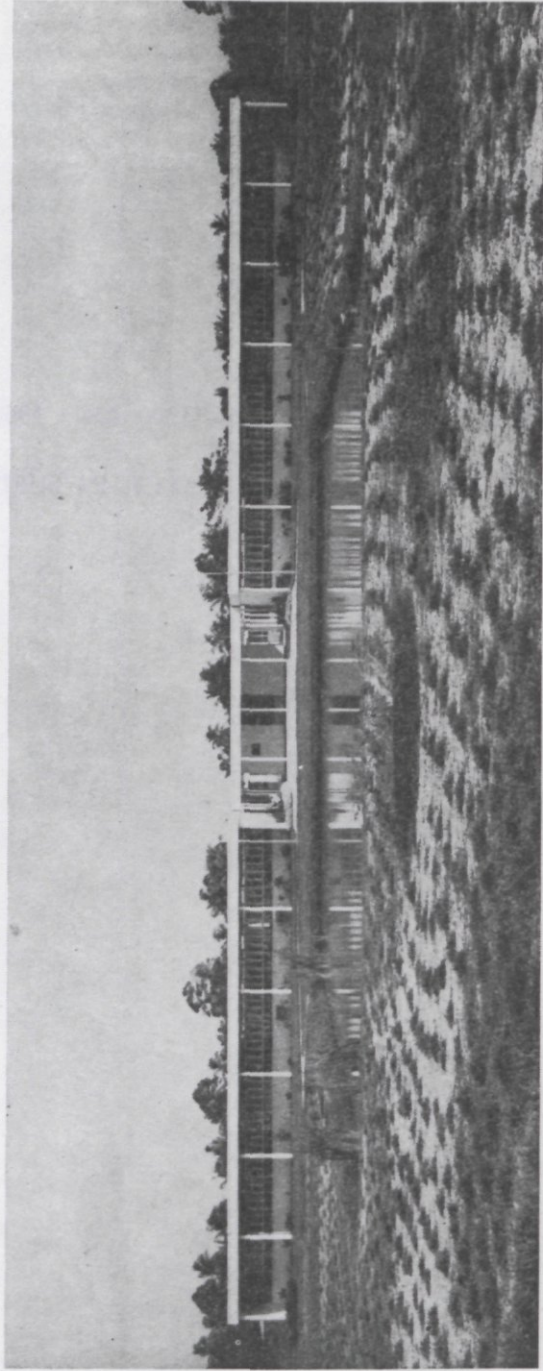


# CELOS bulletins

no. 5

REPORT FOR THE YEARS 1965, 1966 AND 1967  
of the  
CENTRE FOR AGRICULTURAL RESEARCH IN SURINAM



*Main building of the Centre for Agricultural Research in Surinam (front view)*

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## SCIENTIFIC STAFF

### Permanent staff

*Director* DR IR J. RUINARD (since 1 September 1965)

### Visiting staff members

*Animal Science* IR G. MONTSMA, Dept of Animal Husbandry, Agric. Univ. Wageningen (8 August — 30 October 1967)

*Forestry* DR IR J. H. A. BOERBOOM, Dept of Forest Management, Forest Mensuration, and Silviculture and Forest Protection in the Tropics, Agric. Univ. Wageningen (since 20 July 1966)

*Plant Protection* DRS K. W. R. ZWART, Dept of Entomology, Agric. Univ. Wageningen (since 27 September 1967)

*Rural Economics* DR IR H. A. LUNING, Dept of Agricultural Economics of the Tropics and Subtropics, Agric. Univ. Wageningen (31 December 1964 — 13 January 1967)

IR J. T. SITAL, Dept of Agricultural Economics of the Tropics and Subtropics, Agric. Univ. Wageningen (since 28 September 1966)

*Sociology* DRS G. KALSHOVEN, Dept of Rural Sociology and Sociography of the Tropics and Subtropics, Agric. Univ. Wageningen (since 14 January 1967)

## 1. DIRECTOR'S REPORT

### 1.1. INTRODUCTION

The Dutch Agricultural University at Wageningen has long been actively concerned with teaching tropical agriculture and forestry. Until recently, however, the University's educational programme was not supported by a branch of its own in the tropics. The completion of the first buildings of the Centre for Agricultural Research in Surinam (CELOS), officially opened on 21 March 1967, has changed this.

In the years before 1940 most of the graduates who had taken tropical courses were employed in Indonesia at modern estates and research stations or by the government's well organized management and extension services. In such surroundings more experienced staff could transform them from agriculture and forestry theorists with a general overall knowledge into research or advisory officers or plantation managers. Thus at that time there was little or no need to subject the students to a thorough practical and research training. As a consequence the University's syllabuses emphasized theoretical matters.

