

# **PURE SCIENCE AND COLONIAL AGRICULTURE:**

## **The Case of the Private Java Sugar Experimental Stations (1885-1940)**

Wim J. Van der Schoor

Institute for the History of Science, University of Utrecht (Netherlands)

On a picture dating from the beginning of this century, the “hero” of this paper poses in Hellenistic style. Like many colonial buildings, the Experimental station for the Java Sugar Industry at Pasoeroean looked like a Greek temple. It was a temple indeed – a temple of science. Behind the classical facade was a large complex of laboratories and a large staff of scientists.

By the time of the picture it was not the only agricultural experiment station in the Dutch East Indies. It was, however, the oldest and largest and therefore I will take it as an example, a model, Dutch colonial agricultural experimental stations. In general, agricultural experimental stations formed an important foothold for science and scientists in the tropical colonies and this was particularly the case in the Dutch East Indies, the present Indonesia. By 1918, the archipelago was covered by a network of private experimental stations set up to study all main colonial export crops, a movement which had already started in the 1880s.

I will try to give an impression of those experimental stations, their place in colonial agriculture, and point out their scientific character. Our story begins around 1880 and ends about 1940. Briefly, I give some basic information on sugar cane cultivation on Java and on the sugar experiment stations: years, numbers and so on. Then I turn to the “ideology” behind their rise in the 1880s and their aims. Here we meet an important trend in Dutch biology, even Dutch science at the end of the 19th century, which contributed to a large extent to the specific nature of Dutch colonial experimental stations in general. Thirdly, I will portray this “ideology in action” by a few examples.

### **The Java Sugar Industry**

Following the abolition of the mid-nineteenth century Culture System from 1870 onwards, the sugar cane industry on Java, both cultivation and manufacturing, was gradually transformed into a private industry. Java sugar cane cultivation had its own characteristics. The cane was grown on wet ricefields owned by the indigenous popu-

lation. There existed a crop rotation system, alternating cane, rice and other food crops every three years; this system was strictly regulated by the government. Therefore, the ripe cane had to be harvested at once to make way for indigenous food crops. "Ratooning" (taking more than one, often 8 or even 20 harvests of one plant) like on Cuba or Hawaii was not possible on Java. After harvesting, the cane had to be processed as soon as possible because the sugar content decreases very fast. Planting, harvest and transport were very labour intensive, peaking for a few months annually.

In sum, sugar cane cultivation and industry occupied an important place in the social and economical life on colonial Java and had close links with the indigenous population, using (leasing) their ricefields, using water (the limiting factor on Java) for irrigation, and needing labour. Due to the strictly regulated crop rotation system, Java sugar industry had to be very intensive and was therefore very vulnerable in case of falling prices, crisis, pests and diseases.

### **The Sugar Experimental Stations**

The experimental stations were established when the 1883 sugar crisis (due to overproduction on the world market and the sharp competition with European beet sugar, among others) coincided with the so-called *sereh* disease of the cane on Java. Initially, 3 stations were established.

In 1885 several planters, supported by Semarang financial circles, took the initiative for the establishment of the Proefstation "Midden-Java" at Semarang. The German botanist F. Soltwedel was appointed director, assisted by two chemical assistants. In 1888 the budget stood at ca Dfl. 20.000 and the affiliated concerns numbered 33. Notwithstanding a successful start (Soltwedel succeeded in breeding cane out of seeds, which opened up new possibilities in cross-breeding) it was not to exist for long. Soltwedel died in 1889 and the experimental station was closed in 1893.

In 1886 24 sugar manufacturers established the Proefstation voor Suikerriet in West-Java at Kagok. The botanist W. Kruger (a German too) was appointed director, with one assistant. Until 1896 the annual budget stood at less than Dfl. 30.000, but afterwards the staff increased to 8 in 1906.

Finally, in 1887 the Proefstation "Oost-Java" was established at Pasoeroean. The Soerabaiasche Vereeniging van Suikerfabrikanten (Soerabaia sugar manufacturers society) took the initiative. The chemist J.G. Kramers was appointed director, at the outset with one botanical assistant. In 1903 the staff numbered 8. The budget increased from Dfl. 30.000 in 1887 to Dfl. 145.000 in 1906; the number of affiliated concerns from 33 to 73.

