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# From curative policy to preventive efforts: The role of physicians and corporate management in health maintenance for plantation workers at the *Senembah* plantation company, 1871-1940

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**Abstract.** Since the late 19th century, the East Sumatran region transformed into Sumatra's plantation belt, marked by the rise of multinational companies cultivating export commodities such as tobacco, rubber, coconut, and tea. The growth of the plantation industry required a significant labor force, leading to various challenges, including health issues. Harsh working conditions and the exploitation of labor on plantations contributed to the spread of epidemics and tropical diseases, resulting in high mortality rates among workers. This study aims to explore the diverse health issues faced by plantation workers and the efforts made by companies to address them. This historical analysis employs a historical method comprising heuristics, source criticism, interpretation, and historiography. The findings reveal that the *Senembah* Plantation Company had a particular focus on the health maintenance of its plantation workers. Key actors involved in health maintenance included corporate management, plantation doctors, and the plantation workers themselves. Health maintenance on the plantations was also supported by the *Koelie Ordonnantie* regulation, which mandated worker treatment in clinics or hospitals. In addition, the company played a role in providing healthcare facilities, such as hospitals and clinics, and participated in the establishment of the Medan Pathology Laboratory in 1906. The company also implemented ongoing efforts to maintain cleanliness and improve plantation sanitation to prevent the spread of tropical diseases.

**Key words:** plantation workers, health issues, plantation sanitation, *Senembah* plantation

## Introduction

The economic growth and foreign investment in East Sumatra, Dutch East Indies, during the mid-19th century rapidly transformed the region's environment, infrastructure, and demographics. Under Dutch colonial rule, East Sumatra evolved from untamed wilderness into Sumatra's bustling plantation belt (1). This influx of economic investment began with the arrival of Jacobus Nienhuys in Deli in 1863. Previously, Nienhuys operated a tobacco plantation in Lumajang, East Java. He was invited to Deli by Said Abdullah ibn Umar Bilsagih, who suggested that the Deli soil was ideal for tobacco cultivation. Nienhuys's first plantation concession was granted in Titi Papan, with a 99-year lease (2). Since the establishment of Nienhuys's first plantation in 1863, a new wave of entrepreneurs (planters) arrived in East Sumatra, aiming to establish plantations for various export commodities, including tobacco, gambier, pepper, areca nut, rubber, tea, and coffee (3). These investments by entrepreneurs materialized in the founding of plantation companies. The first of these, the Deli Company, was established in 1869, followed by the Arendsburg Tobacco Company in 1875 and the Deli Batavia Company in 1877. The *Senembah* Company was founded later, in 1889, after being acquired and financially supported by the Deli Company (4). The rapid expansion of plantations

in East Sumatra from the 1860s onward led to labor challenges, as local inhabitants were unwilling to work on the plantations. Initially, entrepreneurs sourced labor from outside the region, particularly from the Straits Settlements (British colonies in the Malay Peninsula), recruiting Chinese workers. This recruitment of Chinese workers continued through the end of the 19th century. However, beginning in the 1880s, incidents of worker agent exploitation and plantation cruelty prompted the British colonial government to protect its citizens in the Malay Peninsula, complicating recruitment efforts. In response, plantation entrepreneurs began directly sourcing Chinese workers from southern China (5). In addition, approaching the 20th century, plantation owners increasingly recruited workers from Java in the Dutch East Indies (6). Poor recruitment practices and exploitation of plantation labor were widespread in the early stages of plantation development. This exploitation led to the spread of tropical diseases and high mortality rates among plantation workers. Common illnesses included cholera, malaria, dysentery, typhoid, fever, and tuberculosis. One contributing factor was inadequate ventilation in processing areas and tobacco warehouses (7). Health issues among plantation workers in East Sumatra at the end of the 19th century became a central concern in the expansion of the plantation industry in the Dutch East Indies. Klaveren's (1995) study indicates that high mortality rates among plantation workers, stemming from harsh working conditions and untamed environments, led to the widespread transmission of diseases (8). However, in response to these health challenges, Pelzer (1978) and Breman (1992) highlight data from reports by *Senembah* Plantation Company doctors from 1897-1907, which document a reduction in worker mortality at the company in the early 20th century following outbreaks of cholera and beriberi. These physicians played a key role in health research, exploring the relationship between environmental factors and the spread of tropical diseases (9,2). The *Senembah* Plantation Company's medical reports offered hope and a positive outlook for the future of plantation worker health in East Sumatra. Several studies conducted by other researchers on the health of plantation workers in East Sumatra include those by Marieke van Klaveren (1997), Frank Ochsendorf (2018), Devi Itawan (2020), Budi Agustono, et al. (2021), Ririn Darini (2023), Gani A. Jaelani (2023), and Junaidi, et al. (2023) (10-14,1,8). These previous studies broadly address health issues in East Sumatran plantations without focusing on a specific company or plantation. This paper specifically examines the efforts made by the *Senembah* Plantation Company to maintain plantation workers' health and improve sanitation on the plantation. Building on the background above, this article seeks to trace the efforts of the *Senembah* Plantation Company in addressing the health issues faced by its plantation workers. More specifically, it examines the role of plantation doctors and the company's initiatives to improve the health quality of its workers. Before delving into these efforts, this article will first outline the conditions and lives of plantation workers, as well as the historical origins of the *Senembah* Plantation Company.