After 1945 fewer and fewer graduates went to Indonesia. But in many other tropical countries there was a growing need for men educated at Wageningen or similar schools of tropical agriculture and forestry. Hence the interest of students for opportunities in the tropics continued to be great. This is illustrated by table 1, giving the specializations taught at the University and the student numbers and percentages for each discipline on 31 December 1967. Not included in the list are students who had not yet passed the first examination. Thus 14% of all students had opted for straightforward tropical specializations and 55% for bilateral disciplines offering a choice between courses related to the temperate zone and courses concerned with the tropics. Many students attend the tropical courses of some of these bilateral disciplines (e.g. forestry, soil science); less students follow others (e.g. dairying, horticulture). Altogether about 25% of the students who graduated during the past years intended to apply for posts in tropical regions. The table shows that this figure in future years is not likely to be smaller.

Before 1940 students needed only a theoretical basis. But now already in their first job the graduates often have to stand on their own feet so that they must first obtain practical experience in their subject. The University therefore sends the students attending tropical courses during the final phase of their study for periods of at least half a year to the tropics. Thus they can become acquainted with their future environment and do relevant practical and research work.

As a result of the expanding annual intake of students (thirty years ago less than 100, now 500), the increasing depth of specialization during the study (formerly 5 choices of discipline were offered, now 22), and the growing necessity for the University to be actively engaged in research, also the number of departments involved in teaching tropical agriculture and forestry and the number of their academic staff are now considerably larger than in the past. Before 1940 the head of a department

Table 1 - Numbers of students in the academic year 1967-68 attending courses in 22 disciplines

Discipline	Students in 1967-68 (as per 31 December 1967)	
	Number	Percentage of grand total
<b>Tropical disciplines :</b>		
Agronomy and crops of the tropics	29	1.9
Tropical animal science	8	0.5
Rural economy of the tropics	41	2.7
Land drainage and improvement of the tropics	93	6.2
Rural sociology of the tropics	40	2.7
total	211	14.0
<b>Bilateral disciplines :</b>		
Dairying	28	1.8
Horticulture	90	6.0
Forestry, silviculture	62	4.1
Forestry, technology and economy	43	2.8
Landscape architecture	102	6.7
Plant breeding	84	5.6
Plant protection	74	4.9
Soil science	107	7.1
Agricultural engineering	63	4.2
Food science	138	9.1
Rural home economics, technology	41	2.7
Rural home economics, sociology and economy	7	0.5
total	839	55.5
<b>Non-tropical disciplines :</b>		
Agronomy and crops	42	2.8
Animal science	88	5.8
Rural economy	108	7.1
Land drainage and improvement	172	11.4
Rural sociology	51	3.4
total	461	30.5
grand total	1511	100.0

was usually assisted by only one scientist. Now the average number of teaching and research staff in the departments concerned is eight. Of course, these departments must do at least part of their research in a tropical area. It is also important that scientific staff go out occasionally to the tropics so as not to lose touch.

These considerations made the university decide to establish a branch in a tropical country, where its staff would find research facilities and the students could become

conversant with their future sphere of work. The governments of Surinam and the Netherlands concluded an agreement on 7 April 1965 that Surinam would be host country to this tropical branch of the Agricultural University and that it would be named Centre of Agricultural Research in Surinam (CELOS).

## 1.2. ORGANIZATION AND AIMS OF THE CENTRE

CELOS should be regarded as an interdepartmental institute, directly responsible to the Governing Board of the University. All University departments concerned with tropical affairs contribute to it by making available academic staff and students, whose working-programmes are drafted in consultation between the Centre and these departments.

The Centre has in the first instance ten scientific departments: agricultural engineering, agronomy and crops, animal science, forestry, land drainage and improvement, plant breeding, plant protection, rural economy, sociology, and soil science.

Initially each of these departments is scheduled to have an academic staff of one or two scientists. They are seconded to the Centre and usually spend two years in Surinam before being replaced by colleagues. Consequently all members of the University's research and teaching staff with a tropical specialization, who are fit for work overseas, get an opportunity to be temporarily attached to the Centre. It also means that the staff of CELOS changes frequently.

The students come to Surinam after they have passed their last examination but one. At that stage they are well capable of actively participating in research, management or extension work. Most students are engaged on research under the direction of the academic staff. Others are allowed, if they wish, to take part in management and extension activities with government services or private enterprises. All of them are required to work in this country for a period of at least six months, that will be extended to nine months or even a year if the students will benefit thereby. The Centre will probably also organize lecture courses in certain subjects so that they may further profit from their stay in the tropics. According to recent estimates at least fifty students per year will be soon sent to CELOS.

In the selection of research topics the Centre concentrates on fundamental research which in the tropics does not yet receive the amount of attention it deserves. Most experimental stations are compelled by circumstances to allocate all available man-power and resources to applied work. The final choice of the topics that will be included in the research programmes depends among other things on the kind of research in progress at the departments of the University at Wageningen, the main interest of the scientists concerned, the possibility of useful participation by students, the long-term importance for the tropics in general and this part of the world in particular, and physical possibilities in Surinam. The Centre tries to co-ordinate the many disciplines and diversity of interests among the academic staff, to achieve a continuous approach to important problems, rather than a short-lived, haphazard pursuit of frequently varying topics.

