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Experimenting for Empire: Plant Health as an Agricultural Problem in German East Africa, Togo and Cameroon, 1905–1914

Abstract: Plant health was a primary concern for German colonial agriculturalists around 1900. On the one hand, plant health and diseases determined the profitability of cash crops and the plantation economy. On the other hand, colonists associated plant diseases with a lack of "hygiene" and allegedly inferior agricultural practices. The article demonstrates the transdisciplinary, applied and experimental nature of phytopathological knowledge production in tropical agriculture. Plant pathologists blended multiple forms of disciplinary and layman knowledge to tinker with plants in the field and assess possible causes for and remedies against plant diseases. However, they also tried to apply experimental methods to control and discipline the indigenous populations. This article scrutinizes agricultural research stations and plantations as sites for phytopathological studies, scientists of various disciplinary backgrounds as their primary drivers and field trials as their primary method. Based on the travel reports and articles of Walter Busse and Julius Vosseler, two phytopathologists working in German Cameroon, German Togoland and German East Africa, the article shows that scientists collaborated with planters in terms of fending off plant diseases while also aiming to impart European agricultural techniques to indigenous farmers. Agricultural knowledge production did not only feed into plantation practices but also became a playfield for the ambivalent "cultural mission."

Keywords: agricultural research stations, plantation, colonialism, field sciences, applied science

Introduction

High imperialism went hand in glove with scientific knowledge production.[1] A characteristic of this period, starting in the mid-nineteenth century, was the "scien-

1 In revising this article, I benefitted from the lively discussions held at the Bodensee-Retreat "Wissensgeschichte" organized by Anne Kwaschik in Konstanz in June 2023. I thank the section editors and the reviewers for insightful comments and suggestions.

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tization of colonialism."[2] Numerous research institutes and education tracks in the various imperializing European nation-states and international scientific conferences were aimed at understanding and controlling the colonial project. However, the role of medical discourses with regard to plant diseases has rarely been examined.[3] This article studies colonial discourses on phytopathology and forms of phytopathological expertise in the German colonies in Africa in the early twentieth century. Phytopathology, the study of plant diseases, their origins, their prevention and their cures, serves as an emblematic example of a scientific endeavor connecting different areas of knowledge in various functional domains during the colonial era. In the colonial context, research on plant health and diseases blended approaches from botany, zoology, mycology, entomology, meteorology and agricultural sciences. Furthermore, phytopathological research was not limited to academic knowledge; it also relied heavily on practical insights gained in tropical agriculture. In turn, it offered research findings that could be applied to benefit colonial policy and the colonial economy.

This article follows scientists and laypeople who, in the German colonies around 1900, produced knowledge concerning plant health. The main argument is that phytopathological research in tropical agriculture was a transdisciplinary and applied form of knowledge production pursued by scientists in agricultural

2 On the nexus between science and empire, see Alves Duarte da Silva, Matheus, Thomas A. S. Haddad and Kapil Raj, "Science and Empire: Past and Present Questions," in *Beyond Science and Empire: Circulation of Knowledge in an Age of Global Empires, 1750–1945*, eds. Alves Duarte da Silva, Matheus, Thomas A. S. Haddad and Kapil Raj (London and New York: Routledge, 2024); Andrew Goss, ed., *The Routledge Handbook of Science and Empire* (London: Routledge Taylor & Francis Group, 2021); Anne Kwaschik, "Die Verwissenschaftlichung des Kolonialen als kultureller Code und internationale Praxis um 1900," *Historische Anthropologie* 28, no. 3 (2020); Daniel R. Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (New York: Oxford University Press, 1981). Out of many elucidating case studies, see Jens Ruppenthal, *Kolonialismus als "Wissenschaft und Technik": Das Hamburgische Kolonialinstitut 1908 bis 1919* (Stuttgart: Steiner, 2007); Carsten Gräbel, *Die Erforschung der Kolonien: Expeditionen und koloniale Wissenskultur deutscher Geographen, 1884–1919* (Bielefeld: Transcript Publishing, 2015); Sebastian Beese, *Experten der Erschließung: Akteure der deutschen Kolonialtechnik in Afrika und Europa 1890–1943* (Paderborn: Brill Schöningh, 2018); Moritz von Brescius, *German Science in the Age of Empire: Enterprise, Opportunity and the Schlagintweit Brothers* (Cambridge: Cambridge University Press, 2019).

3 On German and Italian entomological research in colonial spaces, see Tomás Bartoletti, "The Transimperial Emergence of Pest Control Research: Economic Entomology Between Europe and the Tropical World, c. 1890–1930," *Comparativ* 32, no. 6 (2022). On the challenges of establishing transatlantic regulations to prevent the spread of pests around 1900, see Stéphane Castonguay, "Creating an Agricultural World Order: Regional Plant Protection Problems and International Phytopathology, 1878–1939," *Agricultural History* 84, no. 1 (2010).

research stations and planters in the field attained by an experimental approach of trial and error. Its modes of application were aimed at the colonial regime's combined economic and cultural objectives. While agricultural science always oscillated between basic and applied research, phytopathology in the colonies primarily sought to preserve and advance the plantation economy and intervene in indigenous agricultural practices to implement European norms and control the colonized population. Hence, phytopathological studies did not exclusively serve to support the German colonial plantation economy, as argued by Samuel Eleazar Wendt.[4] Rather, the application of phytopathological knowledge was used both to make the colonial plantation economy profitable *and* to introduce European concepts of tropical hygiene, thereby dismissing the long-lasting wealth of the native population's agricultural knowledge.[5] However, control over the native population's environment and human surroundings proved fragile as colonists had imperfect knowledge of local conditions while their disciplinary measures did not avert resistance.

Hitherto, studies in the German history of agriculture and the agricultural sciences seem to have neglected the colonial period. While several works examine the agricultural sphere in the German Empire, the Weimar Republic and the Third Reich, they do not broaden the geographical focus to include the colonized areas, nor do they consider the prevalent imperial mindset at the time.[6] The most comprehensive overviews of phytopathology as a field were authored by practitioners. The narratives presented usually center on heroic figures and include educational ele-

4 Samuel E. Wendt, "Securing Resources for the Industries of Wilhelmine Germany: Tropical Agriculture and Phytopathology in Cameroon and Togo, 1884–1914," in *Environments of Empire*, eds. Ulrike Kirchberger and Brett M. Bennett (Chapel Hill: The University of North Carolina Press, 2020).

5 In this regard, phytopathologists in West and East Africa shared similarities with German coffee planters in Guatemala. At the turn of the twentieth century, German plantation owners and geographers promoted the perception of Guatemalan tropical nature as untamed and "uncivilized," viewing the establishment of plantations as a means to transform it into organized and productive landscapes. Christiane Berth, "Between 'Wild Tropics' and 'Civilization': Guatemalan Coffee Plantations as Seen by German Immigrants," in *Comparing Apples, Oranges, and Cotton: Environmental Histories of the Global Plantation*, ed. Frank Uekötter (Frankfurt a. M.: Campus, 2014).