In 1903 a special committee was set up, consisting of members of the Boards of both surviving sugar experimental stations, to draw up the estimates and to tune the joint research programmes; in 1907 both experimental stations, East and West, merged into the "Proefstation voor de Java Suikerindustrie". In the following years, the budget increased steadily from Dfl. 260.000 in 1912 to Dfl. 1.400.000 in 1929. From 1927 onwards all sugar concerns on Java were affiliated with the station, of which in 1929 the scientific staff numbered more than 60. The experiment station then consisted of a Chemical, an Engineering and an Agricultural Department, from 1925 all situated at

Pasoeroean. Besides, a subdivision of the Agricultural Department at Cheribon acted in fact as an independent experiment station. The largest division was the Agricultural Department; its staff numbered 33 in 1929. It consisted of a research group at Pasoeroean and a decentralized extension service.

It appears that the experimental stations were formally not established by individual planters, but by specially established experimental station associations backed by planters, large commercial enterprises and banks. At the head of an experimental station was a Management Board, elected by the members. The Board consisted of prominent planters and (a growing number of) agents of large concerns and banks. In charge of the scientific management was a director, appointed by the Board, who was responsible to the Board. Each year, the director and the Board drafted a budget and a workplan, which indicated the research subjects. In the 1910s, more and more concerns (often owning several estates) also enlisted private cultural advisors and a Delegation of Experts was formed to participate in the negotiations on the workplan.

Statutory, individual planters had no direct influence on research, the Board and the workplans acting as a buffer. Access to the experimental station buildings was also formally confined to office hours assigned by the director. Members of the station had the right of submitting written requests for advice; the workplans were usually discussed in the annual meetings. For members and non-members, the station carried out at a charge analyses of cane and soil samples.

The sugar experimental stations were financed by members' subscription fees, without state subsidy. The affiliated estates paid a certain sum per area under cane; in the early years, a significant addition to subscription fees came from the stations' experimental garden yields.

Initially, the experimenters published their results in their own series of *Mededeelingen* (Communications) for members and anyone interested. However, already in 1893 a central journal was established, the independent *Archief voor de Java-suikerindustrie* by joint efforts of planters and scientists at the stations. Herein the *Mededeelingen* of the several experimental stations were published (which were also published separately for members) and also e.g. translations from foreign journals, reviews, statistics and discussion papers. A few years later, many of the *Mededeelingen* were translated into English, German and/or French because, it was argued, "on every field of science, investigations interlock, and therefore isolation leads inevitably to sterility." (1) This liberal publication policy lasted until the 1930s.

Why not establish one experimental station immediately in the 1880s? The main factor was, that the planters associations were divided. As sugar cane cultivation was widespread on Java, they tended to stress local differences in cultivation. Therefore, and also because of the perceived need of visiting estates and keeping in close contact with practice by the experimental station scientists, the planters wanted their own stations and scientist-experts as near as possible.

However, why didn't the planters cooperate with the government botanic garden at Buitenzorg? Besides all the reasons already mentioned, the director of the government botanic garden, Melchior Treub (1851-1910), made it a condition that the scientific work should be supervised by him (as a scientist) and that the planters should have

absolutely no influence. He felt, that "if in the pursuit of scientific study one consults the requirements of practice, in the end this will appear to be harmful to both science and practice" (2) and one would never yield any results of enduring practical use.

### **Pure Science for Practice**

Although the sugar cane experimental stations were private and independent from the start and continued to be, ideas like Treub's had a strong hold and left an important mark on the sugar station. What was this ideology?

There is an important trend in Dutch biology, in Dutch science indeed, at the end of the 19th and in the early 20th century (3). It was led by men like Treub and in particular by the biologist Hugo de Vries (1848-1935), who introduced experimental botany in the Netherlands. According to him (3), the only basis for progress in agriculture, but also social progress, was science - pure science. Note that De Vries, Treub, etc. were representatives of the experimental "new botany". In their view, all progress came quite literally from the laboratory.

Progress by pure science was attained in two ways: in the first place, by distributing "useful knowledge" as a civilizing force; secondly, by its applications. Notably, science was considered as a civilizing agent for the colonial planters in the sense of "Bildung"; the indigenous population was rather out of sight in this respect.