CELOS intends to keep close contacts with universities and research institutes in other tropical countries, particularly in Central and South America; concerted action will benefit both sides. The Centre also should be able to participate in the technical aid programme of the Dutch Government.

### 1.3. ACTIVITIES

#### 1.3.1. Scientific staff

Dr Ir H. A. Luning, agricultural economist, arrived in Surinam on the last day of 1964, before CELOS was actually established. He worked in this country for just over two years and returned to Wageningen on 13 January 1967. Dr Ir J. Ruinard was appointed director of the Centre from 1 September 1965. Dr Ir J. H. A. Boerboom, silviculturist, joined CELOS on 20 July 1966, Ir J. T. Sital, agricultural economist, on 28 September 1966, Drs G. Kalshoven, sociologist, on 14 January 1967, and Drs K. W. R. Zwart, entomologist, on 27 September 1967. From 8 August to 30 October 1967 Ir G. Montsma, animal scientist, was employed at the Centre.

#### 1.3.2. Students

In 1965 four students of the Agricultural University were attached to CELOS, in 1966 eight and in 1967 twelve. For many other students opportunities for practical work were found with government services and private enterprises.

#### 1.3.3. Land and buildings

In 1966 the Surinam government gave CELOS a favourably situated plot of 17 hectares in the outskirts of Paramaribo on long lease. Part of this land is used as a building site; the rest is being planted with crops, fodders, trees and ornamentals for demonstration, collection and trials.

The main building will eventually consist of two units. Both are composed of four wings, containing offices and laboratories, grouped around a central building which houses common facilities. Between the two units a lecture room has been planned. Construction of the first unit, a shed, a garage, a road, a bridge and a parking area started in July 1966, and was completed less than a year later. A house was then built on the premises. In October 1967 the construction of two wings of the main building's second unit began.

The Centre was officially opened on 21 March 1967 by Ir A. P. Minderhoud, president of the Governing Board of the Agricultural University.

#### 1.3.4. Research

It is neither possible nor useful to discuss in this report all research carried out by staff members and students during the past three years. Only the most important topics will be noted, very briefly in the current paragraph and more comprehensively in the following chapters.

In the field of animal science the milk yields of the dairy herd of the Surinam Government Livestock Farm were studied over a period of four successive years. Maximum daily production varied widely within the herd. The milk yields declined steeply a few weeks after calving. Severe culling and an increase of the percentage Friesian blood in this herd should substantially improve the average milk production.

Emphasis in forestry research is on two long-term projects, viz. succession and regeneration studies in the lowland rain forest of Surinam. The former include periodic recordings of the vegetation in permanent plots situated in deforested areas, on land abandoned after shifting cultivation, in exploited forest and in virgin forest. The regeneration studies are seeking technically and economically sound methods of natural



regeneration to convert exploited areas to forest in which valuable species play a more prominent role than before exploitation.

Rural economics research was focused on farm management problems in peasant agriculture. Until the end of 1966 rice farms of 2-3 ha were studied, the main topic being labour productivity on these smallholdings. Then a comparative investigation was set up to appraise the effect of farm size upon the economics of rice growing. The work is concentrated on three farm size classes with net rice acreages of 1-2, 4-6 and 8-20 ha respectively.

Actual progress on smallholdings lags far behind contemporary advances in agricultural methods. Therefore the sociology department examines the various factors influencing the results of extension work among small rice farmers on farms of the same size as in the comparative farm management study. A preliminary analysis of the data collected hitherto suggests that contacts between extension workers and small farmers are generally scarce and superficial.

### 1.3.5. Contacts

From 6 to 11 November 1966 the director visited the Faculty of Agriculture of the University of the West Indies. He was again in Trinidad from 2 to 8 April 1967 to attend the First International Symposium on Tropical Root Crops. Dr Boerboom was abroad from 10 May to 6 June 1967 visiting forestry institutes and projects in Costa Rica, Nicaragua and Guatemala.

From 19 to 26 June 1967 CELOS was host to a group of 19 students of the Faculty of Agriculture of the University of the West Indies, who in the company of some of their lecturers came to Surinam to get acquainted with the country's agriculture.

### 1.3.6. Publications and reports

In 1966 the Centre began publishing a series of scientific papers called *CELOS Bulletins* containing original papers as well as reprints of articles written by the Centre's staff for journals and other periodicals. The annual reports will also be included in this series.

In 1966 and 1967 the following bulletins were published:

1. LUNING, H. A., 1966. Farm size, employment and agricultural planning (Dutch; English summary).
2. LUNING, H. A., 1966. Some notes on the place of agriculture in the economic development of Surinam (Dutch; English summary).
3. SCHULZ, J. P., 1967. The natural regeneration of the mesophytic forest of Surinam after exploitation (Spanish; English and French summaries).
4. RUINARD, J., 1967. The Centre for Agricultural Research in Surinam (Dutch; English summary).

For the benefit of those who are closely concerned with the Centre mimeographed quarterly reports have been issued in Dutch since 1967. They contain general information and detailed accounts of current research.

