from the institute's model of 47 research centers spread around the country that focus

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on specific agricultural commodities, themes or biomes. Decades of scientific research at these centers has elevated Embrapa as an example of how the World Bank says to “get it right” when it comes to agricultural research (Correa and Schmidt, 2014). Embrapa is often attributed as the key protagonist in the transformation of the Cerrado, and the growth of both is often held to be synonymous (Martha et al., 2012). In this paper, I situate the origins and politics of Embrapa within the transformation of the Cerrado to analyze the relationship between public agricultural research and international geopolitics.

I argue that the establishment of Embrapa and industrial agriculture in Brazil's Cerrado emanates from the intersection of three unique interrelated conditions: new tropical ecologies with relative underdevelopment; social relations of scientific knowledge production between Brazilian and US scientists and; the power of political interests to establish an agricultural sector dependent on US agro-inputs. This paper builds on and contributes to research in the history of science, Science and Technology Studies (STS) and historical geography. I connect the various scales of scientific knowledge production to situate regional materialities and national agencies within the history Cold War geopolitics as a lens to understand the broader power relations and hybridity of technoscience between the Global North and South (Rajão and Duque, 2014). Thus, this case expands the historical and geographical scope of postcolonial STS (Anderson, 2002; Harding, 2011), while also putting the politics and production of scientific knowledge at the center of environmental change in the Cerrado.

There has been a great deal of work analyzing the transformation of the Cerrado with a focus on private efforts of agricultural settlement (Jepson, 2006), farmer organizations (Brannstrom, 2005), land access (Jepson et al., 2010) and the geopolitics of soybeans, now the most widely cultivated crop in the region (Oliveira, 2016). However, few studies have looked outside of the in-house research of Embrapa to analyze the production and role of science and technology used to realize agricultural modernization in the Cerrado. I show that scientific knowledge and the building of research institutions is inherently power-laden, political and relational by focusing on the historical transmission of US environmental experts and expertise abroad (Teisch, 2011; Perkins, 1997; Fitzgerald 1986). In this process, scientific expertise was not simply adopted wholesale but institutionalized and nationalized by the establishment of Embrapa. Thus, the case of Embrapa and the Brazilian Green Revolution offers a way of “assaying local cultures and emergent political economies on the same scale” (Anderson, 2002: 645).

Embrapa has long held a special role in the Brazilian state as being an agency that is centered around a culture of expertise and institutional efficiency, which stands in stark contrast to the history of Brazil's troubled bureaucracies (Schneider, 1991). This image of apparent scientific neutrality has helped Embrapa garner significant political support that is crucial for their continued existence as a public institution. Even their own origins are heavily politicized because of the claims to domestic and international fame in the modernization of the Cerrado. That is why much of the early research conducted by US and non-Embrapa Brazilian scientists has largely been written out of the story by former Embrapa executives and in-house historians (see Cabral, 2005; Embrapa, 2002; Alves, 2016). Part of historicizing Embrapa and the transformation of the Cerrado, then, involves rewriting the role of Brazil and Brazilians into the wider process of the Green Revolution, or the deployment of US agricultural experts during the Cold War (Perkins, 1997). A quick library search on cases of the Green Revolution will yield hundreds of results from high profile countries as India, Mexico and the Philippines but few, if any, will focus on Brazil and/or the Cerrado.

Starting in the 1940s, prominent businessman and philanthropist Nelson Rockefeller hired scientists to work on technological solutions that could make a profit based on the industrialization of the Cerrado (Harrington and Sorenson, 2004). The early research of scientists working for Rockefeller in the region produced the basic scientific groundwork that legitimated agricultural modernization on the basis of imported industrial inputs. Once Rockefeller's scientists demonstrated the industrial potential of the region, political elites from both Brazil and the US worked together to redesign national agricultural research and to train Brazilian scientists (culminating in the establishment of Embrapa).

What makes Brazil such a unique case of the Green Revolution is that Nelson Rockefeller's cooperation with the Brazilian state differed from the more interventionist and largely top-down approach of US foundations and the Consultative Group for International Agricultural Research (CGIAR) who are typically identified as the key protagonists in the Green Revolution (Patel, 2013; Silva, 1997). These different actors and approaches also reinforced Embrapa's story of the Cerrado as an endogenous and apolitical process. Nevertheless, I suggest that Brazil achieved significant yield productivity gains and industrialized agriculture at scale by working closely with politically-motivated US experts – precisely the objectives and methods of the Green Revolution more broadly. A focus on training Brazilian scientists, in conjunction with the establishment of a national agricultural research system (Embrapa) and the availability of the vast Cerrado territory, solidified the Brazilian Green Revolution. This study reveals the long-term institutional legacies of the Green Revolution and the agency of scientists and policymakers from the Global South in the making and remaking of Green Revolution technologies. Thus, the transfer of scientific knowledge and technology was not a direct diffusion from the US to Brazil (Basalla, 1967) but an ongoing process of North-South collaboration through scientific research, academic training and intergovernmental political negotiations.

This paper is based on research conducted in Brazil and the United States throughout 2013 and 2014. I conducted 28 semi-structured interviews with Embrapa employees in June/July of 2013 and January 2014 at Embrapa's headquarters and the Embrapa-Cerrados field laboratory around Brasília. Most of these interviews were conducted with management who were trained as agricultural scientists and at one point worked at one of Embrapa's research centers (a common career path for Embrapa staff). By interviewing these senior staff, I was able to understand the institutional founding and building of Embrapa, including the connections to US scientific expertise. Additionally, I spoke to former US scientists who had worked in Brazil for Nelson Rockefeller during the 1950s and 1960s on research related to the Cerrado. I utilized the public archival records of Dr. Reeshon Feuer and Dr. Kenneth Turk at Cornell University who also worked on agricultural development in Brazil with the US Agency for International Development (USAID) and Rockefeller's organization during the 1950s and 1960s. Their archives contain field notes, personal and professional correspondences, memos and official reports that were fundamental to understand the historical relations of knowledge production and problem setting for agricultural development in Brazil's Cerrado. I also accessed the personal archives of Jerome Harrington, the former president of Nelson Rockefeller's research organization in Brazil and the online archives of USAID. My own positionality as a researcher at Cornell University has allowed for a privileged position to access these sources and place the different actors, categories and meanings around the agricultural research in Brazil's Cerrado.

I start the next section by explaining the early scientific work in the Cerrado that sought to turn on the agro-industrial potential of acidic tropical soils. Then, I introduce the development of agricul-

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