With regard to applications, De Vries conceived applications as following very directly, even automatically, from pure science. There was hardly any intermediary between science and practice. As someone put it, "Practice is applied science." Note that in the 1880s we are only at the beginnings of the debate on so-called "pure" or "applied" science in the Netherlands and their colonies.

This "pure science for practice ideology" seems to be rather typical for Dutch scientists educated at the classical Dutch universities in this period. Notably, university biologists were very influential in Dutch colonial agriculture, at least till 1910, and in contrast with agriculture in the Netherlands. I have mentioned Treub already.

Most important was the botanist F.A.F.C. Went (1863-1935), a pupil of De Vries who, after finishing his dissertation, worked for some time with Treub at Buitenzorg and in 1891 was appointed director of the West Java sugar experimental station. Afterwards he was appointed professor of botany at the University of Utrecht. "He reared his students with the Indies," a contemporary remarked. Many of them worked at least part of their careers in the colonies, at colonial experiment stations or elsewhere.

One of these students was Victor J. Koningsberger (1895-1966). After some years at the Utrecht Botanic Laboratory in the early 1920s, he was appointed director of the Java sugar experiment station in the late 1920s and early 1930s. In 1934, he succeeded Went in Utrecht.

One can detect their "high science" ideology for example in the aims of the experiment stations:

"The aim of the Experimental Station is to search, on a pure scientific foundation, for means of improvement of the sugar cane and combating its diseases, - and furthermore, in general, to pursue a sound, scientific basis for the sugar industry..." (5)

As an experimental station director, Went outlined his views to the planters in 1892:

*"I would like to wipe out immediately any impression, that science is cultivated because of its practical value; on the contrary, true science is ideal and this practical use is not its line. I even dare to say that research only aiming at practical use will never yield much result... If the experimental stations have to yield any results, the investigations has to be carried out on a pure scientific foundation; practical results will follow automatically, although sometimes these must be found by men of practice."* (6)

Finally, in 1927 Koningsberger characterized the task of the Agricultural Department of the station as follows:

*"In the first place, [the Agricultural Department] is concerned with pure scientific research in the field of description, hybridization, improvement and cytology, with the physiology, phytopathology and entomology of the sugar cane and with soil research, while extension officers cooperate with large-scale experiments on the estates."*

He remarked that some of this research was directly connected with practical work, while the extension service was purely practical (7).

As I mentioned before, its role as a civilizing agent concerned the planters. One example is Went's 1892 lecture course for sugar cane planters, almost completely devoted to subjects of a pure scientific nature. Typically, only the last lecture dealt with practical applications, Went arguing that the planters "of course could make these applications themselves".

On the other hand, there existed a competing ideology on the relationship between science and practice. If we call the former a "high science" ideology, we can call this a "low science" approach. (It should be stressed, however, that this had nothing to do with later concepts of "appropriate technology" and so on.)

Although this "low science" ideology was also advocated by some university biologists, it was mainly linked with the Agricultural College at Wageningen. The Agricultural College was established in the 1870s as a local school. From circa 1900 onwards it began to develop university-level ambitions. University biologists (especially Went) didn't like that, but in 1918 Wageningen formally reached the university level. Of course, Wageningen-educated agricultural engineers or agronomists competed with university-trained biologists for jobs at the colonial experimental stations.

Theirs was a more pragmatic engineering approach – they were not so keen on universal or at least tropical "laws" etc. At the Sugar experimental station, this point of view was defended in particular by Philip van Harreveld (a university-trained biologist), director from 1912 to 1926. He preferred a "low science" problem oriented approach:

*"our problems in cultivation cannot be posed nor wholly solved in the laboratory."* (8)

*"With practical problems, the one-sided laboratory man almost immediately wanders away from the point and does not make progress; however, we are obliged to make progress and produce results at short notice."* (9)

Van Harreveld stressed distribution of knowledge, rather than research. In his concept the extension officer or advisor was central, and to this end he appointed many agricultural engineers. His most striking contribution was the organization of the Agricultural Department into a central research group at Pasoeroean and a decentralized Extension Service ("Buitendienst"). During Van Harreveld's directorship also research expanded because the whole experiment station expanded. Notably, in the end he was dismissed, and Koningsberger appointed in 1926 "to make the experimental station more scientific."