## Methods

This paper is a study of the history of health in the Dutch colonial period in East Sumatra. This study employs a historical method comprising four stages: heuristics, source criticism, interpretation, and historiography. The heuristics stage involves identifying historical sources, including archives such as documents, annual reports from plantation companies, reports from plantation hospital doctors, and other company records. These historical sources were obtained from the National Archives of the Republic of Indonesia and the National Library of the Republic of Indonesia in Jakarta. The next step, source criticism, assesses the credibility and authenticity of these sources. Following this, interpretation involves examining historical facts to construct a coherent historical narrative. This interpretation is divided into two forms, which are analysis and synthesis. Analysis refers to explaining facts that contain various possible historical facts, while synthesis can be interpreted as the unification of various historical facts so that their meaning and relationship with one another can be known. The final step, historiography, is the process of reconstructing and writing history. This paper contributes to the study of plantation labourers' health history in East Sumatra.

Furthermore, it explains the role of doctors and plantation management in improving the health of plantation workers of *Senembah* Plantation Company during the Dutch colonial period in East Sumatra.

## *Senembah* plantation workers

The *Senembah* Plantation Company is located on the eastern coast of Sumatra, centered in the Sultanate of Serdang. By 1940, the company operated 13 plantations in Serdang, along with one plantation each in Deli and Langkat. Initially, the *Senembah* plantation concession was confined to the Serdang region, extending along the Bloemai River from the coast to the mountains. Since its establishment in 1889, the area of the plantation concession expanded to 31,565 *bau* (1 *bau*=0.8 hectares). By 1897, this area increased to 50,994 *bau*, with 40,340 *bau* situated in Serdang and 10,654 *bau* located in Deli (2). Before being established as a company named *Senembah*, these plantations were part of a tobacco colony owned by the German trader Hermann Naeher and the Swiss founder of the Helvetia plantation, Karl Furchtegott Grob. They formed a partnership in the tobacco business along the banks of the Bloemai River in Serdang. In 1871, they established a firm named *Naeher & Grob*. Initially, this firm experienced rapid growth due to the unique characteristics of their tobacco leaves, which were notably different from those produced by the Deli Company. Their tobacco leaves were darker and broader. Prior to 1887, the European market favored darker, larger tobacco leaves. However, starting in 1887, although the selling price of the firm's tobacco leaves was slightly lower than that of the Deli Company, they were still able to compete effectively in the European export market for tobacco (15). The economic situation and the tobacco crisis that struck East Sumatra in the 1880s, combined with the declining health of Karl Furchtegott Grob, led the owners of the Naeher & Grob firm to agree to sell their business to the Deli Company. In 1889, the firm was acquired by the Deli Company and restructured as the *Senembah* Plantation Company. On September 11, 1889, the notarial deed for NV. *Senembah* Maatschappij was issued, with the board of directors and commissioners comprising J. Nienhuys and C.W. Janssen as directors, along with J.T. Cremer, H. Naeher, G.E. Haarsma, A.L. Wurfbain, and R. Von Seutter serving as commissioners (15). The administrative center of the *Senembah* Plantation Company is located in Tanjung Morawa. By 1940, the company managed fifteen plantations. Among these, eleven were tobacco plantations: Tanjung Morawa, Tanjung Morawa Kiri, Sei Bahasa, Batang Kuis, Petumbak, Gunung Rintih, Pagar Merbau, Two Rivers, Selayang, Kuala Namu, and Simpang Empat. In addition to the tobacco plantations, there were three rubber plantations: Tanjung Garbus, Melati, and Limau Mungkur, as well as a coconut plantation named Sei Tuan (Figure 1) (15, 16).