6 Thomas Wieland, *"Wir beherrschen den pflanzlichen Organismus besser,. . .": Wissenschaftliche Pflanzenzüchtung in Deutschland, 1889–1945* (Munich: Deutsches Museum, 2004); Volker Klemm, *Agrarwissenschaften in Deutschland: Geschichte – Tradition; von den Anfängen bis 1945* (St. Katharinen: Scripta Mercaturae Verl., 1992); Ulrich Kluge, *Agrarwirtschaft und ländliche Gesellschaft im 20. Jahrhundert* (Munich: Oldenbourg Wissenschaftsverlag, 2005).

ments addressed to an audience aspiring to the practice of phytopathologists.[7] Thus, the colonial setting as a playfield and driving force for agricultural innovation both in the "metropole" and in the "peripheries" has barely been considered. At the same time, while colonial historiography has produced groundbreaking works on medicalized discourse,[8] comprehensive narratives on the study of plant diseases during high imperialism have been few and far in-between.[9] Scrutinizing historical discourses on plant diseases addresses this gap. The attempts of colonists to stabilize hierarchical regimes and the utter instability of these regimes become visible in the discourses related to identifying and taming specific plant diseases.

In terms of method, this article aims to both scrutinize colonial medical discourses and to embed them in their materiality, following recent contributions elucidating the intricate nature of "colonial knowledge."[10] The materiality of phytopathological knowledge included both the research station and the field. The hybrid mode of knowledge production – in the laboratory and in the field – may be grasped thanks to critical laboratory studies. Karin Knorr-Cetina, Bruno Latour and Steve Woolgar have shown that laboratory research methods and their societal contexts were not separate but deeply intertwined.[11] More recently, historical studies of the life sciences have joined in the task of tearing down the alleged wall between laboratory and field sciences.[12] Just like other field sciences around 1900, the study of plant health can only be understood when acknowledging the experimental mindset of its actors. Phytopathologists did not need full-fledged laboratories to conduct experiments. The method to which they ascribed epistemological validity was the field trial, which was based on trial and error and frequent repetition. This article, however, shows that the experimental mind-

7 Herbert Hice Whetzel, *An Outline of the History of Phytopathology* (Philadelphia: W. B. Saunders Company, 1918); Geoffrey Clough Ainsworth, *Introduction to the History of Plant Pathology* (New York: Cambridge University Press, 1981).

8 For instance, Megan Vaughan, *Curing Their Ills: Colonial Power and African Illness* (Stanford: Stanford University Press, 1991); Wolfang Eckart, *Medizin und Kolonialimperialismus: Deutschland 1884–1945* (Paderborn: Schöningh, 1997).

9 A notable exception is Wendt, who adopts an economic history approach, Wendt, "Securing Resources."

10 Ricardo Roque and Kim A. Wagner, "Introduction: Engaging Colonial Knowledge," in *Engaging Colonial Knowledge: Reading European Archives in World History*, eds. Ricardo Roque and Kim A. Wagner (London: Palgrave Macmillan, 2014).

11 Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* (Princeton: Princeton University Press, 1979); Karin Knorr-Cetina, *The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science* (Oxford: Pergamon Press, 1981).

12 Robert E. Kohler, *Landscapes and Labscapes*: *Exploring the Lab-Field Border in Biology* (Chicago: University of Chicago Press, 2010); Raf de Bont, *Stations in the Field: A History of Place-Based Animal Research, 1870–1930* (Chicago: University of Chicago Press, 2015).

set went beyond mere agricultural questions. The attempt to control one's surroundings by inducing stimuli and testing for their effects shaped both the scientific approach of phytopathologists and their attempts to interject in traditional knowledge and practices. Hence, both the laboratory and the field constituted central experimental spaces in which colonial hierarchies were performed.[13]

The sources used mostly originate from the written professional records left by the actors in focus: Walter Busse and Julius Vosseler. Busse and Vosseler produced travel reports, periodical articles and personal notes stored in the Prussian Secret State Archives, the Senckenberg German Entomological Institute and the Berlin State Library. The two perspectives discernible from the records allow for a multi-sited and longer-term view on the development of phytopathological discourse and practices in tropical agriculture. The two men exhibited differences but also shared commonalities. While Busse conducted two expeditions to German Togoland and German Cameroon, Vosseler was permanently based at the Biological Agricultural Research Station Amani in German East Africa. Busse mostly generated his knowledge by interacting with planters and conducting trials on the ground, while Vosseler consulted international academic journals and engaged in academic exchanges with scientists based at research stations run by different empires. In both cases, the marriage between theoretical and experiential knowledge characterizing agricultural sciences was prominent. Already in the German Reich and its African colonies, phytopathology thus appeared as a remarkably versatile endeavor: not exclusively laboratory nor exclusively a field science, not just pure science nor just applied science.[14] The study, reception and use depended on the actors and the materiality of usage involved.

I begin by portraying the actors, sites and methods related to the study of plant health in the German colonies around 1900. Next, I discuss the phytopathologists' economic motives for making the colonial plantation economy thrive and their way of identifying ways to combat plant diseases together with European planters on the ground. Finally, I show that phytopathological trials extended

13 On the notion of experimental spaces, see the introduction to this thematic section.

14 Science studies have confirmed the blurred lines between fundamental and applied research in the nineteenth century. See Graeme Gooday, "'Vague and Artificial': The Historically Elusive Distinction Between Pure and Applied Science," *ISIS* 103, no. 3 (2012), https://doi.org/10.1086/667978; Robert Bud, "'Applied Science': A Phrase in Search of a Meaning," *ISIS* 103, no. 3 (2012), https://doi.org/10.1086/667977. See also Shapin's account on dietetics in seventeenth century England, which argues that no scientific activity can indeed be understood without taking its concrete circumstances of origin and practical implications into consideration. See Steven Shapin, *Never Pure: Historical Studies of Science as If It Was Produced by People with Bodies, Situated in Time, Space, Culture, and Society, and Struggling for Credibility and Authority* (Baltimore: Johns Hopkins University Press, 2010).

way beyond purely economic considerations. They were also aimed at altering the agricultural practices of indigenous farmers in order to control the conduct of the colonized population.

Doing Phytopathology: Agricultural Research Stations and Field Trials

As a field of research, phytopathology around 1900 served as a convergence point for individuals from academia, agriculture and the foodstuff industry. It was carried out both in academic institutions and in practice-oriented field stations, utilizing a diverse range of methods from controlled experiments in enclosed laboratories to hands-on trial-and-error approaches in agricultural settings on the ground. This section presents the main *actors*, *sites* and *methods* involved in the study of plant diseases in the German colonies.