### **A Scientific Agricultural Station**

Concerning the main activities of agricultural experimental stations in general, one can distinguish between research, advising and testing. Compared to European experimental ("testing") stations, the Java experimental station had a rather strong emphasis on research. Routine testing of soil samples, artificial fertilizers etc. was not considered a primary task of an experimental station; invoking science, the planters felt, should result in "real" innovations. Remember the phrase "improvement of the cane": this was considered to be a scientific task. Moreover, as Went remarked more in general, since Darwin scientists knew that research on e.g. agricultural crops may also yield valuable results for science.

If possible, rather fundamental research was carried out. This was legitimized by assuming that tropical biology had a special, different character, while European agricultural knowledge and methods were useless in the Indies. It was also argued that knowledge of diseases required first and foremost fundamental scientific knowledge of the healthy, "normal" cane.

Simple practical problems could trigger investigations of a fundamental nature, which was assumed necessary for durable progress. For example, when some members questioned the use of cutting off young leaves, the scientist concluded: "As a matter of course, this necessitated more general research concerning the nature of evaporation by the leaves of the cane." (10)

Moreover, as Koningsberger argued, in the course of time it became clear that the government botanic gardens did not provide the "basic knowledge" needed by the experiment stations, so they had to find out themselves (11).

On the other hand, the experimental station had a task in legitimizing Western, colonial agriculture. The sugar industry was a private enterprise. The audience of these researches was the government, which (according to the planters' associations) "hindered" sugar industry by laws and regulations.

Scientists were supposed to subscribe to the staunch capitalist viewpoint that business interests were wholly parallel with the interests of the Dutch East Indies, the indigenous population, their wellbeing, and their economic and social development. Most staff members agreed. Or at least they adapted themselves easily to the viewpoint of the planters. More specifically, the planters were not amused by political activism in connection with the indigenous population. In that way one could lose the confidence of the "administrators" and seriously risk one's job.

A clear example of “legitimizing colonial agriculture” is the research on the mutual influence of sugar cane cultivation and indigenous agriculture (mainly rice). On the one hand, the planters had an interest in agronomical arguments to lay rigid regulations on land leasing and crop rotation on the table. On the other hand, the influence of sugar cane cultivation on irrigation and rice yields was questioned.

For example, did or did not artificial manure used for sugar cane cause “deterioration of the soil”? The experimental station undertook the task “to challenge, by special experiments, reappearing misunderstandings that discredit sugar cane cultivation in connection with indigenous agriculture.” (12) Most experimental station publications stressed that sugar cane cultivation caused no harm (or at least would not, if several conditions were observed) to indigenous agriculture; on the contrary, even some beneficial effects were detected.

More generally, the experimental station as a symbol of modern science and progress was a showpiece of the Java sugar industry. The annual reports proudly reported important foreign visitors, looking at “how to manage a colony” at Pasoeroean.

### **An Empire for Science**

To “prove” as it were the endurance of the “high science” ideology (and thus the scientific character of the station) history carried out a nice experiment. I mean the 1929 crisis, which hit the sugar industry badly and caused serious cutbacks at the experimental station. Budgets decreased from Dfl 1.400.000 in 1928 to a paltry Dfl 400.000 in 1935. But where were the blows struck? Several times it was suggested to change the direction of the experimental station away from pure research in the direction of more “applied science” and extension. However, while the extension service was hit badly, the research group at Pasoeroean was relatively spared. Evidently, planters felt the need for continuity in research for the Java sugar industry.

The case of the sugar experimental station makes it clear, in my opinion, that historical concepts of “colonial science” (or “science in the colonies”) and so on cannot take distinctions like pure/applied as unproblematic, ahistorical starting points. In fact, the colonial experimental stations played an important role in the debate among Dutch scientists on the relation between science and practice.<sup>13</sup> Dutch academic biologists could point to colonial experimental stations as examples of the usefulness of their discipline for practice. The perceived needs of the experiment stations triggered several discussions among biologists on e.g. biology education at the Dutch universities.

Also, the characterization of science in the Dutch South East Asian empire as merely “supplementary” (14) doesn’t hold out for this period.