The plantations under the *Senembah* Company are primarily located in the lowlands and highlands along the Bloemai River. This region has a tropical climate characterized by two distinct seasons: the rainy season and the dry season. The rainy season begins in October, with rainfall intensifying in the following months. The dry season typically occurs from February to August each year. These climatic conditions and the geographical environment have accelerated the spread of epidemics and tropical diseases since the late 19th century. Furthermore, the interaction between the environment and humans, coupled with the exploitation of plantation labor, has weakened physical conditions, facilitating the spread of diseases. Notable epidemics recorded on the plantations include typhus, dysentery, cholera, and beriberi. Between 1901 and 1907, outbreaks of typhus and cholera occurred due to drought conditions affecting several plantations. In addition, high humidity levels have expedited the spread of beriberi, particularly during periods of heavy rainfall affecting the plantations (17).

The environmental conditions and tropical climate on the plantations facilitated the spread of diseases among the plantation workers. In addition, the differing environmental conditions, climate, and region from which the workers originated further exacerbated health issues, particularly for the Chinese workers. From the onset of plantation development, the recruited labor force primarily consisted of Chinese workers, who were reported to be skilled and disciplined in the processing and handling of tobacco leaves (18, 15). In addition to Chinese workers, the company also recruited Javanese workers, both male

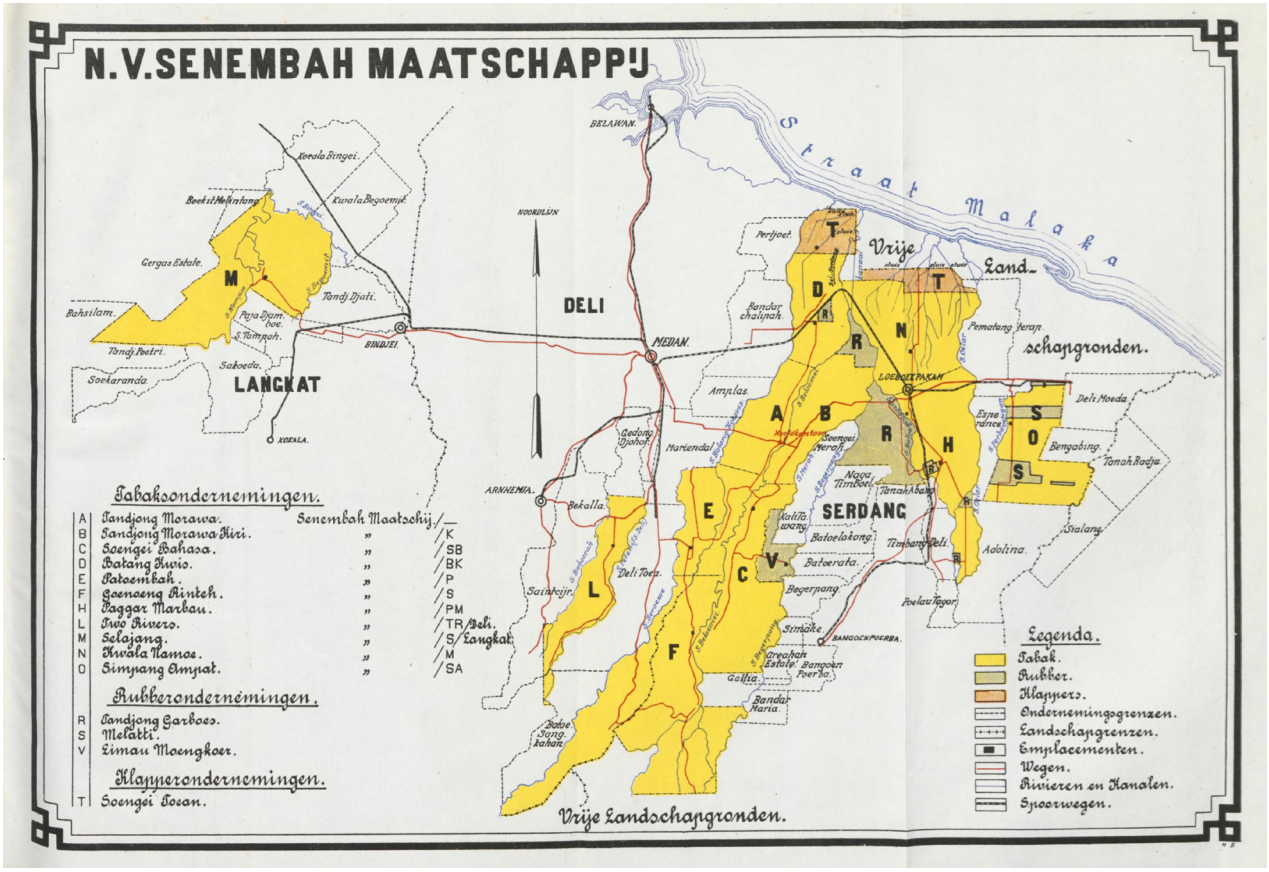


**Figure 1.** Concession Area of the *Senembah* Plantation Company, 1939. Source: Janssen CW, dan HJ. Bool. *Senembah* Maatschappij 1889-1939. Amsterdam: Boek- en kunstdrukkerij v/h Roeloffzen-Hübner en Van Santen;1939.

and female. Female Javanese workers had specific roles such as searching for caterpillars, sorting, grading, hanging, and tying tobacco leaves. Moreover, women were preferred for recruitment due to their lower wage demands compared to their male counterparts (19) (To see the number of plantation workers recruited by Senembah Plantation Company, Table 1). Potential workers were recruited from various regions in Java and China, using sea transportation. They were initially gathered at Belawan Port before being distributed to the plantations. At Belawan Port, there was a Quarantine Station that served as an initial health screening for newly arrived workers. This was to anticipate the spread of contagious diseases that might be brought by the plantation workers (20). These prospective workers were often given an advance payment (known as "persekot") by labor recruitment agents, commonly referred to as "werek." The persekot was a strategy to entice prospective workers to agree to work on the plantations. Workers would repay this advance by having it deducted from their wages each month (9).

