

VARIA

Before the “Fascist Labscapes:” Origin and Development of Plant Breeding in Portugal, 1862-1926

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Abstract: Plant breeding is one of the main factors sustaining the increase in agricultural productivity over the past two centuries. Despite some methodological obstacles to historical research, there is already extensive knowledge about the origins and early development of plant breeding in most European countries, the US, and East Asia. Portugal is absent from the international literature on this subject, and the existing studies focus mainly on the period from the 1930s onwards, connecting plant breeding to the establishment of the dictatorship and its goals of food self-sufficiency. The aim of this article is to analyse the origins and early stages of plant breeding in Portugal and placing them in the international context of this subject. Based on a wide range of sources, this study concludes that plant breeding began in Portugal in the second half of the nineteenth century and became reasonably well established by the early twentieth century, with the development of “Portuguese” hybrid varieties that were distributed to farmers.

Keywords: Plant breeding; agricultural modernization; Portugal; late nineteenth-century; early twentieth century

Introduction

Over the last two centuries, agricultural yields have increased enormously, allowing humanity to sustain its population growth. Several factors have decisively contributed to this outcome, including the increased use of fertilizers, the mechanization of agricultural production, and the expansion of irrigated areas. No less important in this process was plant breeding. The selection of seeds from individuals with specific traits and the hybridization of distinct agricultural plant varieties contributed to productivity gains ranging from 15 to 50 percent of the total, depending on different estimates.¹ Given its significance—at a time when the agricultural sector played a much larger role in every economy—plant breeding became one of the main topics of agricultural modernization in the leading developed countries from the mid-nineteenth century onward, pursued by public institutions, private organizations, and even individual farmers.

Although the historical influence of plant breeding on agriculture is one of the most challenging aspects to study due to methodological issues and suffering from a relative scarcity of sources,² there is a vast scientific literature on the subject that covers the entire North American and European geographical space.³ In fact, in a recent synthesis chapter, Dominic Berry noted that the historiography of crop improvement and plant breeding remains largely confined to a small set of countries, particularly the United States and Central Europe—specifically the United Kingdom, France, Germany, Italy, and the Netherlands— and, more recently, also including China and Japan.⁴ Portugal is rarely included in international histories of plant breeding. Nevertheless, the topic has been

¹ D. Luiz de Castro, *A Produção e a Cultura do Trigo em Portugal* (Lisboa: Real Associação Central da Agricultura Portuguesa, 1893); A.L. Olmstead and P.W. Rhode, “The Red Queen and the Hard Reds: Productivity Growth in American Wheat, 1800-1940,” *Journal of Economic History* 62, no. 4 (2002): 929-966; Jack Kloppenburg, *First the Seed: The Political Economy of Plant Biotechnology, 1492-2000* (Wisconsin: Wisconsin University Press, 2004); Josep Pujol-Andreu, “Wheat Varieties and Technological Change in Europe, 19th and 20th Centuries: new issues in Economic History” *Historia Agraria*, no. 54 (2011): 71-103.

² For the difficulties in identifying agricultural plant varieties due to the complexity of vernacular names, see Inês Gomes and Dulce Freire, “Seeds of Knowledge: Paving the Way to Integrated Historical and Conservation Science Research,” *Journal of Environmental Studies and Sciences* no. 13 (2023): 376-388. <https://doi.org/10.1007/s13412-023-00826-9>; Pujol-Andreu, “Wheat Varieties and Technological Change in Europe,” 71.

³ Kloppenburg, *First the Seed*; Noel Kingsbury, *Hybrid: The History and Science of Plant Breeding* (Chicago: The University of Chicago Press, 2009); Jonathan Harwood, *Europe's Green Revolution and Others Since: The Rise and Fall of Peasant-friendly Plant Breeding* (London: Routledge, 2012); Rolf H. J. Schlegel, *History of Plant Breeding* (London: Taylor & Francis, 2018); Dominic Berry, “Historiographies of Plant Breeding and Agriculture,” in *Handbook of the Historiography of Biology*, ed. Michael R. Dietrich, Mark E. Borrello and Oren Harman (Cham: Springer, 2021), 499-525.

⁴ Berry, “Historiographies of Plant Breeding and Agriculture.” In this article, plant breeding is considered to be the human actions done with the goal to change the genetic characteristics of plants

addressed on some occasions, albeit largely focusing chronologically from the 1930s onward and in connection with the establishment of the *Estado Novo* dictatorship.⁵ Closely connected with other non-communist European dictatorships—namely Fascist Italy—scientists working in plant breeding laboratories developed hybrid varieties that transformed landscapes through laboratory-driven interventions, creating what have been called “Fascist Labscapes.”⁶ Without questioning this conclusion, this article argues that the foundations of these laboratories were laid, and their activities were already underway, some decades before 1926, the year the dictatorship was established.

In fact, for earlier periods, the case of Portugal is poorly investigated. This could be related to a real gap between this country and the more developed ones in terms of structured plant breeding, as its predominantly agrarian economy lagged behind the European core and the United States until the second half of the twentieth century.⁷ However, as this article will demonstrate, this does not reflect the historical reality. In Portugal, public policies and structured private initiatives for plant breeding were developed in the second half of the nineteenth century, not much later than those already identified, for instance, in Germany, in the United Kingdom, or in the United States. These efforts aimed to increase agricultural production, primarily to sustain the food supply for a growing population.

The main objective of this article is to identify the earliest organizationally coordinated plant breeding efforts in Portugal—both public and private—and to trace their early development. It also aims to situate these efforts chronologically within the broader international context, thereby filling a gap in the historiography, as this Western European country is largely absent from studies on the subject. This article divides plant breeding into two actions: first, the experimental work, namely identification, study, and breeding experimentation with landraces, imported varieties, including hybridization, and the adaptation of foreign varieties by public agricultural services and farmers. This includes the earliest surveys of Portugal’s main crops varieties like wheat and maize. Secondly, the

in order to develop new varieties with desired traits, while crop improvement is a broader concept that includes plant breeding but also encompasses all strategies used to enhance crop productivity and quality such as soil management, pest control, fertilizer application or irrigation techniques.

⁵ Tiago Saraiva, “Fascist Labscapes: Geneticist, Wheat, and the Landscapes of Fascism in Italy and Portugal,” *Historical Studies in the Natural Sciences* 40, no. 4 (2010): 457-498; Dulce Freire, “Experiência e Ciência: Modernização da Agricultura nas Últimas Décadas do Estado Novo,” in *Da Economia Moral da Multidão à Arte de Não Ser Governado: E. P. Thomson e James C. Scott na Ibéria*, ed. Diego Palacios Cerezales, Fátima Sá and José Neves (Castro Verde: 100Luz, 2013), 91-108; Tiago Saraiva, “Fascist Modernist Landscapes: Wheat, Dams, Forests, and the Making of the Portuguese New State,” *Environmental History* 21, no. 1 (2016): 54-75.

⁶ Saraiva, “Fascist Labscapes.”

⁷ Luciano Amaral, *The Modern Portuguese Economy in the Twentieth and Twenty-First Centuries* (Cham: Palgrave, 2019).

dissemination of selected improved seeds, hybrid or not, imported or not, among farmers, promoted mainly by public agronomic services.

Focusing on the early decades of plant breeding in Portugal, this study examines the period from the second half of the nineteenth century to the early decades of the twentieth century. It takes 1862 as its starting point, the year in which the Agriculture Department of the Ministry of Public Works, Commerce, and Industry commissioned agronomist José Ignacio Ferreira Lapa to conduct a study on the wheat varieties cultivated in Portugal.⁸ From a symbolic perspective, this study marks the beginning of plant breeding in the country. The endpoint is 1926, when a military coup established a dictatorship that, despite evolving different institutional frameworks, lasted until 1974. That same year, the Ministry of Agriculture increased large-scale wheat seed multiplication,⁹ and soon after, the Wheat Campaign (1928-1938), a state-led plan aimed at increasing wheat production in Portugal in order to achieve food self-sufficiency, but which also included other cereals such as maize and rye, significantly accelerated the process of plant breeding in Portugal. While the historiography has examined plant breeding in Portugal during the dictatorship, this study focuses on the earlier decades, making it possible to trace its development in Portugal to a much earlier timeline—one that is, consequently, not far behind the world-leading countries in this field.