The main *actors* fueling phytopathological knowledge production were pharmacists, zoologists or botanists turned phytopathologists. Around 1900, there was no scientist exclusively trained in phytopathology. Instead, plant diseases became an area of interest for individuals coming from other academic areas. This was even more true in the colonies: More often than not, practical considerations and a shortage of academic staff led colonists to move into and adopt different areas of expertise. For colonial science, this meant a trend toward generalization rather than specialization.[15]

Walter Busse and Julius Vosseler were chiefly involved in phytopathological studies in the German African colonies, primarily German East Africa, German Togoland and German Cameroon. Busse obtained his habilitation in botany in 1900 after having studied pharmacology. Following this, he carried out botanical expeditions to German East Africa, to the botanical gardens ‘s Lands Plantentuin in Buitenzorg (Dutch East Indies), to German Cameroon and to German Togoland. These expeditions were funded by the Kolonialwirtschaftliches Komitee, a private body of financiers enthused by the colonial idea aimed at promoting economic activities in the German colonies.[16] In 1905, Busse joined the civil service by accepting a position at the Kaiserlich Biologische Anstalt für Land- und Forstwirtschaft, the administrative body tasked with identifying means to protect plant

15 Jürgen G. Nagel, *Die Kolonie als wissenschaftliches Projekt: Forschungsorganisation und Forschungspraxis im deutschen Kolonialreich* (Hagen: FernUni Hagen, 2013), 409–411.

16 On the Kolonialwirtschaftliches Komitee, cf. the forthcoming dissertation by Andreas N. Donay.

health and issuing laws concerning plant protection. In 1906, he became head of the Department of Agriculture and Forestry at the Reichskolonialamt where he remained until 1911.[17] More of a civil servant than a scientist, Busse represented the colonial government with regard to the Amani station and deducted measures for colonial policy from his botanical-agricultural travels. As Busse visited Amani and his findings were received by the researchers based there,[18] his observations on the Togolese and Cameroonian situation entered phytopathological thinking concerning German East Africa, a vastly different geographical and climatic region.

While the Kolonialwirtschaftliches Komitee funded its last phytopathological expedition in 1907,[19] this by no means marked the end of phytopathological research in the colonies. On the contrary, the researchers based at the Amani station continued to consolidate and expand on Busse's previous findings, while trying to introduce their results into existing agricultural practices. Chief among them was Julius Vosseler. Vosseler, born in 1841 in Besigheim, obtained his doctorate in 1885 and his habilitation in zoology in 1893 in Stuttgart, where he worked at the Königliche Naturalienkabinett for about a decade. In 1903, he joined Amani as its zoologist and specialized, in the broadest sense of the word, in the study of vermin and pests. Although Vosseler lived in Amani together with his wife, there are no records preserved revealing much about his private life, such as diaries, travelogues or personal correspondence. His unpublished records held at the Senckenberg German Entomological Institute exclusively concern his research: excerpts summarizing the academic papers he read and notes for manuscripts he wrote based on his readings. The way in which he structured his notes indicates Vosseler's keen interest in pests, as he organized his excerpts according to the taxonomy of threats to plant health.[20] Vosseler left German East Africa in 1909 to accept a position as the director of the Hamburg Zoo, which he headed for the following 18 years.[21] While employed in the colonial service, both Busse and Vosseler approached their research in a hands-on manner, seeking to put phytopathological insights into practice.

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17 "Busse, Walter Carl Otto (1865–1933)," https://plants.jstor.org/stable/10.5555/al.ap.person.bm000051684.

18 Walter Busse is frequently mentioned in the extensive correspondence maintained by Karl Braun, head botanist at Amani 1904–1920: Geheimes Staatsarchiv Preußischer Kulturbesitz Berlin, Nachlass Karl Braun, 1902–1934.

19 Wendt, "Securing Resources," 54.

20 See Vosseler's records at the Deutsche Entomologisches Institut in Müncheberg: DEI, Nachlaß Julius Vosseler, Inventarium 75, 1904–1906.

21 Georg Grimpe, "Julius Vosseler zum 70. Geburtstag," *Der zoologische Garten* 4, no. 10/12 (1931).

The main *sites* for phytopathological research to thrive were agricultural research stations and plantations. Raf de Bont refers to "stations in the field" as "every institution for instruction or research in the life sciences [. . .] located in (or next to) the field." Following his definition, such stations are here understood as "true hybrids, mixed in their institutional origins, financial resources, scientific goals, research practices, and composition of visitors."[22] In the German-speaking countries, agricultural research stations had existed since the 1830s and fueled studies in agronomy, which became a vibrant field in Germany in the 1860s. With the onset of formal German colonialism after the Berlin Conference 1884–1885, the Reich also began to establish agricultural research stations in the colonies. Thus, the German Empire followed an approach similar to that of the British across the British Empire,[23] the Dutch in the East Indies[24] and the French in Algeria:[25] The flora was essential for commodifying and 'elevating' the colonized land. Founded around 1889, Victoria in Cameroon was the first German colonial experimental garden. As a state-financed institution, the Research Institute for Land Improvement (Victoria) was intended to increase the yields of surrounding privately run plantations through novel methods in crop science. In 1902, thus a little more than a decade after the Research Institute for Land Improvement, the Amani Biological Agricultural Institute was established in the Usambara Mountains in German East Africa.[26] Originally, the institution was launched as a forestry and agricultural research station with the cooperation of the Botanische Zentralstelle

22 Bont, *Stations in the Field*, 4.

23 Richard Drayton, *Nature's Government: Science, Imperial Britain, and the 'Improvement' of the World* (New Haven: Yale University Press, 2000).

24 On 's Lands Plantentuin in Buitenzorg, Dutch East Indies, see Andrew Goss, *The Floracrats: State-Sponsored Science and the Failure of the Enlightenment in Indonesia* (Madison: University of Wisconsin Press, 2011); Robert-Jan Wille, *De stationisten: Laboratoriumbiologie, imperialisme en de lobby voor nationale wetenschapspolitiek, 1871–1909* (Nijmegen: Radboud University, 2015); Andreas Weber and Robert-Jan Wille, "Laborious Transformations*:* Plants and Politics at the Bogor Botanical Gardens," *studium* 11, no. 3 (2018) and the contributions in this special issue: Florian Wagner, "From the Western to the Eastern Model of Cash Crop Production: Colonial Agronomy and the Global Influence of Dutch Java's Buitenzorg Laboratories, 1880s–1930s," in *Agrarian Reform and Resistance in an Age of Globalisation: The Euro-American World and Beyond, 1780–1914*, eds. Joe Regan and Cathal Smith (London and New York: Routledge, 2019). See Mazzoli's contribution in this thematic section on the role of the Italian Agricultural Colonial Institute of Florence in terms of establishing Italian agricultural colonies in the United States.

25 Christophe Bonneuil and Mina Kleiche, *Du jardin d'essais colonial a la station expérimentale, 1880–1930*: *Eléments pour une histoire du CIRAD* (Paris: CIRAD, 1993).