According to the provisions of the *Koelie Ordonnantie*, companies were mandated to provide adequate housing and health care for every plantation laborer. This requirement is outlined in Article 2 of the *Koelie Ordonnantie* regulations of 1880 (21). With the continuous increase in the number of plantation workers each year, housing issues became crucial, particularly concerning cleanliness and ventilation in the workers' barracks. Poor living conditions and housing could facilitate the rapid spread of infectious diseases (22). The housing and living conditions of plantation workers were differentiated between Chinese and Javanese workers. In the early stages of plantation development,

**Table 1.** Plantation Workers at *Senembah* Plantation Company, 1897-1907.

| Year | Chinese Workers | Male Javanese Workers | Female Javanese Workers | Total Number |
|---|---|---|---|---|
| 1897 | 2,279 | 878 | 718 | 3.824 |
| 1898 | 2,386 | 1,054 | 589 | 4,029 |
| 1899 | 2,517 | 1,306 | 507 | 4,330 |
| 1900 | 2,633 | 1,033 | 501 | 4,167 |
| 1901 | 2,757 | 1,225 | 608 | 4,590 |
| 1902 | 2,760 | 1,476 | 896 | 5,132 |
| 1903 | 3,212 | 1,722 | 975 | 5,909 |
| 1904 | 3,283 | 1,497 | 896 | 5,656 |
| 1905 | 3,032 | 1,795 | 857 | 5,684 |
| 1906 | 2,944 | 1,668 | 1,054 | 5,666 |
| 1907 | 3,273 | 2,036 | 1,194 | 6,503 |
| Total | 31,076 | 15,690 | 8,744 | 55,510 |

Sources: Schuffner WAP. dan W.A. Kuenen. De Gezondheidstoestand van de arbeiders, verbonden aan de *Senembah* -Maatschappij op Sumatra, gedurende de jaren 1897 tot 1907. Amsterdam: De Bussy; 1910.

Chinese workers resided in temporary barracks (usually located in the center of the plantation and relocated with each new planting cycle). These temporary living conditions offered minimal sunlight ventilation. A communal kitchen was constructed in the middle of the barracks to provide food for the plantation workers. In addition to the kitchen, public bathrooms were built around the barracks for bathing and water supply. The quality of this water was monitored by the company annually (22). In contrast, Javanese workers were accommodated in a lodging system. Since the 1920s, this housing pattern has been referred to as colonization (permanent housing). The dwellings were elevated, built on stone floors, and included kitchens, wells, and toilets that were enclosed with wooden panels (23).