To achieve the proposed objectives, this study relies on a wide range of sources. First, agricultural journals such as *Arquivo Rural*—founded in 1858 and the oldest publication in Portugal specializing in this field—and *Gazeta das Aldeias*. Second, official bulletins of the public organizations responsible for overseeing agriculture in Portugal, namely the *Boletim da Direção-Geral de Agricultura*, founded in 1889, and, from 1918 onward, the *Boletim do Ministério da Agricultura*, and of specific plant breeding stations such as *Boletim Agrícola Mensal do Posto Agrário Fixo da Herdade da Mitra*. Third, documentation produced by these same public organizations, kept at the Portuguese National Archive of Torre do Tombo. Finally, published books by various stakeholders, including agronomists and landowners, who described the state of Portuguese agriculture and its innovations. International comparisons are based on the existing literature on the subject.

The article is structured as follows: after this introduction, a summary of the development of plant breeding in the most advanced countries in the field of plant breeding is presented, followed by an analysis of its application to the Portuguese context, subdivided according

⁸ José Ignacio Ferreira Lapa, “Relatorio do Estudo Industrial e Chimico dos Trigos Portuguezes” *Arquivo Rural* V, (1862): 113-145. This study was published in several numbers of *Arquivo Rural* during 1862 and 1863 and later it was published in a book. For the full study, see José Ignacio Ferreira Lapa, *Memória Sobre o Estudo Industrial e Chimico dos Trigos Portuguezes* (Lisboa: Typografia da Academia, 1865).

⁹ Tiago Saraiva, “Fascist Labscapes.”

to the two types of actions already mentioned. Finally, the conclusions indicate that Portugal chronologically closely followed the North American and European plant breeding innovations, adopting some of the most advanced techniques of the time. However, the practical impact on the Portuguese agriculture appears to have been significantly more limited, with the agricultural sector struggling to achieve the desired productivity increase.¹⁰ Probably, the dissemination of improved agricultural plant varieties benefited a limited area of the southern regions where large estates predominated and focusing on a relatively small number of crops, with a particular emphasis on cereals such as wheat.¹¹

Plant Breeding in Modern Agricultural Development

It is legitimate to state that the improvement of agricultural plants by the mean of seed selection is as old as agriculture itself. The selection of seeds with the most desirable traits has been a practice adopted by farmers since the earliest historical records.¹² However, the systematic planning of plant breeding aimed at structurally modifying a specific agricultural crop is a much more recent concept. Only by the end of the eighteenth century did English, French, and German individual pioneer plant breeders start systematic experiments in order to increase the crop yield. Figures such as Philippe Vilmorin in the late eighteenth century, and later, in the early nineteenth century, Thomas Andrew Knight and Patrick Shirreff,¹³ were among the pioneers whose names would be perpetuated through companies like Vilmorin-Andrieux—one of the main suppliers of improved seeds to Portuguese agricultural services, as we will see—or through wheat varieties such as *Shirriff's square head*, which would be tested in Portugal in the late nineteenth century. In the United States, public policies seem to have a more important role in the development of plant breeding since its beginning. In 1839, the United States Congress assigned a significant budget to the Patent Office for the establishment of a seed collection and its subsequent free distribution. In addition to importing plant seeds from various parts of the world, both the department itself and the thousands of farmers who had the opportunity to cultivate previously unknown plants in their regions engaged in plant breeding efforts.¹⁴

¹⁰ Pedro Lains, “Agriculture and Economic Development in Portugal, 1870–1973,” in *Agriculture and Economic Development in Europe since 1870*, ed. Pedro Lains and Vicente Pinilla (London: Routledge, 2009), 333–352.

¹¹ Carlos Manuel Faísca and Dulce Freire, “Not All Wheats Are the Same: Selection and Improvement of Wheat in Portugal since Early Modern Times (Sixteenth to Twentieth Centuries),” *Investigaciones de Historia Económica* 21, no. 1 (2025): 59–86, <https://doi.org/10.33231/j.ihe.2025.01.03>.

¹² Kloppenburg, *First the Seed*, 3.

¹³ Schlegel, *History of Plant Breeding*, 39–46; Kingsbury, *Hybrid*, 80–109.

¹⁴ Kloppenburg, *First the Seed*, 55–57.

In reality, whether coordinated by public policies or driven by private initiative, collective or individual, the nineteenth century was marked by a series of impactful plant-breeding initiatives across the major Western economies. Following efforts dating back to the mid-eighteenth century, in France Vilmorin-Andrieux, founded in 1815, began focusing on plant breeding in the 1830s after extraordinarily successful experiments with carrots and sugar-beet.¹⁵ This led, in the following decade, to its emergence as the world’s leading company in seed production and distribution. One of its notable achievements was the development of one of the first hybrid wheat variety in the world, the *Dattel*, created between 1875 and 1883 through the crossbreeding of the British variety *Prince Albert* and the French *Chiddam Épi Rouge*.¹⁶ This French company is still in operation today.

In the UK, J.B. Lawes, a businessman, established the Rothamsted Experimental Station on his estate in 1841, initially focusing on soil fertilization but soon expanding into plant breeding.¹⁷ Around 1860, sales of the famous wheat varieties developed by Patrick Shirreff since 1819 and, from 1857 onwards, in his own experimental fields, started increasing.¹⁸ In Germany, in addition to individual efforts, such as those of Wilhelm Rimpau, who developed a new rye variety, the 1870s saw the establishment of the first public breeding stations. In 1885, the German Agricultural Society was founded, and two years later it launched a plant breeding program across nine German regions.¹⁹ In neighbouring Austria, the Institute of Agronomy and Plant Breeding, based in Vienna, was founded in 1872.²⁰ Organizations dedicated to plant breeding were also established in the Netherlands in 1865, in Belgium in 1872, and in Luxembourg in 1884.²¹ This international scenario aligns with Harwood’s argument that the emergence of “scientific” plant breeding around 1900 represented not a sudden Mendelian revolution, but the consolidation of practices already developed during the nineteenth century²².

In fact, in the last decades of the nineteenth century, plant breeding became more scientific, complicated, expensive, and difficult. Therefore, it became institutionalized, usually in government-owned institutes or, like the United States, in government-financed

¹⁵ Kingsbury, *Hybrid*, 107-109; Domingos Victoria Pires, *Técnica do Melhoramento de Plantas* (Lisboa: Sá da Costa 1953), 3.

¹⁶ Pujol-Andreu, “Wheat Varieties and Technological Change in Europe,” 80.

¹⁷ Schlegel, *History of Plant Breeding*, 59-60.

¹⁸ Kingsbury, *Hybrid*, 105-106.

¹⁹ Harwood, *Europe’s Green Revolution*, 66-67.

²⁰ Ibid.

²¹ Ibid.

²² Jonathan Harwood, “Did Mendelism Transform Plant Breeding? Genetic Theory and Breeding Practice, 1900–1945,” in *New Perspectives on the History of Life Sciences and Agriculture*, ed. Denise Phillips and Sharon Kingsland (Cham: Springer, 2016), 345–365.

universities.²³ In this context, even in countries with lower levels of development during this historical period, institutionalized plant breeding, and its dissemination, played an important role in agricultural modernization and innovation strategies. In Sweden, for instance, the Swedish Association for Seed Cultivation and Breeding was founded in 1886 as a private organization but received public support from the beginning, establishing an experimental crop improvement station in Svalöf.²⁴ This location became one of the most frequently associated with plant breeding on a global scale, and it would become quite important for plant breeding in Portugal, especially with the visits of leading Portuguese breeding agronomists such as Victória Pires, and, in the field of Silviculture, Joaquim Vieira Natividade from the 1930s onward;²⁵ however, these developments lie outside the chronological scope of this article. Outside Europe, Japan, during the Meiji era, also sought to keep up, creating an Agricultural Experiment Station in Sapporo in 1871, followed by seven more in 1893.²⁶ Even Romania, a country just like Portugal also on the socioeconomic periphery of Europe,²⁷ established a breeding station in Bucharest in 1887.²⁸

In Switzerland, the emergence of scientific plant breeding—marked by the creation of the first experimental stations and official breeding programmes—dates from the early twentieth century,²⁹ much like in Spain, where the Biological Mission of Galicia is one of the earliest major examples, in this case focused specifically on maize.³⁰ It was in this context that, in 1905, the International Institute of Agriculture was created in Rome, Italy—an institution partially served as a precursor to the FAO—and which, among other activities, standardised terminology for varieties and seeds, promoted international trials, and circulated information on improved plant varieties.³¹ As will be shown, the first scientific

²³ Schlegel, *History of Plant Breeding*, 59; Kloppenburg, *First the Seed*, 12.