26 Christoper A. Conte, *Highland Sanctuary: Environmental History in Tanzania's Usambara Mountains* (Athens: Ohio University Press, 2004).

in Berlin.[27] By the time the British administration took over the Institute in 1919–1920, Amani had become well-known to visiting scientists and travelers to Africa from various European countries. The directors Franz Stuhlmann (in office 1903–1908) and Albrecht Zimmermann (in office 1911–1920) and the few scientific staff members, such as Karl Braun, were engaged in lively correspondence with experimental gardens in other colonial states and exchanged duplicate journals as well as seeds and seedlings with them.[28] This flow of personnel, artifacts and knowledge through a wide network of gardens across the empires made stations like Victoria and Amani "remarkably international," as stressed by von Brescius and Dejung.[29]

Contemporary descriptions portray research environments such as Buitenzorg and Amani in an idealized manner. References to 's Lands Plantentuin emphasize its rejuvenating ambience for scholarly endeavors, while extolling the diverse flora and fauna in the gardens as well as the favorable climatic conditions.[30] Nevertheless, agricultural research stations were not isolated entities; instead, institutions such as the Amani Institute were intricately linked to other colonial establishments, including the colonial administration, economy and, notably during World War I, even warfare when Amani played a role in supplying food to German settlers.[31] In examining plant diseases, this study expands the focus to the plantation as a central site for experimentation and a necessary companion of the research station. Phytopathological observations primarily occurred in the field, with research inquiries by plant pathologists aimed at addressing practical challenges faced by planters on

27 Katja Kaiser, *Wirtschaft, Wissenschaft und Weltgeltung: Die botanische Zentralstelle fur die deutschen Kolonien am Botanischen Garten und Museum berlin* (Lausanne: Peter Lang, 2021).

28 On Stuhlmann, see Benjamin Gollasch, *Franz Ludwig Stuhlmann und die kolonialen Reformbestrebungen in Deutsch-Ostafrika vor 1906: Vom Forschungsreisenden zum politischen Entscheidungstrager* (Munich: Allitera Verlag, 2021). Despite the fact that Albrecht Zimmermann was an acclaimed botanist who held high-ranking positions in both Buitenzorg and Amani, no historical account on his life and scientific activities has as of yet been presented. The obituary written by Karl Braun, Zimmermann's assistant, provides some biographical insights: Karl Braun, "Albrecht Zimmermann. Nachruf," *Phytopathologische Zeitschrift* 3 (1931). Karl Braun himself left an extraordinarily expansive body of work, private records and a collection of artifacts stemming from his 16 years in Amani. The "Karl Braun Collection" is currently researched by a German-Tanzanian team funded by the German Lost Art Foundation. See Sebastian Möllers and Lea Steinkampf, "Stade Museums: A Colonial Era Collection Is Being Researched Together with Partner Institutions in Tanzania," *Expotime* no. 2 (2023).

29 Moritz von Brescius and Christof Dejung, "The Plantation Gaze: Imperial Careering and Agronomic Knowledge Between Europe and the Tropics," *Comparativ* 31, no. 5/6 (2021): 580.

30 Goss, *Floracrats*, 61.

31 Albrecht Zimmermann, Mitteilungen aus dem Biologisch-Landwirtschaftlichen Institut Amani, Niedersächsisches Landesarchiv, Dep. 10, Nr. 02285, 118.

the ground and controlling the work of colonized individuals. In this sense, as succinctly emphasized by Peano, Macedo and Le Petitcorps, "plantations are perfect laboratories to bring together environmental and labour dimensions."[32] Stations such as Victoria and Amani, which were embedded in the surrounding plantation ecology, enabled scientists and practitioners to produce phytopathological knowledge and intervene with traditional practices. However, even if the layout of a plantation seemed to follow "technical expertise and hierarchical control," practice in the field entailed numerous unforeseen and unintended challenges.[33]

In terms of *method*, phytopathological research most closely followed the trends shaping the agricultural sciences. The introduction of chemical methods in the agricultural sciences, a turn associated with the name of Julius Kühn (1825–1910),[34] was paramount in developing externally applied remedies against plant diseases. Copper, mercury and sulfur constituted the main materials for insecticides and fungicides that planters and farmers could use as sprays or dusts. The Bordeaux mixture was developed as the first fungicide in 1882 and became a standard appliance against downy mildew, as was the case for lime-sulfur against the peach leaf curl.[35] As the disciplines of zoology and veterinary medicine grew, so did the field of phytopathological zoology. Thus, in the fifth volume of the *Handbook of Plant Diseases* from 1932, the potentially harmful impact of vertebrates, birds and mammals on plant growth was considered on equal footing with fungi and insects.[36]

Just like in the agricultural sciences, the preferred method of phytopathologists in tropical agriculture was the field trial (German: *Feldversuch*). Historian Frank Uekötter has shown which epistemological stance was attributed to the field trial around 1900.[37] While agricultural scientists did conduct chemical experiments in the laboratory to assess soil quality or determine formulas for plant nutrients, they never dismissed the field trial as a valuable source of insight – regardless of reported mistakes, inexact measures or the irreproducibility inherent in the practical approach. Agricultural scientists even encouraged farmers to con-

32 Irene Peano, Marta Macedo and Colette Le Petitcorps, "Introduction: Viewing Plantations at the Intersection of Policital Ecologies and Multiple Space-Times," in *Global Plantations in the Modern World: Sovereignties, Ecologies, Afterlives*, eds. Colette Le Petitcorps, Marta Macedo and Irene Peano (Cham: Palgrave Macmillan, 2023), 5.

33 Peano, Macedo and Le Petitcorps, "Viewing Plantations," 7.

34 Klemm, *Agrarwissenschaften*, 200–201.

35 George M. Reed, "Phytopathology 1867–1942," 166.

36 Otto Appel and Ludwig Reh, *Handbuch der Pflanzenkrankheiten* (Berlin: Paul Parey, 1932).

37 Frank Uekötter, *Die Wahrheit ist auf dem Feld: Eine Wissensgeschichte der deutschen Landwirtschaft* (Göttingen: Vandenhoeck & Ruprecht, 2012), 81–89.

duct trials in the field themselves. While numbers could be neglected, the field trial was indispensable.

This is in contrast to what Sarah Jansen observes with regard to applied entomology in the late nineteenth century. In her view, the mathematization of biological experiments was a sign of validity and scientificity that applied entomologists had to exhibit for their results to be accepted.[38] Here, Jansen uses an a priori definition of what constitutes an experiment as her point of departure: "First, the isolation of an event; second, the identifiability of the event's elements; third, the stability and homogeneity of the constraints of the technical things enabling the observation of isolated and identifiable elements."[39] In colonial settings, phytopathologists adopted a practical approach akin to agricultural sciences by conducting field trials. They did not engage in complex theoretical frameworks or rely on sophisticated equipment. Instead, their experiments were grounded in problem-driven approaches characterized by iterative trial-and-error processes.

This approach also influenced research at the Amani station. In 1902, the Amani station's chemist, Victor Lommel, conducted a study near Mkamba, a rural location south of Dar es Salaam, to determine if a recent locust infestation could be controlled by infecting the insects with fungi. Armed with 20 vials of fungal cultures, he enlisted the help of local villagers to collect the insects for him. He then treated the insects with the fungal cultures to induce infection. After infecting them, Lommel released them back into the environment to initiate an epidemic among the locust population.[40] Jansen's criteria for defining an experiment were hardly met in the case of Lommel's study. Lommel attempted to isolate the specific event, which was the infestation of locusts with the fungus, by separating the infected animals and observing them for some days following the infection. One night, however, due to a lack of necessary storage materials, all the selected insects perished before Lommel could even infect them. Moreover, the physical conditions for observation were often chaotic. The locust swarms frequently changed location unpredictably, and Lommel could not always personally witness these shifts, instead relying on hearsay to track their movements. Notably, Lommel's account does not suggest that mathematical analysis was required to lend scientific credibility to his findings. His report was published in the *Berichte über*

38 Sarah Jansen, *"Schädlinge": Geschichte eines wissenschaftlichen und politischen Konstrukts 1840–1920* (Frankfurt a. M.: Campus, 2003), 142–190.