## Health issues and mortality rates among plantation workers

Since the establishment of plantations in East Sumatra, various epidemics and infectious diseases have resulted in a high mortality rate among plantation workers. The first recorded outbreak was cholera in 1891. One of the primary causes of this outbreak was the arrival of Chinese workers who were already infected with cholera (24). The spread was exacerbated by the lack of health inspections at the Belawan Port. Breman elaborates that the transportation of Chinese workers was overcrowded, with conditions akin to stacked sago leaves. Spaces designed for 40 individuals were crammed with up to 102. Workers lay lined up on the deck of the ship without being provided food, and those who had already contracted the disease were forced to remain on board. This situation was worsened by a prohibition from labor agents against reporting to the authorities (9). The cholera outbreak resulted in a mortality rate of 136 individuals per 1,000 plantation workers at the *Senembah* Plantation Company (17). The second outbreak was that of beriberi. Initially, the company did not understand the cause of this disease. By 1896, the mortality rate among plantation workers at the *Senembah* Plantation Company had reached 105 per 1,000 workers. The underlying cause was attributed to poor food quality and rice consumed by the workers, which lacked vitamin B1 (17). The deteriorating health conditions among plantation workers were also exacerbated by the fact that plantations, particularly those managed individually, had not prioritized health aspects due to uncertainties regarding the sustainability of tobacco cultivation. Following the outbreaks of cholera and beriberi that resulted in high mortality rates among plantation workers, the next epidemic occurred between 1918 and 1919. This outbreak

is known as the Spanish Flu (*influenza*). More than half of all recorded deaths among plantation workers in East Sumatra were attributed to the Spanish Flu. This pandemic spread globally, and its wider reach in East Sumatra was exacerbated by the large-scale recruitment of Javanese workers to the plantations, coinciding with the epidemic's spread in Java. Furthermore, two major plantation hospitals neglected the previously agreed-upon sanitation oversight established by the East Sumatra plantation hospital union (25, 23). In addition to the widespread outbreaks, plantation workers were also afflicted by various other diseases. These included dysentery, typhus, malaria, ankylostomiasis, and helminthiasis. Such diseases led to high mortality rates from the late 19th century to the early 20th century (26). However, data regarding the mortality of plantation workers in East Sumatra was not always mandatory to report. This uncertainty often arose due to the selective registration of certain workers and those who had left their residences but never reached the intended plantations (9). From 1890 to 1909, data on the mortality of plantation workers at the *Senembah* Plantation Company was recorded, with death rates calculated per 1,000 workers. The following table (Table 2) presents the number of deaths among plantation workers at the *Senembah* Plantation Company from 1890 to 1909.

From the mortality data of plantation workers above, Chinese workers constitute the largest proportion compared to Javanese workers. There are three factors contributing to the mortality of Chinese workers. First, the climatic conditions, weather, and geographical area of the plantations differ significantly from the regions where Chinese workers originate. They must adapt to these new conditions, which makes them more susceptible to various diseases. This is not the case for Javanese workers, who are already accustomed to the tropical climate of the Dutch East Indies. Second, the perception among plantation owners that Chinese individuals possess a diligent work ethic leads them to work incessantly, often disregarding their health. They might even work to the point of death. In reality, the strenuous labor is not supported by adequate housing or sanitation. Poor hygiene and sanitation issues were highlighted as significant factors in efforts to improve the health quality of workers by the medical staff at the *Senembah* Plantation Company. In addition, Chinese workers often had unsanitary living habits and lacked privacy in the plantation barracks, exacerbating the spread of diseases among them prior to the 20th century. Third, the habit of consuming opium among Chinese workers rendered their physical condition more vulnerable to infectious diseases (17). Since the early 20th century, the mortality rate among plantation workers at the *Senembah* Plantation Company has experienced a significant decline. From the 1920s onwards, the number of deaths among plantation workers never exceeded 10 per 1,000 workers. This

**Table 2.** Mortality Rates of Plantation Workers at *Senembah* Plantation Company, 1890-1909.

| Year | Number of Deaths per 1,000 Workers | Year | Number of Deaths per 1,000 Workers |
|---|---|---|---|
| 1890 | 74 | 1900 | 45 |
| 1891 | 136 | 1901 | 51 |
| 1892 | 56 | 1902 | 34 |
| 1893 | 32 | 1903 | 38 |
| 1894 | 49 | 1904 | 20 |
| 1895 | 68 | 1905 | 11 |
| 1896 | 105 | 1906 | 10 |
| 1897 | 60 | 1907 | 15 |
| 1898 | 48 | 1908 | 9 |
| 1899 | 35 | 1909 | 12 |

Sources: Schuffner WAP. dan W.A. Kuenen. De Gezondheidstoestand van de arbeiders, verbonden aan de *Senembah* -Maatschappij op Sumatra, gedurende de jaren 1897 tot 1907. Amsterdam: De Bussy; 1910.