²⁴ Kingsbury, *Hybrid*, 160-161.

²⁵ For the connection between Svalöf and Portuguese leading breeding specialists in 1930s see, for instance, Ignácio García-Pereda, *Experts Florestais: Os Primeiros Silvicultores em Portugal* (PhD diss., Universidade de Évora, 2018).

²⁶ Kingsbury, *Hybrid*, 66-67; Schlegel, *History of Plant Breeding*, 59-60.

²⁷ Stephen Broadberry, Rainer Fremdling, and Peter Solar, “Industry,” in *The Cambridge Economic History of Modern Europe: volume 1, 1700-1870*, ed. Stephen Broadberry and Kevin O’Rourke (Cambridge: Cambridge University Press, 2010), 169-171.

²⁸ Schlegel, *History of Plant Breeding*, 59-60.

²⁹ Juri Auderset, “Plant Improvement, the Modernising State, and the Contested Evolution of Wheat Breeding in Switzerland, 1880–1940,” in *The Formation of Agricultural Governance: The Interplay Between State and Civil Society in European Agriculture, 1870-1940*, ed. Jordi Planas, Anton Schuurman and Yves Segers (Turnhout: Brepols, 2025), 221–44.

³⁰ Miguel Cabo, Bruno Esperante, and Lourenzo Fernández-Prieto, “Old and New Plants from the Americas to Europe: Potatoes, Corn and the Genetics of Double Hybrid Corn (1800–1940),” *Rural History* 31, no. 1 (2020): 53–62.

³¹ Niccolò Mignemi and Juan Pan-Montojo, “International Organizations and Agriculture, 1905–1945: Introduction,” *Agricultural History Review* 65, no. 2 (2017): 237–253.

breeding efforts arising from specific public policies in Portugal preceded the chronology of both Switzerland and Spain, and were already underway by the time the International Institute of Agriculture was founded.

Plant breeding became, in this period, one of the most important aspects of agriculture across several regions of the world. Faced with unprecedented population growth, which had to be fed, and with an expanding industrial sector that depended on a wide range of agricultural raw materials, numerous public and private initiatives sought to modernise agriculture. In line with classical definitions, modernisation is taken here as the multidimensional process through which societies shift to a scientifically oriented organisation,³² a transformation that in agriculture, as established in agrarian historiography, comprised at least four major aspects: institutional change, such as land reform or the organisational structures responsible for agricultural development, including the professionalisation of agronomy; economic transformations, such as the integration into international markets or access to agricultural credit; technological and scientific innovations, including the introduction of machinery, fertilisers, and improved crop varieties; and agricultural extension and technical diffusion, meaning the capacity to disseminate these changes to farmers.³³ In this article, plant breeding is assumed to be one of the main elements of agricultural modernisation, both in a technological dimension, through the alteration and introduction of agricultural plants, and in an institutional dimension, as it resulted from the deliberate action of organisations created for that purpose.

The list of countries that, either through public or private initiatives, created organizations strongly or even exclusively dedicated to crop improvement and plant breeding throughout the nineteenth century is extensive. It includes almost all of Europe, the United States, some European colonies—such as South Africa and India—and Asian countries such as Japan and China. However, the Portuguese case is rarely mentioned, an omission that the next section aims to address, filling a gap in the historiography of science of crop improvement and plant breeding.

³² For the broader concept of modernisation see Anthony Giddens, *The Consequences of Modernity* (Stanford, CA: Stanford University Press, 1990); Göran Therborn, “Modernization,” in *International Encyclopedia of the Social and Behavioral Sciences*, ed. Neil J. Smelser and Paul B. Baltes (Oxford: Pergamon/Elsevier, 2003), 10065–71 or Ronald Inglehart and Christian Welzel, *Modernization, Cultural Change, and Democracy: The Human Development Sequence* (Cambridge: Cambridge University Press, 2005).

³³ For the concept and debate surrounding agricultural modernization, see, for instance, Jonathan Harwood, *Technology’s Dilemma: Agricultural Colleges between Science and Practice in Germany, 1860–1934* (Bern: Peter Lang, 2005), 18–21; or Lorenzo González Prieto, ‘Modernización, Estado y Agricultura en la España del siglo XX,’ *Historia Agraria* 55 (2011): 125–128. See also how nineteenth-century Portuguese agricultural development is analysed through all the aforementioned dimensions in Amélia Branco and Ester Gomes da Silva, “Growth, Institutional Change and Innovation, 1820–1930,” in *An Agrarian History of Portugal, 1000–2000: Economic Development on the European Frontier*, ed. Dulce Freire and Pedro Lains (Leiden: Brill, 2017), 217–244.

Plant Breeding in Portugal

Portuguese Plant Breeding Historiography

Portugal is the most western country of continental Europe, situated in the Atlantic Coast of Iberian Peninsula, covering a little over 92,000 sq. kilometers. Portugal was, in the mid-nineteenth century, a predominantly rural society with an economy primarily based on agriculture. At that time, nearly two-thirds of the population worked in the primary sector, with the vast majority engaged in agricultural activities.³⁴ Agriculturally, although there was significant regional diversity, the country could generally be, and still can be, divided into two distinct regions (see figure 1). In the districts north of a line between the cities of Santarém-Castelo Branco, land fragmentation was largely dominant, a pattern linked both to historical social characteristics and environmental conditions such as higher rainfall and, consequently, the spread of more productive irrigated crops, with maize as the main grain³⁵. In contrast, in the south—especially in the interior districts of Portalegre, Évora and Beja, the Alentejo region—large estates prevailed, and agriculture was predominantly dryland-based, with a focus on less productive wheat cultivation. With a growing population, rising from 4.1 million in 1864 to 6.8 million in 1930, Portuguese agriculture faced the challenge of feeding an increasing population, especially as the political goal of food sovereignty prevailed to varying degrees throughout the period covered in this article.

³⁴ Amélia Branco and Ester Gomes da Silva, “Growth, Institutional Change and Innovation, 1820–1930,” in *An Agrarian History of Portugal, 1000–2000*, ed. Dulce Freire and Pedro Lains (Leiden: Brill, 2017), 221.

³⁵ For the agrarian structure of land ownership in Portugal see Rui Santos, “Economic Sociology of the Modern Latifundium: Economic Institutions and Social Change in Southern Portugal, Seventeenth–Nineteenth Centuries,” *Sociologia, Problemas e Práticas* no. 45 (2003): 23–52. The exception was the inner north, where rye was the main grain, as the low temperatures and poor soils of the more mountainous area did not allow other grains to thrive.



Figure 1. Portugal and its administrative division during the large majority of the nineteenth and twentieth centuries. Source: Author's own.