39 Jansen, *Schädlinge*, 144. This and all the following quotations from German materials are translated into English by the author.

40 Victor Lommel, "Bericht über eine Reise nach der Gegen von Mkamba zwecks Infizierung von Heuschreckenschwärmen mittelst des Heuschreckenpilzes," *Berichte über Land- und Forstwirtschaft in Deutsch-Ostafrika* 1 (1903).

Land- und Forstwirtschaft in Deutsch-Ostafrika, a publication by the German East African Government aimed at providing information to colonial planters and financiers in the German Reich. In the realm of phytopathology in tropical agriculture, the emphasis was on practical, hands-on experiments directly addressing the challenges faced daily by plantation owners, rather than relying on mathematical formalization. This resulted in a dual objective of phytopathological research: increasing the yield of cash crops and imparting what they considered superior, "hygienic" agricultural techniques.

Phytopathologists for Cash Crop Production

Using the experimental method of the field trial, scientists at agricultural research stations tied their knowledge to concerns of planters on the ground. To a large extent, this concerned the economic prospects of cash crop production, thus leaving the study of medicinal plants on the back burner. The literature has shed light on the potentially drastic impacts of plant diseases on the colonial plantation economy and, consequently, on the complex interplay of actors from the colonial administration, planters and scientists. Wenzlhuemer shows how disastrous plant diseases could play out in colonial settings. In Ceylon, "King Coffee" had dominated the British plantation economy since the early 1850s. When the first signs of *Hemileia vastatrix,* or coffee leave disease, showed up in the 1870s, the planters were startled and frustrated by the seemingly arbitrary appearance of symptoms. Not only was the colonial plantation economy severely affected but indigenous farmers also suffered a drastic decline in crops. Wenzlhuemer emphasizes what botanists already proclaimed at the time: Monocrop cultivation was a risky affair and threatened the objective of valorization.[41]

Building on Wenzlhuemer, Offermann retraces how the outbreak of an epidemic suddenly led to heightened levels of attention with regard to scientific expertise in the form of Ceylon's botanic garden Peradeniya. Examining the complex relationship between colonial administration, scientists and planters, he argues that planters for the longest time maintained a skeptical attitude toward scientists. Upon its founding in 1843, Peradeniya did not significantly influence the plantation economy. Planters were supported by the colonial administration and counted on practical skills that they disseminated through the Planters' Association. It was only at the onset of the coffee leaf disease that the scientists at Peradeniya were put in a

41 Roland Wenzlhuemer, *From Coffee to Tea Cultivation in Ceylon, 1880–1900: An Economic and Social History* (Leiden: Brill, 2008), 62–69.

special position. When all experiential knowledge was exhausted, scientific knowledge seemed like a beacon of hope.[42] Accordingly, as Wendt states, understanding plant health and how to preserve it was of "paramount concern" for a broad array of colonial actors, including the colonial administration, private financiers such as the Kolonialwirtschaftliches Komitee, individual scientists and, importantly, practitioners in the field.[43]

The economic lens guiding phytopathological inquiries is shown in the problem definitions presented in the sources. In a report on his 1905 expedition to German Cameroon and German Togoland, Walter Busse elaborated on what he considered the two main plagues in the regions: the cacao blight and the bark bug. The blight was caused by various fungi nesting in the cacao fruit, at first rendering the fruits light brown and, at a later stage, yellow-whitish.[44] The bark bug attacked young cacao tree branches and extracted their juice.[45] As they both affected cacao trees, these pests weakened one of the central cash crops in the region.

In Busse's efforts to combat blight and the bark bug, experiments at various points played a crucial role. Field trials were carried out to identify possible causes and solutions, as planters could only report specific symptoms exhibited by the plants. In many cases, the exact cause of the issues was not immediately clear. To pinpoint the causes of diseases, plant pathologists employed various methods, one of the primary approaches being inoculations. During inoculations, potential disease triggers were introduced into healthy plants to observe any resulting symptoms. In Busse's investigation of blight, he injected the fungus *Phytophthora* into 20 cacao fruits and the fungus *Colletotrichum incarnatum* into three additional cacao fruits. In the first group, nine fruits quickly exhibited the typical symptoms of blight. In the second group, only one fruit showed signs of infection, still demonstrating that *Colletotrichum* also constituted a potential threat to the cacao tree.[46]

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42 Michael Offermann, *Peradeniya, Pflanzer und die Presse: Die Zusammenarbeit der botanischen Gärten und der Pflanzer bei der Bekämpfung des Kaffeerosts auf Ceylon Ende des 19. Jahrhunderts* (Heidelberg: Ruprecht-Karls-Universität, 2013). Cf. Barbara Hahn's provocative question regarding the determining character of a cash crop for its social, political and economic surroundings, Barbara Hahn et al., "Does Crop Determine Culture?" *Agricultural History* 88, no. 3 (2014), https://doi.org/10.3098/ah.2014.088.3.407.

43 Wendt, "Securing Resources," 45.

44 Walter Busse, "Reisebericht der pflanzenpathologischen Expedition des Kolonial-Wirtschaftlichen Komitees nach Westafrika," *Der Tropenpflanzer* 9 (1905): 28.

45 Busse, "Reisebericht," 33.

46 Busse, "Reisebericht," 31.

In addition to identifying causes for plant diseases, experiments were also aimed at finding possible solutions. In the course of fighting the bark bug, planters tried various measures with different levels of success. At the Victoria plantation in Cameroon, planters had coated the trees "with a suspension of ordinary lime." In his report for the periodical *Der Tropenpflanzer*, Busse weighed in on the attempt: "This remedy is not recommended, because only the trunk and the stronger branches can be treated, but the younger shoots remain free, because the delicate flowering plants suffer and finally, because the procedure requires too much time." Upon inspection, Busse still found the coated trees lined with bark bugs, thereby concluding that the measure was not even effective. A remedy tried at a different farm – a "decoction of Quassia, pure or in combination with soap or petroleum soap emulsion" – exhibited "such uneven results" that Busse advised to "abandon this method, too."[47] At the Plantation Oechelhausen, the planter Köthe had variously tried a "pure petroleum soap mixture," "sulfur liver" and "sulfur calcium" – all to no avail. Only "a solution of 2.5 kg yellow soap in 100 liters water" proved effective to some extent. Yet, Busse warned of the remedy's "disadvantage of being too easy to wash off: a single heavy rain could impair the effect in an unexpected way." When it came to the trials conducted during his stay in German Cameroon, Busse turned toward a remedy developed at the Moliwe plantation: a mixture of Schweinfurter Grün, petroleum, soap, soda and water. On top of that, he also recommended using "a pure suspension Schweinfurter Grün in water [. . .] with an addition of carpenter's glue to reduce wash-off."[48] Thus, the experiential knowledge of planters was not without benefit to the phytopathological inquiry but, on the contrary, constituted practical trials in the field that the plant pathologist could build on.