**Table 3.** Mortality Rates among Plantation Workers at *Senembah* Plantation Company, 1928-1935.

| Year | Deaths per 1,000 Workers | Year | Deaths per 1,000 Workers |
|---|---|---|---|
| 1928 | 6.0 | 1932 | 4.9 |
| 1929 | 8.4 | 1933 | 9.7 |
| 1930 | 7.3 | 1934 | 7.1 |
| 1931 | 5.7 | 1935 | 8.2 |

Sources: *Anonymous*. Verslag over het boekjaar N.V. *Senembah* Maatschappij 1928-1935. Amsterdam: De Bussy; 1929-1936.

improvement in health and a higher quality of life have been observed among the workers. In addition, there were no major epidemics affecting the plantations, unlike in the late 19th century. Plantation workers also began to acclimate to their working environment, a stark contrast to the conditions during the initial establishment of the plantations. The management of the company also undertook enhancements to healthcare facilities at the plantation hospitals (15). Below is a table (Table 3) depicting the number of deaths among plantation workers at the *Senembah* Plantation Company from 1928 to 1935.

Based on the table above (Table 3), during the eight-year period from 1928 to 1935, the mortality rate among plantation workers did not exceed 10 deaths per 1,000 workers. The lowest recorded mortality occurred in 1932, with 4.9 deaths per 1,000 workers. The mortality rate nearly approached 10 deaths per 1,000 workers due to the occurrence of several epidemics, such as measles, influenza, and malaria on the plantations (27, 28). The improvement in health quality can be observed from the mortality rates during the transition from the 19th to the 20th century and into the 1930s. The company undertook improvements and health maintenance initiatives for plantation workers, recognizing that the continuity and productivity of the workforce constituted a valuable asset in the economic production of the plantation industry.

## Health facilities and the role of plantation doctors

The maintenance of health for plantation workers at the *Senembah* Plantation Company gained significant momentum when the German physician W.A.P. Schuffner was appointed as the head of the hospital and took responsibility for the health of the plantation workers. Several health policies and interventions were implemented by this doctor. From the early 20th century, Dr. W.A.P. Schuffner, along with Dr. W.A. Kuenen, developed and organized the management of the central hospital in Tanjung Morawa to enhance the health of plantation workers. Curative efforts involved the treatment and care of plantation workers who had contracted diseases. These curative measures included providing medical care to plantation workers at health facilities established by the company (To see the treatment room facilities for female workers at Tandjong Morawa Hospital, see Figure 2). The Central Hospital of the Tanjung Morawa Plantation was established in 1882 as the primary healthcare facility for plantation workers (29). In addition to this, clinic facilities were established at various plantations, including Gunung Rintih, Petumbak, and Sei Bahasa. The clinics provided care for workers suffering from minor ailments, while those with severe and dangerous conditions were referred to the central hospital for diagnosis and further treatment. Workers were transported to the hospital using horse-drawn carriages (17). Each year, the *Senembah* Plantation Company allocated a budget for the healthcare of its workers, with the cost of health maintenance for each plantation worker ranging from f. 12 to f. 15 annually (26). The treatment measures were further supported by research on tropical diseases conducted by plantation doctors. Since the late 19th century, various diseases had been identified that had not been adequately diagnosed. By the early 20th century, plantation physicians had discovered differences in the characteristics and symptoms of tropical diseases such as malaria, typhus, and other fevers. Beriberi and ankylostomiasis exhibited similar symptoms, while dysentery presented in multiple forms. Syphilis

**Figure 2.** Treatment room for female workers in Tandjong Morawa Hospital at *Senembah* Plantation Company. Available from http://hdl.handle.net/1887.1/item:782057

shared external symptoms with dermatological conditions such as leprosy and framboesia (30). A variety of research efforts were undertaken to investigate the causes of these disease outbreaks and their relationship with the plantation environment. The efforts to eradicate these diseases involved collaboration among various stakeholders, including doctors, healthcare workers, plantation management (such as administrators, assistants, and overseers), and plantation workers.