Despite industrial growth, the country was far from becoming an industrialized nation, something that would only occur in the second half of the twentieth century.³⁶ It has thus been considered to be situated in the “third Europe,” alongside other less developed countries such as Spain, Norway, Finland, present day Slovakia, Romania, and much of southeastern Europe.³⁷ Given the importance of the agricultural sector in the Portuguese economy, the country’s economic performance depended primarily on the progress of agriculture. The governing elite was well aware of this reality, and agricultural modernization was frequently addressed in parliamentary debates and government legislative initiatives. These discussions approached the several aspects mentioned above—from land-ownership regimes to agricultural machinery, as well as agricultural economic policy and the creation of public and associative structures to support the sector, and, from a certain period in time, also plant breeding. After a tumultuous first half of the nineteenth century, marked by high levels of violence and destruction—including a foreign occupation during the Napoleonic Wars (1808-1810), a Civil War (1832-1834), and several *coups d’état* (1820, 1823, 1824, 1836, 1837, 1842, 1844, 1846, 1851)—Portugal finally achieved the necessary political stability to reform public policies during the Regeneration period (1851-1868), building a new state organization after the dismantling of the *Ancien Régime* society, which began with the *coup* of 1820.³⁸

It was in this context that public policies in Portugal began to address crop improvement, including plant breeding—a topic acknowledged in the scholarship but never carefully researched. For example, the chapter on the nineteenth and early twentieth centuries in *An Agrarian History of Portugal* devotes only a few lines to the issue, briefly noting RACAP’s late nineteenth-century efforts in seed selection and crop breeding and the State’s facilitation of access to seeds after 1917,³⁹ while omitting plant breeding from the explanation of productivity change in the conclusion.⁴⁰ Maria Carlos Radich and Fernando Oliveira Baptista, the latter not only an academic but also Minister of Agriculture in 1975, dedicate a paragraph to the subject in their analysis of agricultural policy during the Portuguese First Republic (1910–1926). However, it remains a short reference for such an important subject.⁴¹

³⁶ Amaral, *The Modern Portuguese Economy in the Twentieth and Twenty-First Centuries*, 171-225.

³⁷ Broadberry, Fremdling and Solar, “Industry,” 169-171.

³⁸ Branco and Gomes da Silva, “Growth, Institutional Change and Innovation, 1820–1930,” 228-233.

³⁹ *Ibid.*, 239-240.

⁴⁰ *Ibid.*, 219-244.

⁴¹ Maria Carlos Radich and Fernando Oliveira Baptista, *Terra e Agricultura: Século XX* (Lisboa: 100 Luz, 2021), 80–81.

Initiatives carried out by the dictatorship (1926-1974) have garnered more attention and have been framed within the broader context of similar policies implemented by other non-communist European authoritarian regimes. Tiago Saraiva’s work is particularly significant in this regard.⁴² In Italy, Germany, and Portugal, Saraiva argues, liberal capitalism vanished from rural areas, giving way to vast bureaucratic structures aimed at controlling food production, processing, and distribution.⁴³ These efforts encompassed plant breeding, forest policies, and the construction of dams and irrigation systems. According to Saraiva, plant geneticists were essential to the institutionalization of European fascist regimes in the 1930s, strengthening ties between them and producing similar impacts on their national landscapes through laboratory work, in what he termed “fascist labscapes.”⁴⁴

While these initiatives reached an unprecedented scale during the dictatorship, Saraiva also points out that the development of crop varieties by Portuguese breeders dates back to the early twentieth century.⁴⁵ This implicitly suggests that crop improvement and plant breeding in Portugal must have originated at least in the late nineteenth century. Dulce Freire also focused her analysis on post-Second World War public policies, when the so-called Green Revolution model was adopted more explicitly.⁴⁶ It is also worth noting that, as with forest policies and with dams and irrigation systems,⁴⁷ although these projects were largely executed under the dictatorship, their conceptualization can be traced back to the nineteenth century, if not earlier. It therefore appears that much of the agrarian policy of the dictatorship was designed in the nineteenth century, but this subject will be addressed in another investigation. For now, in the following pages, the focus will be on the origins and early developments of plant breeding in Portugal, since it is the objective of this article.

Identification, Experiments and Improvement of Crop Varieties

Like in other European countries, Portuguese botanical gardens promoted the introduction and acclimatisation of exotic agricultural plants during the eighteenth century, including citrus varieties, sugarcane, cassava. This work was supported by exchange networks with colonial and European institutions and by exploration expeditions. The Ajuda Botanical

⁴² Saraiva, “Fascist Modernist Landscapes,” 54–75.

⁴³ Ibid., 56.

⁴⁴ Saraiva, “Fascist Labscapes.”

⁴⁵ Ibid., 490-491.

⁴⁶ Freire, “Experiência e Ciência.”

⁴⁷ Carlos Manuel Faísca, “De la Retórica a la Aplicación: Ideas, Expectativas e Impactos del Regadío en el Alentejo (Siglos XVIII a XXI),” in *Control y Usos del Agua en la Península Ibérica: Perspectivas Diversificadas a Largo Plazo*, ed. Juan Manuel Matés-Barco, Ana Cardoso de Matos and Maria Ana Bernardo (Madrid: Sílex, 2023), 207–37; Carlos Manuel Faísca, “El Negocio Corchero en Alentejo: Explotación Forestal, Industria y Política Económica, 1848–1914” (PhD diss., University of Extremadura, 2019).

Garden, founded in 1768, and the Botanical Garden of the University of Coimbra, established in 1772, were at the centre of these exchanges in Portugal.⁴⁸ However, it was not until the second half of the nineteenth century, during a period of political stability, that the Portuguese State began to develop an institutional framework that would lead to a public policy for the promotion of plant breeding. Just a year after the *coup* that established the Regeneration period (1851-1868) and led to a profound reform of the Portuguese state, the first state body dedicated exclusively to agriculture was created in 1852: the Agricultural Division of the Ministry of Public Works, Commerce, and Industry. At the same time, the government decided to organize agricultural education, which had been practically non-existent until then. The decree of December 16, 1852, structured education into three levels: higher education was assigned to the Lisbon Agricultural Institute, intermediate education to the Regional Schools of Lisbon, Viseu, and Évora, and elementary education to the Teaching Farms. None of these educational levels, which presupposed practical training and, in the case of higher education, scientific research, made any reference to plant breeding. However, in 1857, Andrade Corvo, professor of botany and agriculture at the Lisbon Polytechnic School since 1844 and a future Minister responsible for Agriculture,⁴⁹ upon his visit to the Universal Exhibition in Paris in 1855, praised the “victory achieved by the esteemed and enlightened Mr. Vilmorin over nature. . .by creating a variety of beet that contains proportionally twice as much sugar as the ordinary varieties.”⁵⁰ Soon after, in 1859, in an article in the first year of the oldest Portuguese agricultural journal, *Arquivo Rural*, Rodrigo Moraes Soares, future General Director for Agriculture, grieved Portuguese agriculture’s lack of attention to “improving the best potato varieties,”⁵¹ in contrast with France, where the Central Agricultural Society’s catalogue already listed fifty-five different varieties. Moraes Soares, who was already the Chief of the Agricultural Division, recognized the importance of plant breeding, even if not explicitly named as such, due to the “great superiority of some varieties over others.”⁵²

Following this concern, in 1862 the Agricultural Division commissioned José Ignacio Ferreira Lapa to conduct an exhaustive survey of the wheat varieties cultivated in Portugal, as shown in figure 2, with the goal of “understanding the value and industrial and

⁴⁸ João Carlos Brigola, “A Aclimação de Plantas do Oriente e do Brasil no Real Jardim Botânico da Ajuda (1768–1808),” *Revista Portuguesa de História* 36, no. 2 (2002–2003): 59–72.

⁴⁹ On Andrade Corvo’s biography, see Daniel Gamito-Marques, “Corvo, João de Andrade (1824–1890),” in *Dicionário Biográfico de Cientistas, Engenheiros e Médicos em Portugal*, ed. Maria Paula Diogo et al. (Lisboa: Centro Interuniversitário de História das Ciências e da Tecnologia, 2023), <https://doi.org/10.58277/CQEH5201>.

⁵⁰ João Andrade Corvo, *Relatório sobre a Exposição Universal de Paris: Agricultura* (Lisboa: Imprensa Nacional, 1857), 241.

⁵¹ Rodrigo Moraes Soares, *Arquivo Rural* I (1859): 619.

⁵² Rodrigo Moraes Soares, *Arquivo Rural* I (1859): 619.

nutritional qualities of each wheat” as well as “determining in which location each type of wheat performed better or worse.”⁵³ With a total of twenty-nine wheat varieties collected from across the mainland and islands, this study demonstrates that, during this period, only landraces were cultivated. However, the names of some varieties suggest an external geographical origin, such as *Sicilio* and *Egypcio*, indicating possible connections to Sicily and Egypt. Shortly afterwards, in 1870, Andrade Corvo published a similar study focusing on maize varieties cultivated in Portugal.⁵⁴



Figure 2. Three ears of Portuguese wheat landraces published in the survey of Portuguese wheat varieties. Source: José Ignacio Ferreira Lapa, “Relatorio do Estudo Industrial e Chimico dos Trigos Portuguezes,” *Archivo Rural* V (1862): 113–145.