Besides coming across chemical means through trial and error, colonial planters and indigenous farmers actively participated in plant pathological experiments as these required long-term observation. Traveling on a Buitenzorg stipend for a limited period,[49] Busse appreciated that individual planters played an active role in phytopathological research on site. During his expedition through German Togoland, Busse encountered the German planter Robinson "whom I

47 Walter Busse, "Reisebericht III der pflanzenpathologischen Expedition des Kolonial-Wirtschaftlichen Komitees nach Westafrika," *Der Tropenpflanzer* 9 (1905): 251.

48 Busse, "Reisebericht III," 252.

49 On the Buitenzorg stipends, see Florian Wagner, "Inventing Colonial Agronomy: Buitenzorg and the Transition from the Western to the Eastern Model of Colonial Agriculture, 1880s–1930s," in *Environments of Empire*, eds. Ulrike Kirchberger and Brett M. Bennett (Chapel Hill: The University of North Carolina Press, 2020), 111. Issued by the German government between 1898 and 1914, these travel stipends were used to fund expeditions to the Buitenzorg botanical garden in the Dutch East Indies but also to other German colonies.

have come to appreciate as an excellent observer." Together, both men went to great lengths to identify the harmful insect that "had pitted or curled [the cotton roots] to sometimes an astonishing extent."[50] Busse recommended conducting further trials with antifungals to restore the health of the cotton plants. Robinson's plantation at Nuatyä would be "the suitable place" and Robinson himself was "without a doubt the suitable personality" for such trials.[51]

Similarly to Busse, Julius Vosseler from the Amani station reached out to the German planters and invited them to share their knowledge and experiences to determine the origins of specific plant diseases. To be sure, the exchange with planters on-site did not constitute the only source of knowledge for Vosseler. He took extensive notes based on his readings in journals such as *Tropical Agriculture* or the *Agricultural Bulletin*.[52] Thus, he took the planters' knowledge or routines with a grain of salt and at times skeptically questioned their approaches. For instance, Vosseler dismissed a method tried by African and Indian farmers in the Usambara region and adopted by German planters to prevent coconut trees from losing their fruits before they had matured (plucking a nail into the trunk).[53]

Still, various accounts reveal a collective approach toward conducting field trials and pinpointing the exact reasons and remedies for any given plague. Depending on his ongoing research interests or current threats to plant health in the region, Vosseler called on the colonial planters to send in specimens of particular insects or report how the disease in question unfolded on site. After several planters had already shared their observations of the leaf curl having afflicted cotton plants, Vosseler stated that the question of the origins of the disease seemed to be more or less settled. Still, he invited planters to send in more experience reports tying his request to the practical concern of battling the disease: "The more versatilely the question is dealt with, the faster and more thoroughly it is clarified."[54] Vosseler's motivation was partly found in pure science, partly in making the resulting knowledge useful in the field: The faster a threat to plant health could be addressed, the smaller the hurdle for establishing a functioning plantation economy.

50 Walter Busse, "Reisebericht II der pflanzenpathologischen Expedition des Kolonial-Wirtschaftlichen Komitees nach Westafrika," *Der Tropenpflanzer* 9 (1905): 180.

51 Busse, "Reisebericht II," 181.

52 DEI, Nachlaß Julius Vosseler.

53 Julius Vosseler, "Altes und Neues über Kokosschädlinge," *Der Pflanzer* 3, no. 17/18 (1907): 276–277.

54 Julius Vosseler, "Noch einmal die Kräuselkrankheit," *Der Pflanzer* 1, no. 18 (1905): 282.

Pest Control for Empire: Tropical Hygiene and the Civilizing Mission

While the economic interest in phytopathological forms of knowledge is apparent in travelogues and periodicals, it should be noted that the context of tropical agriculture offered another subtext to the ways in which plant diseases were studied and remedied: the objective of "educating" and "elevating" the colonized population, related to fears of the prospect that the "natives" could not be controlled.[55] Even though there was no German term directly corresponding to the British "civilising mission" or the French "*mission civilisatrice*," similar tendencies were seen in parts of the German colonial activities. Referred to as "*Kulturarbeit*" (cultural work) or "*Kulturmission*" (cultural mission), German colonists negotiated ways to intervene in local routines and impart their norms upon the colonized population.[56] This motif of the civilizing mission not only figured in religiously driven missionary activities.[57] The agricultural sphere seemed to be another area where the indigenous population could be "educated" and their lives "improved." This perspective overlooked the centuries-old knowledge of indigenous farmers with regard to soil cultivation, crop rotation and fertilization, something that Sebald has highlighted for Togo and Koponen for Tanzania and Zanzibar.[58] Duala and Bamileke entrepreneurs had steered agricultural development in the Cameroonian littoral from the 1880s and onwards.[59] Hence, the educational attempts largely defeated their purpose, which did not deter the colonists from trying.

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55 The civilizing missions of various empires have been discussed extensively, such as by Boris Barth and Rolf Hobson, eds., *Civilizing Missions in the Twentieth Century* (Boston: Brill, 2021). On colonial anxieties, see the contributions in Harald Fischer-Tiné, ed., *Anxieties, Fear and Panic in Colonial Settings: Empires on the Verge of a Nervous Breakdown* (Cham: Palgrave Macmillan, 2016); Maurus Reinkowski and Gregor Thum, eds., *Helpless Imperialists: Imperial Failure, Fear and Radicalization* (Göttingen: Vandenhoeck & Ruprecht, 2012); Ann Laura Stoler, *Along the Archival Grain: Epistemic Anxieties and Colonial Common Sense* (Princeton: Princeton Univ. Press, 2009).

56 Jürgen Osterhammel, "Epilogue: From Civilizing Missions to the Defence of Civility," in *Civilizing Missions in the Twentieth Century*, eds. Boris Barth and Rolf Hobson (Boston: Brill, 2021), 209.

57 Richard Hölzl and Karolin Wetjen, "Negotiating the Fundamentals? German Missions and the Experience of the Contact Zone, 1850–1918," in *Negotiating the Secular and the Religious in the German Empire: Transnational Approaches*, ed. Rebekka Habermas (New York and Oxford: Berghahn, 2019).

58 Peter Sebald, *Togo 1884–1914*: *Eine Geschichte der deutschen „Musterkolonie" auf der Grundlage amtlicher Quellen* (Berlin: Akademie-Verlag, 1988), 119–128.

59 Andreas Eckert, "African Rural Entrepreneurs and Labor in the Cameroon Littoral," *The Journal of African History* 40, no. 1 (1999).

Busse's expedition reports exemplified the 'developmental' attempts of the phytopathologists. His texts contained lengthy remarks on the local population at the beginning and the end, thus framing his arguments through a cultural narrative. German planters were vocal regarding their violent attitude toward the indigenous population and advocated for the use of force in disciplining the indigenous workforce. Busse, deviating from the openly dehumanizing discourse, called for "educating" natives in the agricultural techniques of the white man. In his view, the colonized needed to be introduced to proper agricultural methods for hygienic reasons. Since he identified air circulation as a driver for spreading fungi, plantations not tended according to the "proper" way seemed like a potential source of further infections and thus a threat to the plantation economy.[60] This echoed the contemporary discourse of "tropical hygiene" prominent in tropical medicine.[61] Although Busse highlighted that numerous European plantations were in an equally regrettable state as their owners did not fight the sources of disease, no lengthy calls for action were aimed at the Europeans.