Given the growth of plantations and the increasing complexity of health conditions among plantation workers, the *Senembah* Plantation Company established collaborations with health institutions and hospitals from other plantations. Since 1921, the Tanjung Morawa Central Hospital has partnered with the Perbaungan Hospital, Petumbukan Hospital (*Serdang Doktor Fonds*), Sei Sikambing Hospital, and Bangkatan Hospital to provide healthcare for plantation workers. This policy mandated that plantations located far from the central hospital refer their workers to the nearest hospital. This practice was implemented at the Simpang Empat, Titian Urat, Ramunia, and Melati plantations, where workers received care at the Perbaungan Hospital. The Petumbukan Hospital (*Serdang Doktor Fonds*) served as the healthcare facility for workers from Pagar Merbau, Lubuk Pakam,

**Figure 3.** Hospital with water tower and soup kitchen facilities at *Senembah* Plantation Company, 1903. Available from http://hdl.handle.net/1887.1/item:918806

and Kuala Namu plantations. Up until 1922, the Sei Sikambing Hospital provided treatment for workers from Selayang, Wampu, Two Rivers, and Tanjung Garbus plantations. However, when the Sei Sikambing Hospital was closed in 1922, sick workers from Selayang and Wampu plantations were redirected to the Bangkatan Hospital in Binjai (Deli Company), while those from Two Rivers and Tanjung Garbus plantations were transferred to the Tanjung Morawa Central Hospital (15) (To see the condition and facilities of Tanjung Morawa Hospital at Senembah Plantation Company, see Figure 3).

In addition to inter-institutional collaboration among health organizations within plantation companies for the care of plantation workers, the establishment of the Medan Pathology Laboratory was initiated in 1906 by the Deli Plantation Company, *Senembah* Plantation Company, and Medan Tabak Plantation Company. Key figures in the establishment of this institution included J.W. van Vollenhoven, the Administrator of the Deli Plantation Company, and C.W. Janssen, the Managing Director of the *Senembah* Plantation Company (31, 29). The laboratory aimed to investigate the causes and origins of tropical diseases in East Sumatra. Research conducted by scholars and doctors was focused on the development of serums, vaccines, and medications. Various studies undertaken by physicians sought to trace the causes of diseases, the relationships between symptoms and environmental factors, as well as the spread of epidemics within specific regions (4, 12). The first director of the Medan Pathology Laboratory was W.A. Kuenen, a physician from the *Senembah* Plantation Company. The activities carried out by this institution included research on the pathology of tropical diseases, providing advice and information on health maintenance, such as the establishment of a Quarantine Station at the Port of Belawan, inspections of workers' settlements, and the promotion of hygiene awareness within the plantations. In addition, doctors and staff conducted

comparative studies in Java and Southeast Asia to inform the development of the laboratory and health research initiatives (31).