All students attached to CELOS must write a full report in Dutch of their work before returning to the Netherlands. After approval by the Centre's scientific staff these reports are mimeographed for limited distribution as "CELOS Reports". In 1967 four were issued, two of them on home economics extension in several rural districts of Surinam, one on the economics of some middle-sized rice farms in west Surinam, and one on various forestry problems.

#### 1.4. ACKNOWLEDGEMENTS

We are greatly indebted to Mr. J. C. Rigg of PUDOC (Wageningen, the Netherlands) for correcting the English text of this report, and to Dr José H. da Costa Ferreira and Mr. J. O. Luurs for translating the summary into Portuguese and Spanish respectively.

## 2. ANIMAL SCIENCE

### 2.1. THE LACTATION CURVE OF THE DAIRY HERD AT THE GOVERNMENT LIVESTOCK FARM IN SURINAM (Vlt/67/1)

Milk yield of cows in the humid tropics is in general comparatively low. Reasons for this include high ambient temperature and relative humidity, inadequate feedstuffs and feeding, low genetic capacity, low fertility and poor level of management.

Shape and level of the lactation curve may supply useful information about the principal causes of this low yield, in particular whether the yield is limited by environmental or genetic bounds. A very steep slope of the curve may be indicative of a less favourable environment, for instance, whereas a shallow curve may be caused by a low genetic capacity for milk production.<sup>1)</sup>

Available were daily milk yields of 172 lactations from 90 cows from November 1962 to December 1966. Lactation lasted at least eight months.

The herd is genetically heterogeneous. The following breeds have been used in the history of the farm: Dutch Friesian, Criollo (as basic breed), Holstein, Dutch Red Pied, Santa Gertrudis (!) and Red Sindhi. They are up to seven-eighth Friesian but most cows are half or three-quarter Friesian.

Cows were milked at 5 a.m. and 2 p.m. Data considered were: milk yield, shape and level of lactation curve, variation in milk yield and persistency, blood composition of the cows and calving interval.

Numerical data and graphs will be published elsewhere.<sup>2)</sup> Because of the small number of records the results can only be indicative.

The milk yield declined steeply and continuously, both for high and low yielders. One of the reasons for this may well be that only a small proportion of the milk yield is obtained from grass, the high yielders thus receiving more concentrates in their total ration.

This rapid decrease in milk yield a few weeks after calving is most likely to be caused by environment. After the fourth month of lactation the decline becomes less rapid and may be due to conception and to Criollo and Zebu ancestry.

The most striking result is the large variability in maximum daily yield and in calving interval (3.6-15.1 kg and 316-777 days respectively), whereas the variation in persistency is rather less both for high and low yielders, i.e. high initial yield means high final yield.

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<sup>1)</sup> MAHADEVAN, P., 1966. Breeding for milk production in tropical cattle. *Tech. Commun. Commonw. Bur. Anim. Breed. Genet.*, 17.

<sup>2)</sup> MONTSMA, G., 1968. The milk yield curve of the dairy herd at the Government Livestock Farm in Surinam. *Surin. Landb.*, 16: 17-26. Also as *CELOS Bulletins*, 6.

Severe culling should substantially improve the average level of production of milk and offspring. As the milking herd is small, part of the farm's total milk yield would have to be sacrificed but the economics of milk production would improve considerably.

Because of the general similarity in shape of the lactation curves and also because the yields of three-quarter and seven-eighth Friesian were a bit higher than that of half Friesian it appears worthwhile to try a higher percentage of Friesian blood in this herd.

The steep slope of almost all the curves indicates the great need for further research on environmental conditions, particularly on nutrition and management practices. Dry matter and energy value of forages must first be examined and then the protein supply must be checked.

### 3. FORESTRY

Ever since this department began in 1965, it has closely co-operated with the Government Forest Service. The present research programme covers twelve subjects which can be grouped under four headings.

#### 3.1. SUCCESSION STUDIES IN TROPICAL LOWLAND RAIN FOREST

Succession may be studied either by direct or indirect methods. Direct studies mean the periodic recording of the vegetation in permanent plots for a certain length of time. Thus changes in botanical composition and structure can be followed closely, giving a detailed picture of succession in the plots studied.

If succession is studied indirectly the vegetation in a number of plots is recorded only once. On account of botanical composition, age class representation, vitality and fertility of the species, historical and other data, the mutual relationship between various vegetations is fixed and general lines of succession may be drafted. The indirect approach has the advantage of leading to results more quickly than the direct method. But interpretation of the data is much more difficult, details may escape observation, and conclusions are often tentative.

Succession studies are rather scarce in the tropics, especially in the Western hemisphere, and are mostly indirect. Permanent plots have rarely been checked for more than 5 or 10 years.

In 1967 CELOS started succession studies of the lowland rain forest of Surinam. Permanent plots were laid down in various vegetations originating from virgin forest after some form of human interference. In these plots the vegetation is being described and trees are being measured periodically. Any further disturbance must be avoided. Observations will continue over many years. Additional data on the succession of these and similar vegetations will be gathered indirectly.