⁵³ José Ignacio Ferreira Lapa, “Relatorio do Estudo Industrial e Chimico dos Trigos Portuguezes,” *Archivo Rural* V, (1862): 113–45.

⁵⁴ *Gazeta das Aldeias*, year 31, no. 1391 (May 16, 1926).

Simultaneously, the agricultural services initiated an effort to study other landraces and imported varieties, sometimes with the collaboration of private farmers. Thus, as early as 1863, a journal article was published with the results of the cultivation of thirty cabbage varieties purchased by the Agriculture Division from the French seed producer company Vilmorin and sent to a farmer in Guimarães, district of Braga, who was tasked with growing them and reporting the results.⁵⁵ In the following year, local wheat landraces were tested at the Quinta da Cartuxa, in Évora, a state farm,⁵⁶ and shortly after also barley landraces.⁵⁷ These experiments lasted, at least, for five consecutive years. In 1868, a government decree established eighteen Experimental Agronomic Stations—one in each district capital—along with the Regional Farm of Sintra. This decree undeniably marked the establishment of a public policy of central planning for agrarian innovation, which included plant breeding and was intended to reach all regions of mainland and insular Portugal. However, as with so many other policies, its implementation fell short of expectations, and by the 1870s, only the stations in Sintra, Lisbon, and Braga were operational. In 1901, the Lisbon station was renamed the National Agronomic Station, a name it has maintained to this day, although it is now located in Oeiras and not Belém, but still in the Lisbon Metropolitan Area.⁵⁸ It was at this institution that the first wheat hybrids in Portugal were produced in the early twentieth century. However, back in the 1870s, the work carried out at this and the other experimental agronomic stations focused mainly on other crop improvement measures mainly fertilizer experiments in a wide range of agricultural crops, while the scarcity of information regarding plant breeding suggests that it should have been of lesser importance.⁵⁹

Evidence suggests that, between the 1850s and the 1870s, agricultural modernization in Portugal regarding technical change primarily focused on increasing fertilizer use—an approach explicitly stated by Ferreira Lapa in a conference in Braga and corroborated by documents from the Lisbon Experimental Station.⁶⁰ Nevertheless, during the 1850s and 1860s there was an awareness of the importance of different varieties for crop performance, as demonstrated by wheat and maize identification efforts, subsequent experiments, and the purchase of French seeds from Vilmorin-Andrieux company by the agricultural services for experiments in northern Portugal. At the same time, the reception of Darwin’s ideas in Portugal may have contributed to the gradual emergence of a scientific framework that

⁵⁵ *Arquivo Rural* VI, (1863): 547-548.

⁵⁶ *Arquivo Rural* VII, (1864): 518.

⁵⁷ *Arquivo Rural* IX, (1866): 316-317.

⁵⁸ Maria de Lourdes Borges, Manuel Viana Silva, and Nair Sá, *Estação Agronómica Nacional: 50 Anos de Atividade, 1936–1986* (Lisboa: Estação Agronómica Nacional, 1986), 1.

⁵⁹ *Arquivo Rural* XIII, (1871): 521; António Filipe da Silva, *Relatório dos Resultados Obtidos na Estação Agronómica Experimental de Lisboa* (Lisboa: Imprensa Nacional, 1872).

⁶⁰ *Arquivo Rural* XIII, (1870): 312. Silva, *Relatório dos Resultados Obtidos na Estação Agronómica Experimental de Lisboa*.

valued variability, adaptation, and selection as central principles for improving crops. Júlio Henriques, Director of the Botanical Garden of the University of Coimbra, played a decisive role in introducing evolutionary thought into Portuguese botanical teaching and research, embedding Darwinian concepts in floristic observation and species classification. Although this intellectual influence is well documented for Coimbra,⁶¹ its potential impact on agricultural practice—particularly on the development of plant breeding at the Lisbon agronomy school, the only institution of higher agricultural education in the late nineteenth century, and within the network of agricultural stations—remains largely unexplored.

A key event in the early history of Portuguese crop improvement was the Decree of 30 October, 1888, which instructed all regional agrarian stations under state administration to conduct comparative experiments of Portuguese and foreign wheat varieties. These stations had been created two years earlier, in 1886, at the rate of one per Portuguese Agrarian Region, amounting to twelve in total.⁶² The decree acknowledged that wheat yields elsewhere in Europe were significantly higher than in Portugal, attributing this gap to deficient agricultural practices, inadequate fertilisation, and the absence of seed selection. This initiative followed a study published in 1884 that analysed various wheat varieties in terms of straw production,⁶³ and preceded another, in 1893, which identified and characterized wheat varieties grown in Portugal, in the same exhaustive manner as the earlier survey published by Ferreira Lapa.⁶⁴ Although other crops were also targeted by agricultural breeding policies, sources indicate that wheat was the primary focus in the late nineteenth century. This is unsurprising, as from 1889 onward, wheat production in Portugal was heavily protected by public policies in response to the influx of cheap foreign wheat, arriving primarily at the port of Lisbon from the United States, other countries in the Americas, and, to a lesser extent, from the Russian Empire.⁶⁵

Also in 1889, twenty-one imported wheat varieties were sown at the Algarve experimental field, in the southernmost region of mainland Portugal. Among the foreign varieties tested were some that would later succeed in Portuguese agriculture, such as the French *Dattel*—

⁶¹ Ana Leonor Pereira, “The Reception of Darwinism in Portugal (1865–1914),” in *The Reception of Darwinism in Europe*, ed. Eve-Marie Engels and Thomas F. Glick (London: Continuum, 2008), 331–43.

⁶² The official portuguese name was *Estações Químico-Agrícolas*. To understand the work at a concrete Station, see Carlos Manuel Faísca, *Organizações e Investigação Agrária em Loulé (1849–1960)* (Loulé: Município de Loulé, 2025).

⁶³ António Xavier Pereira Coutinho, *Os Fenos Espontâneos e as Palhas de Trigo em Portugal* (Lisboa: Imprensa Nacional, 1884).

⁶⁴ Dom Luiz de Castro, *A Produção e a Cultura do Trigo em Portugal*. José Ignacio Ferreira Lapa, “Relatório do Estudo Industrial e Chimico dos Trigos Portuguezes.”

⁶⁵ Jaime Reis, “A ‘Lei da Fome’: as Origens do Protecçãoismo Cerealífero (1889–1914)” *Análise Social* 15, no. 60 (1979): 745–93.

the first hybrid wheat—,⁶⁶ the Italian *Rieti* and the Russian *Noé*.⁶⁷ In the following year, well-known improved British varieties, such as *Shirreff's square head*, were also included.⁶⁸ Simultaneously, at the Évora experimental field, also part of the State Agrarian Stations network, both foreign varieties and local landraces were sown. The results did not demonstrate a systematically higher yield for the improved foreign varieties; however, the *Rieti* variety achieved the best outcomes.⁶⁹

Despite the predominance of wheat, several other types of crops were tested according to the regional suitability of each. Thus, in the Algarve, the introduction and “acclimatization” of new fig varieties was initiated.⁷⁰ Meanwhile, in the mountainous region of the district of Castelo Branco, rye varieties purchased once again from Vilmorin-Andrieux, namely *Brie*, *Champagne*, *Saxony*, *Alpine*, *Mountain*, and *St. John rye*, were cultivated.⁷¹ Later, maize followed: between 1899 and 1901, sixteen varieties of imported maize were cultivated for study purposes in the Lisbon Agronomic Station. Of these, the *Rothlücker*, *Virginia*, and *Harlekin* varieties achieved the highest yields, with 938 kg/hectare, 860 kg/hectare, and 521 kg/hectare, respectively.⁷²

In this context, and following the rediscovery of Gregor Mendel's pioneering work on genetics in 1900,⁷³ on 22 November, 1901, a Government Order was published instructing all its agrarian research and education organizational network, namely practical schools of agriculture, agricultural chemistry stations, and agricultural development stations, to undertake actions of artificial crossbreeding and selection with the aim of obtaining new, good quality varieties of wheat. Only a year after the scientific awakening to Mendelian genetics, Portuguese public policy had already recognized the importance of the new methods of hybridization which, in 1902, began to be implemented at the National Agronomic Station, located next to the Jerónimos Monastery, in Belém. This led the prominent agronomic geneticist Domingos Vitória Pires—who would later become Director of the National Crop Improvement Station and Secretary of State for Agriculture during the dictatorship—to state, four decades later, that this proved “the advanced position we [Portugal] held at that

⁶⁶ Pujol-Andreu, “Wheat Varieties and Technological Change in Europe,” 98.