**Preventive measures and sanitation in plantations**

Efforts and measures for maintaining the health of plantation workers were implemented through disease prevention and sanitation in the plantations. The preventive and sanitation initiatives undertaken by the company included the provision of clean water, nutritious food, and the maintenance of cleanliness and hygiene. The provision of clean water was achieved through two primary methods. First, wells were constructed in and around the workers' settlements. Second, the flow of the Bloemai River was utilized during the dry season when the wells ran dry. Regular inspections were conducted to monitor the wells, and the bacterial content in the water was tested using a device known as the Eijkman Water Controller. This device measured the bacterial load in the water, thereby helping to prevent the spread of diseases among plantation workers (17). The construction of wells served two distinct purposes: one for personal hygiene activities (bathing, washing, and sanitation) and the other for providing drinking water to the plantation workers. The wells designated for drinking water were equipped with protective barriers to prevent contamination. The company established clear boundaries regarding the functions of both types of wells as a preventive measure against disease transmission through water supply. The utilization of water sources from the river was limited to the dry season due to the poor quality of water found in the Bloemai River, which was often contaminated by local residents (Malay) disposing of household waste into the river. Consequently, the river water was used solely for bathing and washing (17). The policies implemented by the company and plantation doctors regarding the drinking water consumed by plantation workers were stringent. Workers, whether employed in the fields or engaged in forest clearing, were provided with boiled drinking water to eliminate bacteria or pathogens responsible for infectious diseases. Furthermore, the drinking water was supplemented with tea to purify it (32). The tea used was sourced from China, with each kilogram capable of purifying between 200 to 300 liters of drinking water. The cost of each kilogram of tea was f. 1.70. Annually, the total expense for providing drinking water to plantation workers amounted to f. 8,728.60, which included logistics and transportation costs for delivering the water to the workers on the plantation (17). The provision of drinking water purified with tea has significantly reduced the incidence of waterborne infectious diseases. This initiative was spearheaded by plantation doctors and received full support from the Director of the *Senembah* Plantation Company, C.W. Janssen. The range of diseases whose spread has been effectively curtailed includes ankylostomiasis, dysentery, typhus, and cholera (17). These diseases had previously resulted in a high mortality rate at the *Senembah* Plantation Company during the late 19th century. In addition to providing clean water, the *Senembah* Plantation Company's policy also included the provision of nutritious food that was rich in protein to combat the threat of beriberi among plantation workers. Beriberi had become an epidemic by the late 19th century. Initially, this disease was considered mysterious and was attributed to the tropical climate of the plantations. However, plantation doctors identified the root cause of the beriberi outbreak as the diet of the plantation workers (32). The primary food provision for plantation workers consisted of polished rice imported from Siam (Thailand). In addition to this staple food, the workers were also supplied with dried fish. As a preventive measure against beriberi, Chinese workers were given additional food items such as pork, green peas, beans, and vegetables. However, beriberi continued to afflict Chinese workers consuming the imported rice from Siam. Upon investigation by plantation doctors, it was determined that the polished rice from Siam had significantly reduced levels of Vitamin B1, which is crucial for preventing beriberi. Subsequently, the doctors replaced the polished rice with semi-polished rice *(zilvervlies)*. This policy effectively curtailed the incidence of beriberi among plantation workers. The only case of beriberi reported was that of a Chinese foreman who refused to consume the semi-polished rice, perceiving it as inferior to the more refined white rice from Siam. The foreman

felt that his social status was diminished by consuming the semi-polished rice (33). In addition to food as a preventive measure against disease, plantation workers were also provided with meat during specific celebrations or events organized by the company, where beef was distributed among the workers. Typically, the foreman assigned specific teams to prepare this food (15). The cooking tasks were generally handled by shopkeepers, the foreman's wife, or cooks stationed in the plantation barracks. When the cooks were engaged in food preparation, their wages were typically charged to the plantation workers (9). The sanitation development of the plantations was carried out by the company in collaboration with the Regional Health Office and the Labor Inspectorate. Sanitation measures implemented included the construction of latrines that met high standards and quality. The cleanliness aspect in building permanent latrines involved the use of bricks and cement, along with the provision of adequate clean water. The latrines were constructed at a considerable distance from water sources to prevent contamination of the clean water supply. This initiative was not limited to the living quarters and barracks of plantation workers but also extended to the tobacco sorting warehouses. The high density in tobacco sorting warehouses necessitated an effective sanitation system to prevent the spread of diseases. This effort aimed to combat diseases such as cholera, dysentery, typhus, and ankylostomiasis (17). Sanitation and hygiene improvement efforts aimed at eradicating infectious diseases were also implemented in cities across East Sumatra (34). The advancement of medical technology and the government's shift in health approach from curative to preventive prompted stakeholders to focus on improving hygiene and sanitation within urban areas. This initiative coincided with the enforcement of ethical policies in the Dutch East Indies (34, 35). A sanitation and drainage system was also constructed at the Tanjung Morawa Central Hospital. Regular cleanliness maintenance involved disinfecting rooms, particularly in wards treating cholera, dysentery, and typhus. The hospital also established waste disposal channels and toilets employing a flushing system. Waste disposal pits were constructed to prevent contamination of the soil and the flow of the Bloemai River (17).

## Conclusion

In general, the maintenance of health among plantation workers at *Senembah* Plantation Company was driven by the roles of plantation doctors and company management. The health maintenance policies for plantation workers encompassed curative efforts, including the treatment of workers at healthcare facilities such as hospitals and plantation clinics. The involvement of plantation doctors in researching tropical diseases and establishing pathology laboratories to identify symptoms and the epidemiology of these diseases significantly accelerated the prevention of disease spread. All these actions were supported by healthcare personnel and other stakeholders who promoted healthy lifestyles and access to clean water. Preventive measures and the development of sanitation in the plantations were executed in collaboration with various parties, including the company, plantation doctors, local health authorities, labor inspectors, and the workers themselves. Ultimately, the maintenance efforts were further reinforced by the actions of doctors who instilled hygienic behaviors among plantation workers.

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