In this way the succession is followed on deforested areas (Bsk/67/1), in exploited forest (Bsk/67/2), in exploited and subsequently refined forest (Bsk/65/3), and on land abandoned after shifting agriculture (Bsk/67/3). Complementary studies are in virgin forest (Bsk/67/4).

#### 3.2. NATURAL REGENERATION OF TROPICAL LOWLAND RAIN FOREST

Exploitation of the mesophytic forest of Surinam is selective. Though at present some 30 species are considered valuable, the total cut does not normally exceed 20 cu. metres per ha, i.e. 10% of the standing volume.

Since 1957 the Forest Service has been studying the silvicultural treatment of worked-out areas. Conversion by natural regeneration to a forest in which valuable species play a considerably greater part than in the original forest proved to be technically possible. The system developed has three characteristics:

- 1) As a rule, advance growth of the principal desirable species is present in the forest under consideration, the distribution over size classes being reasonably normal (positive stand table).
- 2) The growth of seedlings, saplings and poles in the closed forest is very slow, but is greatly stimulated by canopy opening.
- 3) Maintenance of a fair growth rate can only be achieved by subsequent liberations (sensu DAWKINS<sup>3</sup>), i.e. the release of individuals by the elimination of competing plant growth.

Accordingly the two main operations in regenerating are:

- 1) General refining (sensu DAWKINS<sup>3</sup>), i.e. poisoning of all weed trees over a certain diameter.
- 2) Continued tending of desired trees.

At this moment the area under natural regeneration is about 400 ha. A detailed account of the methods and the preliminary results is given in two recent publications<sup>4</sup>).

Repeated tendings weigh heavily on the total costs of the treatment. Therefore present research is directed principally at simplifying tending operations.

Additional knowledge about the growth rate and mortality of advance growth in different size classes and under different conditions is being obtained from an experiment started in 1965 (Bsk/65/3). In two blocks with poisoning limits of 10 and 20 cm dbh (diameter breast height) respectively, various systems will be used for tending. The following scheme has been adopted tentatively:

Treatment	Years after refinement before liberation											
	3	3½	4	4½	5	6	7	8	9	10	11	12
1	+	+	+	+	+	+	+	+		+		+
2	+		+			+		+				+
3			+			+		+				+
4						+		+				+
5								+				+
6												

Treatment 1 almost corresponds to present practice. Treatments 2, 3, 4 and 5 represent different stages of simplification. Treatment 6 is the control.

<sup>3</sup>) DAWKINS, H. C., 1958. The management of natural tropical high forest with special reference to Uganda. *Inst. Pap. Commonw. For. Inst.*, 34.

<sup>4</sup>) BOERBOOM, J. H. A., 1965. The natural regeneration of the mesophytic forest of Surinam after exploitation; Parts I and II. Agric. Univ., Wageningen, the Netherlands (Dutch; English and Spanish summaries).

SCHULZ, J. P., 1967. The natural regeneration of the mesophytic forest of Surinam after exploitation. *Boln Inst. for. lat.-am. Invest. Capacit.*, 23: 3-27 (Spanish; English and French summaries). Also as *CELOS Bulletins*, 3.

In the central part of each of 96 plots all individuals of the valuable species have been labelled. They are measured yearly.

At the end of 1967, i.e. two and a half years after refinement, nearly all poisoned trees had died. The two blocks showed an interesting difference in appearance. Where weed trees of 10 cm dbh and over had been killed a dense understorey had developed, in which secondary tree species and lianas play a leading role. In the block submitted to the less rigorous treatment the understorey definitely reacted but was less clearly marked off and more open in character. Components of the original forest still prevailed. The conditions resulting from the latter treatment seem more favourable.

In another experiment, begun in 1967, various silvicultural techniques will be practised (Bsk/67/6). Earlier investigations had shown that it is neither practicable nor desirable to release all regeneration of the accepted species. Therefore the following four methods are being compared:

- 1) Refinement and subsequent liberation of desirables in 3-m wide E-W-strips, interspaced at 12 m.
- 2) Refinement and subsequent liberation of the most promising specimen per unit area (25-50 m<sup>2</sup>).
- 3) Refinement and subsequent liberation of all desired trees over a minimum diameter (3.5 cm dbh).
- 4) Release of all healthy poles of desirable species (minimum diameter 15 cm) without previous refinement.

The first system has been practised with some success since 1961<sup>5)</sup>. Very little experience, if any, exists on the other systems.

### 3.3. CANKER OF *EUCALYPTUS GRANDIS* HILL EX MAIDEN AND *E. SALIGNA* SM.

In Surinam plantations of *Eucalyptus* on a commercial scale are of recent date only. They occur in the coastal region (0-50 metres above sea-level) on loamy sands as well as on peat. In 1965 a disease was observed in the main plantation of *E. grandis* and *E. saligna* planted in 1962. In co-operation with the Agricultural Experiment Station of Surinam, CELOS started an investigation in 1966 (Bsk/66/1).