⁶⁷ Portugal. Direcção-Geral de Agricultura, *Boletim da Direcção-Geral de Agricultura* 5, Year 1 (1889): 284-285.

⁶⁸ Ibid, 11, Year 2 (1890): 1132-1133.

⁶⁹ Ibid.

⁷⁰ Portugal. Direcção-Geral de Agricultura, *Boletim da Direcção-Geral de Agricultura* 8, Year 1 (1889).

⁷¹ Ibid., 6, Year 1 (1889).

⁷² Real Associação Central da Agricultura Portuguesa, *Boletim da Real Associação Central da Agricultura Portuguesa* 4, no. 7 (1901): 401.

⁷³ Kloppenburg, *First the Seed*, 77–78.

time.”⁷⁴ During this period, the acquisition of improved and/or hybrid seeds from foreign companies appears to have diversified, as documents also confirm the purchase of seeds from American firms, as shown in figure 3, and not just Vilmorin-Andrieux.



Figure 3. Purchase of seeds by the National Agronomic Station from the US company W. Atlee Burpee & C^o., 1905. Source: Ministério das Obras Públicas, Commercio e Industria, Direcção-Geral de Agricultura, NP 1047, doc. 25, Arquivo Nacional da Torre do Tombo – PT/TT/MOPCI/DGA/NP 1047.

Sources furthermore show that crop improvement expanded in the early twentieth century, not only at the National Agronomic Station, with experiments on maize varieties, for example, taking place in 1907,⁷⁵ but also across the country, through regional agricultural

⁷⁴ Domingos Vitória Pires, “O Melhoramento de Plantas e a Produção Agrícola Nacional,” *Revista Agronómica* 34, no. 1 (1946): 13–18.

⁷⁵ Ministério da Agricultura, Livro 599, Arquivo Nacional da Torre do Tombo – ANTT/PT/TT/MA-EAN/STESMP/006/00001.

services and district agronomists, following the directives issued by the National Agronomic Station and the General Directorate of Agriculture. There are numerous examples of such initiatives. Also in 1907, in Beja, the district agronomist sent four packets of wheat seeds to each of the municipalities and agricultural syndicates in the district, requesting that they experiment with them and inform him of the results obtained.⁷⁶ Meanwhile, in Castelo Branco, the district agronomist, together with local farmers, purchased seeds of various potato varieties from a number of foreign companies. These included J.C. Schmidt, Erfurt (Germany); Louis Van Houtte Père, Ghent (Belgium); J.W. Thorburn & Co., New York (USA); and Vilmorin-Andrieux & Co., Paris (France). Following a series of trials, the German variety *Blaue Riesen* and the French *Géante sans pareille* were identified as the most productive.⁷⁷

In 1910, Portugal became a republic, but this political change does not appear to have brought about any significant transformation regarding plant breeding. Despite the political instability that characterized the new regime, combined with persistent financial difficulties and participation in the First World War, experiments with imported varieties of various agricultural crops continued to be carried out across the country. Moreover, the first hybrids produced by the renamed National Agronomic Station in Lisbon were obtained during this period, namely *Belém*, *Ideal*, *Nacional*, *Barbaro* and *Serrano*.⁷⁸ Additionally, in the Island of S. Miguel, Azores, the regional agricultural services bought, again from Vilmorin-Andrieux, and tested wheat, maize and sugarbeet varieties;⁷⁹ in Mora, District of Évora, among others, Italian rice varieties *Bertone* and *Ranghino* were tested;⁸⁰ and the same happened with several wheat varieties in Montemor-O-Novo, District of Évora.⁸¹ In this last example, out of the seven wheat varieties, four were hybrid, including the “Portuguese” *Belém* and *Ideal*.

Importantly, experiments in plant breeding were also carried out by farmers. In the early 1890s, two prominent farmers established wheat improvement fields. One of them, D. Luiz de Castro, published the results of his experiments with seventeen foreign wheat varieties

⁷⁶ District Agronomist of Beja to the municipalities and agricultural syndicates of Beja district, Ministério das Obras Públicas Comércio e Indústria, Direção-Geral de Agricultura (hereafter MOPCI, DGA), NP 977, doc. 50, Arquivo Nacional da Torre do Tombo, 1907 – ANTT/PT/TT/MA-EAN/STESMP/006/00001.

⁷⁷ District Agronomist of Castelo Branco, José de Sousa Tavares, to the General Director of Agriculture, MOPCI, DGA, NP 977, doc. 105, Arquivo Nacional da Torre do Tombo, 1907.

⁷⁸ Domingos Victoria Pires, *Técnica do Melhoramento de Plantas*, 7.

⁷⁹ Posto Agrário Fixo da Herdade da Mitra, *Boletim Agrícola Mensal do Posto Agrário Fixo da Herdade da Mitra, Circunscrição Agrícola do Sul* 4 (April 1917).

⁸⁰ Alfredo Maria Rodrigues, “Cultura do Arroz,” *Boletim Agrícola Mensal do Posto Agrário Fixo da Herdade da Mitra, Circunscrição Agrícola do Sul* 8 (August 1917).

⁸¹ Posto Agrário Fixo da Herdade da Mitra, *Boletim Agrícola Mensal do Posto Agrário Fixo da Herdade da Mitra, Circunscrição Agrícola do Sul* 5 (May 1918).

and various local landraces.⁸² He concluded that only two of the imported varieties—*Rieti* and *Australia*—produced higher yields than the landraces over the course of the two harvests during which the experiment took place.

By the 1920s, a Seed Testing Station was working actively in plant breeding, and its network covered a large part of the Portuguese territory. In 1922, it collected 1,196 samples of wheat, rye, barley, oats, maize, rice, and broad beans. These samples were then studied, sown, and seeds from the varieties considered most useful to Portuguese agriculture were multiplied. In 1923, a public exhibition was organized to show this work.⁸³ To give an idea of the geographical expansion far beyond the central services in Lisbon, adaptation trials of wheat were carried out in forty different localities during 1925-26.⁸⁴ Regardless of the scale that plant breeding—particularly wheat—would assume in the following decade, the foundations and early developments leading to the creation of the “fascist labscapes” had already been laid before the establishment of the Republic, since the second half of the nineteenth century.

Distribution and Dissemination of Improved Varieties

The identification, study, and experimentation with agricultural plant varieties had, as it still has, the goal of transforming Portuguese agriculture, particularly by increasing productivity levels and, consequently, production. Thus, beyond the research itself, from almost its beginning public agricultural services undertook the distribution—whether free of charge or through sales—of improved seeds, hybrid or not, imported or not, to farmers. As previously mentioned, in 1863, the Agriculture Department sent thirty varieties of cabbages to António Torres, a farmer from Guimarães, district of Braga, so that he could cultivate them and report on the performance of each one⁸⁵. However, this seems to be an isolated case, as no other example of an initiative that could have led to the dissemination of “new” varieties among Portuguese farmers was found up until the late 1880s. It was in this decade, precisely in 1888, that José Maria Pimenta, an agronomist, wrote to the General Director of Agriculture requesting small portions of foreign wheat so that we could distribute to farmers in Torres Novas, district of Santarém, following the announcement by the Agriculture Directorate that foreign wheat seeds were available for free distribution among farmers.⁸⁶

⁸² Dom Luiz de Castro, *A Produção e a Cultura do Trigo em Portugal*.

⁸³ Portugal, Ministério da Agricultura, “Anais da Estação Agrária Nacional,” *Boletim do Ministério da Agricultura* 7, nos. 1-6 (1926): 37.

⁸⁴ *Ibid.*, 38.

⁸⁵ *Arquivo Rural* VI, (1863): 547-48.