In many respects the sugar cane experimental stations gave a model for some 10 or 15 private experimental stations that mushroomed in the Dutch East Indies from the 1890s till 1918. These private scientific institutions contributed to the peculiar technocratic, even scientific character of Dutch colonialism in the Dutch East Indies, while at the same time serving as an empire of Dutch academic science.

## NOTES

The author is preparing a dissertation on pure and applied science in the tropics: biological research at private experiment stations in the Dutch East Indies, 1870-1940. This research was supported by the Foundation for Historical Research (SHW), which is subsidized by the Netherlands Organization for Scientific Research (NWO).

- 1) *Verslag van het Proefstation voor Suikerriet in West-Java te Kagok-Tegal 1896.*
- 2) M. Treub, *Onderzoekingen over de natuur der lichenen. Academisch proefschrift* (Leiden, 1873) 88.
- 3) B. Theunissen & F. van Lunteren (red.), *Zuivere wetenschap en praktisch nut: visies op de maatschappelijke betekenis van wetenschappelijk onderzoek rond 1900* (Rotterdam, 1994; special issue of *Gewina* 17 (1994) 3).
- 4) B. Theunissen, "Knowledge is power: Hugo de Vries on science, heredity and social progress", *British Journal for the History of Science* 27 (1994) 291-311.
- 5) "Statuten van het Proefstation voor Suikerriet in Oost-Java", *Mededeelingen van het Proefstation Oost-Java* No.1 (1887) Artikel 4.
- 6) F.A.F.C. Went, *Variabiliteit en erfelijkheid* [1892], manuscript in Museum Boerhaave, Leiden.
- 7) V.J. Koningsberger, "Europese suikerrietcultuur en suikerfabricatie" in C.J.J. van Hall & C. van de Koppel, *De landbouw in de Indische archipel* IIa ('s-Gravenhage, 1948) 278-404, 321-322.
- 8) Ph. van Harreveld to J.W. Moll 30/11/1914, Archief Moll, Universiteitsbibliotheek Groningen.
- 9) Ph. van Harreveld to J.W. Moll 9/12/1913.
- 10) *Verslag van het Proefstation voor Suikerriet in West-Java te Kagok-Tegal 1894.*
- 11) V.J. Koningsberger, "Het werk van Melchior Treub na 25 jaren", *Koloniale Studiën* (1934) 249-258, 257. Koningsberger criticized the institutional splitting up of pure and applied science at the botanic gardens since Treub's retirement in 1909.
- 12) See e.g. *Jaarverslag van het Proefstation Oost Java 1906.*
- 13) W.J. van der Schoor, "Biologie en landbouw: F.A.F.C. Went en de Indische proefstations", in B. Theunissen & F. van Lunteren (red.), *Zuivere wetenschap en praktisch nut: visies op de maatschappelijke betekenis van wetenschappelijk onderzoek rond 1900* (special issue *Gewina* 17 (1994) 3) 9-25.
- 14) K. van Berkel, *In het voetspoor van Stevin: geschiedenis van de natuurwetenschap in Nederland 1580-1940* (Amsterdam, 1985) 208.



**LES SCIENCES HORS D'OCCIDENT  
AU XX<sup>E</sup> SIÈCLE**

**SÉRIE SOUS LA DIRECTION  
DE ROLAND WAAST**



**VOLUME 3**

**NATURE  
ET  
ENVIRONNEMENT**

**YVON CHATELIN  
ET CHRISTOPHE BONNEUIL**  
ÉDITEURS SCIENTIFIQUES

**CRISTOM**  
éditions

**LES SCIENCES HORS D'OCCIDENT  
AU XX<sup>e</sup> SIÈCLE**

20<sup>TH</sup> CENTURY SCIENCES:  
BEYOND THE METROPOLIS

**SÉRIE SOUS LA DIRECTION  
DE ROLAND WAAST**

**VOLUME 3**

**NATURE  
ET  
ENVIRONNEMENT**

NATURE AND ENVIRONMENT

**YVON CHATELIN  
ET CHRISTOPHE BONNEUIL  
ÉDITEURS SCIENTIFIQUES**

---

**ORSTOM Éditions**

L'INSTITUT FRANÇAIS DE RECHERCHE SCIENTIFIQUE POUR LE DÉVELOPPEMENT EN COOPÉRATION  
PARIS 1995