At that time the eucalypts had attained a remarkable size: diameters of up to 25 cm and heights of 18-23 metres (spacing 5 by 2 metres). Nearly all trees appeared to be infected, and some had died. In part of the plantation, spaced 3 by 1½ metres, the trees were considerably smaller and mortality was over 50%.

It appeared that all over the country plantations were suffering from the same disease. In a 14-months old planting it was found in its initial stage. A description of the symptoms and epidemiology follows.

When the tree attains a diameter of about 5 cm (normally 14-18 months after planting) the base of the trunk swells slightly and cracks longitudinally. Soon afterwards pycnidia form on the bark. They are 1-2 mm high, often forked at their base, and dark reddish-brown to black. The cracks deepen and locally the bark dies off at the base of the trunk. Generally the infection is followed by a second one, about a metre

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<sup>5)</sup> BOERBOOM, J.H. A. (in press). Some remarks on the natural regeneration of tropical rain forest, with special reference to a method newly applied in Surinam. *Proc. Wld. For. Congr.*; 6, Madrid, 1966.

higher. It always develops near a branch scar or crack caused by thickening, and it is presumed that these are the places of penetration. The tree reacts by forming callus on both sides of the infection. A ruby-coloured gum exudes. As the gum is water-soluble, the colour spreads along the trunk, turning it characteristically reddish. After two or three years as many as five apparently separate infections along the stem may be observed. Finally these infections coalesce.

Though heavily infected, trees growing well may have a nearly full foliage. Crowns of less vigorously growing specimens tend to be open. Many or most of the trees die.

The causal organism was identified as *Endothia havanensis* BRUNER. The fungus has not been recorded in Surinam before. Considering the general occurrence of the disease, the fungus may have been wide-spread before the introduction of the eucalypts. No reference is known to *Endothia havanensis* in the literature of forest pathology.

On a small scale, various fertilizers have been applied to find their possible effects on the disease. So far no significant effects have been noticed. Special attention will be paid to some trees which seem to suffer less from the infection. For the time being extensive planting of either of the two species should be avoided.

#### 3.4. PLANTATIONS OF *PINUS CARIBAEA* MORELET

Since 1956 *Pinus caribaea* var. *hondurensis* has been planted commercially by the local Forest Service. At the end of 1967 plantations covered 1925 ha and considerable extension of the area is planned for the near future.

Three aspects are being studied by CELOS :

- 1) Spacing and thinning (Bsk/65/1).
- 2) The compilation of a volume table (Bsk/65/2).
- 3) Fundamental studies on the root systems of *Pinus caribaea* and the principal weeds in pine plantations (Bsk/66/2, Bsk/66/3).

The spacing-and-thinning trial was begun in 1965. Spacings of  $2\frac{1}{2} \times 2\frac{1}{2}$ ,  $3 \times 3$  and  $3\frac{1}{2} \times 3\frac{1}{2}$  metres are being studied in a latin square design. A tentative volume table of Surinam-grown *Pinus caribaea* has been compiled<sup>6)</sup>.

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<sup>6)</sup> DE VRIES, P.G. (in press). Some data on stem form and stem volume of young Caribbean Pine in Surinam. *Proc. Wild For. Congr.*; **6**, Madrid, 1966.



## 4. RURAL ECONOMICS

### 4.1. FARM MANAGEMENT OF RICE SMALLHOLDINGS IN SURINAM WITH EMPHASIS ON LABOUR PRODUCTIVITY (Lhk/65/1)

In the years 1965 and 1966 farm management was studied with emphasis on rice, which occupies 60% of cultivated land in Surinam and accounts for 40% of the gross agricultural product.

Labour productivity was studied to find whether it determines wage structure on peasant farms in the coastal plains. The hypothesis was tested that remuneration for labour accords with its productivity and marginal analysis was tested as a means of handling problems of resource allocation. Smallholders in low-income countries are often alleged to be irrational in their behaviour, by economic standards.

The field survey was undertaken on smallholdings of 2-3 ha in the districts of Nickerie (54 farms), Saramacca (45 farms) and Suriname (40 farms). The Saramacca sample was drawn from two different ethnic groups, Javanese and Hindustani<sup>7)</sup>. All the other farmers were Hindustani. Except for the Javanese group the farms were surveyed for two successive years. Field staff used the cost-accounting method and visited the informants therefore twice a week.

The hypothesis of agricultural labour's remuneration was tested by multiple regression analysis. The zero hypothesis could never be rejected. Family labour ceased to be used before its marginal productivity reached zero. The results for labour input accorded closely with theory. The theoretically calculated values for marginal product did not vary much between the two years.

The Nickerie sample was tested to find whether smallholders may have a target income in mind. The concept "farmer" is too simple for the majority of Surinam's peasants, as much of their income derives from off-farm activities. A limited-aspiration model (which connected net farm income per family consumption unit with the non-farm income per potential family worker) was found to be consistent with actual conditions. Alternative use of labour seems to be decided by relative profit margins.