⁸⁶ José Maria Pimenta to the General Director of Agriculture, November 9, 1888, MOPCI, DGA, Arquivo Nacional da Torre do Tombo – ANTT/PT/TT/MOPCI-DGA/A-A-6-84-1.

From that point onward, the dissemination of improved agricultural plant varieties became more frequent, including through authorizations by the agricultural services for farmers themselves to purchase foreign seeds for sowing in Portugal. In 1894, for instance, José Campelo de Andrade was authorized to buy 606 kg of seeds from France, and the Viscount of Coruche, an important nineteenth century farmer and politician, purchased 80 kg.⁸⁷ There is evidence that these actions had practical consequences. For example, as early as 1903, the world's first hybrid wheat variety, Vilmorin's *Dattel*, along with the Italian *Rieti* variety, were being cultivated in the district of Évora for commercial purposes.⁸⁸ By 1906, both *Rieti* and the *Fucense* variety were already reported to occupy relatively large areas in the district of Santarém.⁸⁹ In fact, the *Rieti* variety truly thrived in Portugal, appearing not only in the southern districts of Alentejo, but also in regions where wheat was less prominent, such as Bragança, Guarda, and Coimbra districts.⁹⁰ In 1952, it was still one of the main cultivated wheat varieties in the municipality of Portalegre.⁹¹

In addition to these three varieties, other wheat varieties were identified: *Bordeaux*, *Japhet*, and *Shireff* in Idanha-a-Nova, district of Castelo Branco; *Petanielle* in Caldas da Rainha, district of Leiria; *Noé* in Elvas, Benavente, and Vila Viçosa, districts of Santarém, Portalegre, and Évora; and *Petanielle noir from Nice* in Ferreira do Alentejo, district of Beja.⁹² The dissemination of the first two hybrid wheats developed in the country, *Belém* and *Ideal*, were also an important outcome of public plant breeding policies. During the 1920s, the latter was already recommended by agricultural supervisors' associations, especially for poorer soils.⁹³ By the end of that decade, both *Belém* and *Ideal* were considered to be well adapted to the district of Évora's agroecological conditions, showed good production rates, and were common varieties among farmers.⁹⁴

⁸⁷ Agricultural Services authorizations to José de Oliveira Campelo de Andrade and Visconde de Coruche, 1894, MOPCI, DGA, Arquivo Nacional da Torre do Tombo – ANTT/ PT/TT/ MOPCI/DGA/NP 1047.

⁸⁸ José Tavares Silva, *A Cultura Económica do Trigo* (Évora: Empreza Typographica Eborense, 1906).

⁸⁹ MOPCI, DGA, NP 977, Doc. 85, Arquivo Nacional da Torre do Tombo – ANTT/PT/TT/ MOPCI/DGA/NP 977.

⁹⁰ João Silva Fialho, *Cultura do Trigo* (Lisboa: Livraria Clássica Editora, 1907).

⁹¹ João de Deus Vaz Pereira, *Inquérito Agrícola e Florestal de Portalegre* (Lisboa: Plano de Fomento Agrário, 1953).

⁹² João Silva Fialho, *Cultura do Trigo*.

⁹³ Associação dos Regentes Agrícolas, *Boletim da Associação dos Regentes Agrícolas* (Lisboa: Associação dos Regentes Agrícolas, 1929).

⁹⁴ Augusto Calado Rosa, “Subsídios para o Melhoramento da Cultura do Trigo no Distrito de Portalegre” (Dissertação de licenciatura, Instituto Superior de Agronomia de Lisboa, 1929).

Sources also mention the distribution of other crops, though wheat was the main target of public policies in this period. Regarding maize, for example, in 1909 two varieties of dryland maize improved at the Lisbon Agronomic Station were sent for cultivation in Arraiolos, district of Évora,⁹⁵ and the same occurred in the Azores islands in 1919 with the distribution of the *Hicory King* variety,⁹⁶ as shown in figure 4. The following year, after several years of successful trials at the Évora experimental field, the Ministry of Agriculture ordered a large quantity of various maize varieties—*Red-Fife*, *White-fife*, *Kolben*, *Preston*, and *Stanley*—to be purchased from Vilmorin-Andrieux with the aim of making them common in local agriculture, something that had already been attempted a few years earlier without success.⁹⁷ In the case of rice, by 1922, thirteen foreign varieties had been identified as suitable for cultivation in Portugal. Some of these, being of Italian origin, were imported for future production.⁹⁸ Later, in 1926, the National Agronomic Station announced the public sale of seeds of the following Italian rice varieties: *Ostiglia*, *Nero de Vialone*, *Ranghino*, *Onsen*, *Chinês Originário*, and *Bertone*.⁹⁹ These last two varieties thrived in the Portuguese rice production for decades.¹⁰⁰ In the case of rice, public services ultimately followed the pioneering efforts of a private farmer who, in the region of Coimbra, had introduced rice varieties of Asian origin—varieties that had been selected and improved in Italy as early as 1910.¹⁰¹

⁹⁵ N.a., *O Lavrador, O Milho: Sua Cultura Aperfeiçoada e Rendosa* (Porto: Of. Comércio do Porto, 1913).

⁹⁶ Joaquim Manuel Santos Garcia, “Trigos de Primavera,” *Boletim Agrícola Mensal do Posto Agrário Fixo da Herdade da Mitra, Circunscrição Agrícola do Sul* 4, no. 3 (1920): 64–69.

⁹⁷ Joaquim Manuel Santos Garcia, “Trigos de Primavera,” 64–69.

⁹⁸ Portugal, Ministério da Agricultura, *Boletim do Ministério da Agricultura* 7, nos. 1–6 (1926): 37.

⁹⁹ *Gazeta das Aldeias*, year 31, no. 1391 (January 31, 1926).

¹⁰⁰ Manuel Viana Silva, *Arroz* (Lisboa: Fundação Calouste Gulbenkian, 1969).

¹⁰¹ Carlos Manuel Faísca, Dulce Freire, and Cláudia M. Viana, “The State and the Natural Resources: 250 Years of Rice Production in Portugal, Eighteenth to Twenty-First Centuries,” *Ler História* 79 (2021): 243–64, <https://doi.org/10.4000/lerhistoria.9542>.

39.^a Sub-região Agrícola

Lista das pessoas a quem foi fornecido trigo e milho para semente no ano agrícola de 1919

NOMES	Quantidades — Litros	Qualidade da semente	Localidades onde foi semiado
José Jacinto Cabral.....	128	Trigo Ideal	S. Roque
José Pereira Cabral.....	32	»	Capelas
João da Costa... ..	160	»	S. Roque
Antonio de Medeiros.....	48	»	Ponta Delgada
João da Costa Falcão.....	32	»	Arrifes
José Tavares de Brum.....	56	»	Arrifes
Inocencio Pacheco Ramalho....	96	»	Ponta Delgada
Luiz Ataíde C. Real Estrela....	480	»	Ribeira Seca
Antonio Correia da Silva.....	20	»	Ponta Delgada
Manuel Carreiro	16	»	Relva
Antonio Rapozo.. ..	40	»	Relva
Eugenio Botelho da Camara....	480	»	Fajá de Cima
José Miguel d'Almeida.. ..	64	»	Fajá de Cima
Francisco Rapozo de Souza....	24	»	Arrifes
João Faria.....	12	»	Arrifes
João Inacio de Melo.....	8	»	Ponta Delgada
Manuel de M. Arruda.....	240	»	Arrifes
Carlos Arruda Quental.....	56	Milho Hicory King	Lagôa

Figure 4. List of Azorean farmers who received wheat and maize seed varieties from agricultural services, 1919. Source: Posto Agrário Fixo da Herdade da Mitra, *Boletim Agrícola Mensal do Posto Agrário Fixo da Herdade da Mitra, da Estação Agrícola da 7.^a Região*, no. 11 (1926), 308.

Although quantitative information on the scale of improved seed distribution is typically scarce, some examples allow us to understand the impact of these measures. In 1924, the Ministry of Agriculture stated that it had distributed 414 varieties of wheat, barley and rye among 88 farmers located in the main wheat-producing regions of Portugal.¹⁰² Given the 418,000 hectares of wheat cultivated that year,¹⁰³ it is clear that, although not negligible, this was still a relatively small effort. Nevertheless, available information suggests that significant

¹⁰² Portugal, Ministério da Agricultura, *Boletim do Ministério da Agricultura* 7, nos. 1–6 (1926): 39.