However, while arguing for the generally flawed disposition of farmers in the Victoria district in Cameroon, he conceded that "not all of these farms deserve a derogatory judgment."[62] According to him, a farm run by an African man named Beecroft in close vicinity to the plantations of the Westafrikanische Pflanzungsgesellschaft Victoria exhibited exceptional results, which he attributed to Beecroft's level of knowledge and the fact that he had adopted European phytopathological practices:

> This farm testifies to the extraordinary intelligence and agricultural talent of its owner. It is quite a valuable property, and, as far as the infestation by the bark bug is concerned, it does not differ in any way from the equally infested plots of some European plantations, where control attempts have not been made or have been insufficient. Incidentally, it should be noted that Beecroft has taken action against the bark bug in the same way as the West African planting company Victoria, by pruning and liming.[63]

Believing in the indigenous potential to "develop" with the right kind of guidance, Busse suggested that any measures taken on indigenous farms in the Victoria district should meet three criteria: they should be "simple to carry out," "cheap" and "controllable." For this reason, Busse did not endorse the mandatory implementa-

60 Busse, "Reisebericht III," 254–255.

61 Sarah Ehlers, "Disease Control and Human Experimentation: Networks, Practices, and Biographical Pathways from Colonial Medicine to Nazi Germany," in *Colonial Paradigms of Violence*, eds. Michelle Gordon and Rachel O'Sullivan (Göttingen: Wallstein Verlag, 2022).

62 Busse, "Reisebericht III," 254–255.

63 Busse, "Reisebericht III," 254.

tion of the method of removing bark bugs from trees, which he considered "still indispensable for European plantations for the time being" as an obligatory measure implemented by the local population "because it is quite uncontrollable."[64] In addition to outlining potential measures, Busse took steps to instruct the indigenous population on-site. He had planned to conduct a practical course for a group of Cameroonian farmers, teaching them how to administer a serum using a syringe. He complained that he was unable to proceed with the course due to the absence of the required materials, which had not been delivered from the German Reich in time.[65] Still, he viewed his role as extending beyond diagnosing diseases and making specific recommendations for remedies. He saw himself as a facilitator of practical knowledge and transferring skills with a dual objective: protecting the plantation economy and influencing the behavior of the local population to impart European agricultural practices.

Julius Vosseler's writings reveal the flipside of Busse's belief in "developing" indigenous agriculture: the lack of knowledge on flora and growth techniques that the colonists brought to the table and the fears of failing to control a population that far outnumbered the small number of German settlers and planters. As a zoologist at the Amani station in German East Africa, Vosseler published extensively in the bi-weekly periodical issued by the institution: *Der Pflanzer*, a "guidebook for tropical agriculture" as the subtitle indicated aimed at German planters in the East African region. From 1905 to 1914, the scientists at the Amani station condensed their findings in *Der Pflanzer* to derive practical forms of application from their studies that could elevate the German plantation economy. Just like Busse's travels enabled encounters between science, colonial policy and economic practice, *Der Pflanzer* could have served as an arena for shared knowledge. Yet, in contrast to the interpersonal knowledge transfer effectuated by the traveling consultant Busse, the impact of written advice seemed limited. Söldenwagner notes that few German planters were eager to gain agricultural knowledge and skills, thus largely ignoring *Der Pflanzer*.[66] Hence, while officially aimed at the planter community, the periodical mainly strengthened the self-affirmation of Amani researchers like Vosseler.

Vosseler's writings show that phytopathological experts viewed indigenous knowledge from a distance and appropriated traditional agricultural techniques where they exhibited superior results. A case in point was the unsuccessful attempt to pursue monoculture in Amani. Unfamiliar with the quality of the soil,

64 Busse, "Reisebericht III," 254–256.

65 Busse, "Reisebericht III," 255.

66 Philippa Söldenwagner, *Spaces of Negotiation: European Settlement and Settlers in German East Africa, 1900–1914* (Munich: Martin Meidenbauer, 2006), 142–143.

the weather conditions and the various vermin and pests, the Amani staff had weeded out any plants they considered a disturbance to the eye to instead plant single crops. Vosseler was perplexed by the contrast between the unhindered growth of cucumbers in the fields of indigenous farmers and the severe fungal impact on crops at the research station. Acknowledging the disappointing outcomes, he conceded that adopting the local farmers' practice of crop variation might be beneficial: "[F]ield and root crops also suffer from the same pests as the cucumber when planted in isolation, but remain unaffected when associated with other plants. Should the habit of the blacks to grow their crops in mixed cultivation perhaps be due to this experience?"[67] While conflating the various ethnic groups of Arabs and Swahilis who looked back on a substantial farming tradition in East Usambara,[68] Vosseler also revealed an epistemic insecurity: After all, not only could indigenous planters learn from Europeans, the opposite was also true.

However, colonial insecurities were not only epistemic. Through Vosseler's account, we can also observe the colonists' anxious attempts to control the indigenous populations. Not only weather conditions, fungi and insects seemed to threaten the crops: Through the eyes of the colonists, the colonized subjects revolting also appeared like pests. Since 1905, Vosseler regularly published texts about threats to the coconut tree in *Der Pflanzer*. In an article from 1907, he deviated from his usual focus on fungi and insects and stated "quite an increase in enemies to the coconut tree," including mammals.[69] In his view, one mammal stood out among the hostile elements: "In the series of creatures, the human being stands above all in this regard, naturally as the anima nigra, as the black variant."[70] Planters had reported an increased number of coconut thefts that allegedly cut the copra yields in half. Referring to rumors that half of the population on the island Mafia on the east coast was engaging in coconut theft, Vosseler made projections regarding the dire potential impact of large-scale stealing on the plantation economy: "robberies" would have "an inhibiting effect on the operation of existing plantations by Europeans and paralyze the entrepreneurial spirit for new plantations." In addition, thieves did not differentiate between "ripe and half-ripe nuts," thereby contaminating the copra yield: "This reduces the value of

67 Julius Vosseler, "Gurkenschädlinge in Ostusambara," *Der Pflanzer* 1, no. 18 (1905): 287.

68 Juhani Koponen, *Development for Exploitation: German Colonial Policies in Mainland Tanzania, 1884–1914* (Helsinki: Lit Verlag, 1995), 197–212.