Finally it was found that the transformation process from traditional to commercial rice growing did not depend on ethnic factors. Mainly responsible were the absence or presence of irrigation and drainage.

### 4.2. A COMPARATIVE FARM MANAGEMENT STUDY OF RICE FARMING IN SURINAM (Lhk/67/1)

In 1967 the farm management continued to be investigated on peasant rice farms. Economic efficiency and other aspects were compared on farms of different size.

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<sup>7)</sup> Descendants of immigrants from Java and former British India respectively.

The economic relationship between scale, farm size and resource productivity is important when planning efficient use of agricultural resources. A scale relationship exists when changes in output are associated with a proportional change in all inputs. The economic literature using this theoretical concept distinguishes proportional and semi-proportional relationships. Since changes in all inputs are hardly likely to be in proportion to the increase in agricultural production, this scale concept has limited practical value. Normally changes in level of output involve variation in resource proportions. This study therefore concentrates on economies through changes in resources and their use, according to farm size. Little is known about this in low-income countries. Some authors believe that great economies will be attained by organizing large units, because of greater possibilities for the efficient use of scarce and indivisible factors and for the adoption of innovations. Others argue that in low-income countries economic incentives for efficient use of resources diminish as farms enlarge.

The economics of farm size must be understood to plan changes in farming pattern of existing areas and to plan farms for land-settlement projects. Our study of this general problem and the formulation of relationships should allow planning of alternative types of rice farms for Surinam.

Another interesting question is whether there are any significant differences in the economics of rice farming between Javanese and Hindustani, two different ethnic groups in almost the same physical and economic environment.

The rice growing district of Nickerie, in western Surinam, with its irrigation and drainage facilities, was selected for field study. There are plenty of farms of all sizes and the soils and water conditions are more uniform than elsewhere. Some machinery is being used, enhancing the interest of the area.

Three sizes were selected :

- 1) Small farms, with a net rice area of 1-2 ha.
- 2) Medium farms, with a net rice area of 4-6 ha.
- 3) Large farms, with a net rice area of 8-20 ha.

In the first class a sample of 50 was taken among the Javanese, and one of 60 among the Hindustani farmers. In both other classes the sample comprised approximately 60 Hindustani farmers only.

Farms were selected to give an even sample in resource use, output and size-efficiency relations. Because of the current changes in farm size pattern in Nickerie, caused by the yearly leasing and letting of plots, more farms of each class were sampled than required for final analysis.

Information on farm structure, resource use and output is collected mainly by the cost-accounting method.

In Nickerie ample opportunities exist for working off the farm and for contracting out agricultural machinery. To ascertain the degree of economic divisibility of resources, data are collected on on-farm and off-farm economic activities. Most farmers in the area are semiliterate and could or would not do their own book-keeping. So field workers visit them twice a week with a schedule of the relevant items.

To allow for variations in climatic and other external conditions influencing input or output, the field study will continue for three years.

The field work began in April 1967 and no serious problems were encountered during the year. Some farmers were frequently away but in general they co-operated very well, considering the frequent visits and monotony of our interviews.

Rice growing was found to be in a transitional stage, with, in general, the large farms

furthest transformed. Tillage is already fully mechanized and labour-saving broadcasting is increasing at the expense of laborious transplanting. Harvesting is by hand, usually with a sickle, but threshing is by tractor-operated machines. By 1967 machine harvesting got under way, particularly on the large farms, encouraged by the introduction of combine harvesting on contract. Instead of under one rice crop a year an increasing area is now under two rice crops per year.

The whole system of rice farming is changing. Production methods (planting and harvesting) differ between farms and even on farms, as innovations take time to catch on. Under such conditions comparisons between years are difficult.

In view of the size of the study most of the attention had to be concentrated on the field work and the cross-checking of collected data. As these data are still being processed, conclusions are not yet possible.

## 5. SOCIOLOGY

### 5.1. SOCIOLOGICAL ASPECTS OF AGRICULTURAL EXTENSION IN SURINAM (Soc/67/1)

One of the most urgent problems in developing countries is how to produce more food. In the long term, this problem is connected with raising the standard of living for the rural population. To increase agricultural production modern methods must diffuse to the farmers in order to improve upon their traditional way of farming. Research centres have developed many useful farming methods and techniques. However, there is still a wide gap between these methods and the actual practices on the farms.

Extension workers are bringing the information to the farmers. Despite some success, this information is not sufficiently adapted to the conditions under which the farmers live and work. Often farmers do not accept improved methods because they are unable to apply them. Frequently they have too low an income to be able to risk a failure on a new practice. Lack of local services also limits acceptance. Many areas of developing countries are isolated or lack proper roads and transport so that marketing is difficult. The spread of new practices is hampered by the low literacy and by the use of many dialects or even languages within one country. Traditional customs and culture may hinder the changes from old, accepted practices to new and unfamiliar ones.