¹⁰³ Portugal, Instituto Nacional de Estatística, *Estatísticas Agrícolas 1947* (Lisboa: Instituto Nacional de Estatística, 1948), 16.

changes took place in the Portuguese agricultural landscape, at least in some regions. In the wheat-producing districts of Santarém, Portalegre, Évora, and Beja, although not yet dominant, improved varieties already accounted for one-third of total wheat production by the early 1930s.¹⁰⁴ Meanwhile, in the Azores, also in 1924 and as a result of the actions of agricultural services, local varieties had been replaced by the US *Golden Beauty* and *Hickory King* varieties—a phenomenon that was also beginning to happen in the mainland.¹⁰⁵

Alongside this circulation of seeds, plant breeding efforts in this period also unsurprisingly involved the circulation of foreign experts. In the district of Évora, in the 1890s the Italian Aníbal Ripi was in charge of selection trials with national and foreign wheat varieties and was assisted by the German chemist Fedor Dickman.¹⁰⁶ That was also the case of the German chemist Otto Klein, to whom, in fact, the correspondence regarding seed acquisition by the National Agronomic Station, shown in figure 3, is addressed.¹⁰⁷ Indeed, throughout the period covered in this paper agronomists, farmers, and political decision-makers seemed to agree that Portugal would benefit from the scientific knowledge brought by Europe’s most advanced plant-breeding centres, such as those in Germany and Italy. Among the various examples, it can be highlighted the President of the Agricultural Society of Faro who, in 1875, in a speech underlining the importance of the Society possessing an experimental field, referred to the example of the “wise Germany,” which, with its extensive network of experimental stations, had achieved remarkable results.¹⁰⁸ Later, in 1889, it was the official publication of the Directorate-General of Agriculture itself that stated that “our agriculture has everything to gain from the introduction and dissemination of foreign seeds.”¹⁰⁹

The impact of the introduction of improved crop plants in Portuguese agriculture is more difficult to assess. In 1908, while discussing the wheat varieties cultivated in Portugal, a milling industrialist complained about the existence of only five breeding stations in the country, compared to seventy in Germany, sixty-eight in France, sixty in the United Kingdom, and twenty in Italy.¹¹⁰ He also emphasized that Sweden even had a station specialized in the

¹⁰⁴ Faísca and Freire, “Not All Wheats Are the Same.”

¹⁰⁵ António da Cunha Monteiro and Francisco Vilhena, “Nota sobre o Estudo dos Milhos Portugueses,” *Gazeta das Aldeias*, year 31, no. 1391 (1926).

¹⁰⁶ Portugal, Ministério das Obras Públicas, Commercio e Industria, *Boletim da Direcção-Geral de Agricultura* 4, no. 12 (1892).

¹⁰⁷ W. Attle Burpee & C.^o to Otto Klein, March 29, 1905, MOPCI, DGA, NP 1047, doc. 25, Arquivo Nacional da Torre do Tombo – PT/TT/MOPCI/DGA/NP 1047, doc. 25.

¹⁰⁸ Ata da Sociedade Agrícola de Faro, February, 14, 1875, ACD, GCFAR, I-A-A, 004/0001, Arquivo Distrital de Faro.

¹⁰⁹ Portugal, Ministério das Obras Públicas, Commercio e Industria, *Boletim da Direcção-Geral de Agricultura* 1, no. 6 (1889).

¹¹⁰ Arthur José Baptista, *Breves Considerações sobre a Industria da Moagem em Portugal* (Lisboa: Ateliers Graphicos B. Nogueira, Successor, 1908).

export of selected seeds. D. Luiz de Castro also stressed this issue in 1923.¹¹¹ In fact, the distribution of improved agricultural plant varieties—apparently limited almost exclusively to cereals—may have had only a limited impact, which could help explain why Portuguese agriculture experienced only moderate growth in average physical productivity over the period covered in this article, though other factors influencing agricultural productivity and production also need to be considered.¹¹² What is undeniable is that crop improvement was already underway by the late nineteenth century, preceding and laying many of the foundations for the transformations that the “fascist labscapes” would later bring. As Harwood has argued, the emergence of “scientific” plant breeding around 1900 did not constitute a sudden Mendelian rupture but rather the consolidation of experimental practices in several countries, and Portugal seems to be one of those cases¹¹³.

Conclusions

In Portugal, modern plant breeding began in the final decades of the nineteenth century. From the 1860s onwards, several efforts were made to study the varieties of the main agricultural crops cultivated in the country. There are also records of a few apparently isolated initiatives aimed at improving agricultural crops, carried out both by public agricultural services and farmers. From the 1880s onward—and especially after the establishment of a state network of Agrarian Stations in 1868, its reinforcement in 1886, and the wheat-breeding legislation published in 1888—these activities increased significantly. Various types of crops were tested—especially cereals—constantly compared to improved seeds imported from abroad purchased from the main seed companies, such as Vilmorin-Andrieux. Seeds resulting from these trials were selected and distributed to farmers.

Two years after the international rediscovery of Mendel’s Laws, the National Agronomic Station was already engaged in hybridization and, shortly after, was producing hybrid wheat varieties which, within a decade, were being cultivated over substantial areas in the country’s main wheat-growing regions. At the same time, imported varieties—whether hybrids or not—sometimes introduced by farmers but often promoted by the state, spread throughout Portugal’s agricultural landscapes. This was true not only for wheat but also for other crops such as maize and rice. Some of these varieties endured for decades, such as the *Rieti* wheat or the *Chinês Originário* rice. As Harwood has noted, the shift to Mendelian

¹¹¹ D. Luiz de Castro, “Da Necessidade de Fundação de Estações Agronómicas em Portugal,” *Jornal de Ciências Matemáticas, Físicas e Morais* 3, (1923): 16–33.

¹¹² Fernando Brito Soares, “Agricultura,” in *História Económica de Portugal*, vol. 3, *O Século XX*, ed. Álvaro Ferreira da Silva and Pedro Lains (Lisboa: Imprensa de Ciências Sociais, 2005), 164–65.

¹¹³ Harwood, “Did Mendelism Transform Plant Breeding?,” 345–46.

genetics after 1900 did not erase earlier breeding traditions but reconfigured them within new institutional and conceptual frameworks. The Portuguese case fits this trajectory.

Placing the Portuguese case in an international context, it is clear that Portugal was not a pioneer in this field. In fact, a country that diverged economically from the more industrialized nations during the nineteenth century—despite a small increase in all the main macroeconomic indicators—was unlikely to lead in what was then a cutting-edge technology. However, chronologically, Portugal was not far behind the leading group. Many of the most important international crop improvement institutions were established during the 1860s and 1880s, a period when this type of agricultural modernisation was already a reality in Portugal, albeit with probably limited impact. The earlier work carried out in botanical gardens, or the diffusion of Darwinism from the mid-1860s onward, probably helps to explain the attention given by the Portuguese state to plant breeding shortly after other European countries, as does the period of political stability of the second half of the nineteenth century.

In fact, this relative precocity of Portugal with a clear public policy for plant breeding by late nineteenth century in a country often regarded as peripheral, may have multiple explanations. One of them is the long scientific legacy of its botanical gardens. Although they did not yet constitute modern genetic breeding, they created a tradition of botanical expertise, classification practices, and varietal observation that could later support the emergence of organizational plant breeding. Nevertheless, only a comparative study with the other countries discussed here can determine whether the presence, or the absence, of botanical gardens played a decisive role in the early development of plant breeding in different national contexts.

However, agricultural productivity growth in Portugal was modest compared to other Mediterranean countries with similar climatic conditions. This suggests that plant breeding was less effective than in other countries, although other factors preventing agricultural modernisation and growth must be considered—land tenure systems, access to credit, mechanization, among others. Nonetheless, it is undeniable that plant breeding gained a certain presence in Portugal well before the establishment of the dictatorship in 1926. The National Agronomic Station, founded in 1901 in the footsteps of the Agricultural Experimental Station, established in 1870, should therefore be included within broader histories of one of the most essential aspects of global agricultural modernization.

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Competing interests

The author has declared that no competing interests exist.