69 Vosseler, "Kokosschädlinge," 288.

70 Vosseler, "Kokosschädlinge," 288.

the product and the reputation of the producing country on the world market. So another indirect disadvantage!"[71] Just as Busse extensively laid out possibilities to combat pests through chemical means, Vosseler went to great lengths to elaborate on means to prevent theft – conceptualizing the colonized themselves as a pest that had to be combatted:

> Perhaps the mentioned method of setting traps may be enough of a deterrent. However, it should not be forgotten that the thieves soon learned to use long sticks to close the traps in front of them and render them harmless. Moreover, the suggested idea of covering tree trunks with sharp metal spikes and thorns would not provide absolute defence, would cost a lot of money, and make harvesting more difficult. Nighttime guards are also of little help. They often perform their duties inadequately without proper control. [. . .] Fences made of barbed wire or living thorn hedges may perhaps serve their purpose best, despite significant initial costs, especially for smaller plantations, if they are consistently maintained.[72]

While seemingly demonstrating the colonists' range of ways to exert control, Vosseler's account revealed the insecurities and fears that the colonists frequently grappled with. As Reinkowski and Thum point out, many such colonial fears were not grounded in reality.[73] At the time of Vosseler's writing, virtually no German planter was based on Mafia. Sunseri speaks of only one German planter on the island by 1910 and states that five more followed within four years, resulting in a total number of six German planters on Mafia by 1914.[74] The copra production on Mafia was dominated by Arab and Swahili plantations running on slave labor, and Indian traders exported copra from the island to the mainland markets. Rather than impoverishing the copra plantations, the slaves were responsible for protecting the coconut trees from pests such as "monkeys, wild pigs, and birds," as well as climbing the trees, the latter being a "particularly strenuous job."[75] When German planters settled on Mafia, the pre-existing plantation infrastructure and available labor force quickly turned Mafia into "German East Africa's

71 Julius Vosseler, "Altes und Neues über Kokosschädlinge (Schluss)," *Der Pflanzer* 3, no. 19/20 (1907): 290.

72 Vosseler, "Kokosschädlinge (Schluss)," 290.

73 Maurus Reinkowski and Gregor Thum, "Helpless Imperialists: Introduction," in *Helpless Imperialists: Imperial Failure, Fear and Radicalization*, eds. Maurus Reinkowski and Gregor Thum (Göttingen: Vandenhoeck & Ruprecht, 2012), 11.

74 Thaddeus Sunseri, "Slave Ransoming in German East Africa, 1885–1922," *The International Journal of African Historical Studies* 26, no. 3 (1993): 498.

75 Sunseri, "Slave Ransoming," 497.

chief source of copra."[76] Vosseler's projected fear had not materialized. Still, in his writing, he showed that the colonial mind could seamlessly transfer the epistemic category of a pest to subjugated human beings.[77]

Concluding Remarks

Considered in conjunction, the accounts of Busse and Vosseler exemplify the same "complicated mix of developmental fantasies, colonial insecurities, and racism" discerned by Sarah Ehlers among colonial physicians.[78] Pest control in the German colonies was meant to fulfill various objectives: on the one hand, the valorization of lands and plants and, on the other, pursuing the cultural mission of "elevating" the indigenous population. Thus, the agricultural research station as an experimental setting drew its raison d'être directly from impacting its immediate surroundings: the plantation economy in its racialized environments. In addition, a few individuals funded by the Kolonialwirtschaftliche Komitee traveled to various colonies in different climatic zones and visited plantations to conduct field trials on site. Here, phytopathology followed an experimental logic. Phytopathologists such as Walter Busse created controlled settings for trials and provoked reactions to be studied in order to identify plagues and ways to fight them. To a significant extent, phytopathological field trials were based on the experiential knowledge gained by the planters on site, and planters and scientists worked alongside to build the plantation economy.

The study of two actors rooted in different institutional settings and with different interpretations of the colonial agenda shows that both the economic objectives and the cultural mission could be pursued differently. Travel reports, articles in periodicals and archival material give an in-depth picture, albeit leaving the perspective of the indigenous population obscured. Busse advocated for "educating" and "helping" indigenous farmers in the face of planters' calls for disciplining the local labor force in a harsh and possibly violent manner. In contrast to Busse, Vosseler defined black individuals as "pests" themselves, likening them to the fungi, insects and other animals that the plants needed protection from. Hence, a paternalistic position met with a racialized view.

76 Sunseri, "Slave Ransoming," 498.

77 Jansen shows how the German notion of *Schädling* (pest) came into being between 1840 and 1920, blending entomological knowledge and motifs of social hygiene, see Jansen, *Schädlinge*.

78 Ehlers, "Disease Control," 112.

In 1909, when he was already employed as a civil servant at the Reichskolonialamt, Busse was critical that the Amani station had not done enough in terms of "elevating" indigenous agriculture but had primarily focused on biological research.[79] In this regard, he echoed the credo of "scientific colonialism" that had become the official agenda of the Reichskolonialamt under Bernhard Dernburg.[80] Following the approach of the civilizing mission, Dernburg had since 1907 sought to preserve the colonies by "improving" them through scientific means and more labor-friendly policies.[81] In 1910, one year after Busse's intervention, Amani scientists started to offer structured courses to German planters and focused more on "indigenous crops" in their research, following the direction of the Reichskolonialamt.[82] Curiously, 1909 was the year that Vosseler left Amani to return to the Reich. He was replaced as Amani's zoologist by Hermann Morstatt, who quickly became an expert on plant pathological trials.[83] Even after returning to the Weimar Republic after 1919–1920, Morstatt published several manuals on plant protection.[84] Thus, knowledge production began in the colonies and circulated back to the metropole.

This article has shown that an experimental mindset guided the pursuit of the phytopathologists involved in tropical agriculture. The study of plant diseases was significantly shaped by an approach of trial and error, while being aimed at solving concrete issues at hand in the tending of cash crops. At the same time, the sources reveal that the experimental approach extended beyond tinkering with plants and their health. In the same way, Vosseler scrutinized how to combat plant diseases and mused on ways to keep the insurgent indigenous population at bay, thereby demonstrating the colonists' epistemic and material insecurities. This is relevant to the study of science and empire overall: A medicalized mindset was characteristic of the time of high imperialism and shaped the colonists' attitude toward people, places and things. Comparing and contrasting the colonial medicalized view of humans, plants and animals alike is beyond the scope of this

79 Nagel, *Kolonie*, 333.

80 Andrew Zimmerman, "Ruling Africa: Science as Sovereignty in the German Colonial Empire and Its Aftermath," in *German Colonialism in a Global Age*, eds. Bradley Naranch and Geoff Eley (Durham: Duke University Press, 2014), 100.

81 Katharina Abermeth, *Heinrich Schnee: Karrierewege und Erfahrungswelten eines deutschen Kolonialbeamten* (Kiel: Solivagus Praeteritum, 2017), 263–267.

82 Nagel, *Kolonie*, 333.

83 "Personalien," *Der Pflanzer* 5, no. 10/11 (1909); Hans Sachtleben, "Entomologische Chronik," *Beiträge zur Entomologie* 9, no. 5/6 (1959): 710–12, https://doi.org/10.21248/contrib.entomol.9.5-6.708-712.

84 Hermann Morstatt, "Zur Ausbildung für den Pflanzenschutzdienst," *Zeitschrift für Pflanzenkrankheiten* 31, no. 3/4 (1921).

article. However, how a medicalized lens guided the inquiry of a range of pre-disciplinary endeavors in the colonies, be it in botany, entomology, mycology or zoology, constitutes an intriguing object for further inquiry.

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