The present research project is designed to study the various factors that influence the process of extension work in Surinam. It is focussing on those factors which possibly retard or accelerate the adoption of innovations by small rice farmers. To this end, a theoretical framework has been constructed to test a number of hypotheses under actual field conditions. The study is composed of two main parts, a surveying and a case-study approach.

For the survey a stratified sample of 300 rice farmers was drawn from the population in three rural districts in the coastal plain of Surinam (Nickerie, Suriname and Commewijne). These districts differ in irrigation and communications. As the adoption of innovations is closely related to farm size, the holdings were classified as small, medium and large. To compare groups of different ethnic compositions, farmers of East Indian and Javanese origin were sampled. Sewell's modified socio-economic scale and other scaling techniques were used. The survey's design was based on a set of exploratory interviews. Later interviews were either structured or unstructured, using a partially coded questionnaire. For these interviews specially trained schoolteachers were employed who spoke fluent Hindi or Javanese.

Most of the field work has been completed and the data from Nickerie were tentatively analysed.

It was found that most innovations were in rice varieties, fertilizers and insecticides. A striking difference occurs in the score of adoptions between the three sizes of farms, as may be seen from table 2.

Of the group of large farms 48% were adopters of insecticides; against 33% for

Table 2 - Use of insecticides on farms of different sizes in Nickerie (1966)

	size of farm			total
	1-2 ha (small)	4-6 ha (medium)	8-20 ha (large)	
insecticides used	9	11	13	33
insecticides not used	31	22	14	67
total number of farms	40	33	27	100

the medium and 22% for the small farmholders. On average large farmers had started to use insecticides five years earlier than smallholders.

Most of the large farmers stated that they had obtained information about several innovations from the advisory service of the Ministry of Agriculture. Small farmers had heard about it from other farmers in their neighbourhood.

Farmers and extension officers meet mainly in the paddy stores of the extension service. Here, the farmers buy seed and agricultural chemicals, and are told how to use them. Because farmers are interested mainly in obtaining their requirements, they identify the extension work more with distributing material than with supplying knowledge and information. This impression is strengthened because most extension workers visit the farmers primarily to collect data about paddy areas and rice yields for research and statistical purposes.

Farmers of East Indian origin have more contacts with the advisory service than farmers of Javanese origin. The latter seldom go to the paddy store and extension officers only visit them as an exception, partly because few workers of the advisory service speak Javanese. Social and cultural factors, such as the traditional value system of the Javanese, also discourage technical change.

Besides the government extension service, there is another important source of information, viz. three large rice farms in Nickerie, where selected rice varieties are sown and farming is fully mechanized. Many progressive farmers from the district visit these farms to see the improved rice varieties and the techniques of mechanized rice farming.

During the interviews many farmers expressed their needs for extension. Most of these needs were directly related to subjects which could immediately be used under present farm conditions, for example, new rice varieties, insecticides, herbicides and fertilizers. It was found that respondents who expressed their needs for these modern materials were also eager to expand their farms. The need for more and better irrigated paddy land was expressed particularly by those who wanted to change from traditional to mechanized farming.

## RELATÓRIO DO CENTRO DE PESQUISAS AGRÍCOLAS DE SURINAM, REFERENTE AOS ANOS DE 1965, 1966 E 1967

(Traduzido por Dr José H. da Costa Ferreira, Instituto de Estudos Hispânicos, Portugueses e Ibero-Americanos, Utrecht, Holanda)

A Universidade Nacional de Agronomia de Wageningen, na Holanda, há muito que se ocupa intensamente do ensino da agricultura tropical e da silvicultura. Até há pouco tempo, todavia, a Universidade não tivera uma delegação própria num país tropical que pudesse prover a um programa de ensino. O estabelecimento do Centro de Pesquisas Agrícolas de Surinam (CELOS) em Paramaribo veio modificar esta situação.

O CELOS é um instituto integrado no complexo da Universidade de Agronomia. Todas as secções da Universidade relacionadas com assuntos tropicais dão o seu contributo coadjuvando os estudantes do Centro e um ou outro dos seus componentes directivos. Os cientistas permanecem geralmente dois anos em Surinam até serem substituídos por seus colegas. Os estudantes só vêm para Surinam após terem sido aprovados no seu penúltimo exame. Ficam no Centro por períodos que vão de seis meses a um ano. Estes estudantes participam activamente em trabalhos de pesquisa corrente e recebem um treino prático a fim de se familiarizarem com a sua futura matéria profissional.

O Centro dedica-se, tanto quanto possível, à pesquisa básica no sector da agricultura, tomada no seu sentido mais lato. Dispõe, para já, de dez secções científicas: engenharia agrónomica, agronomia e colheitas, pecuária, silvicultura, drenagem e tratamento da terra, cultivo de plantas, protecção de plantas, economia rural, sociologia e estudo do solo. Pelo fim do ano de 1967, cinco destas secções iniciaram os seus trabalhos, devendo seguir-se-lhes as demais, logo que estejam preparadas as necessárias condições.

O CELOS deseja estabelecer estreitos contactos com universidades e institutos de pesquisa de outros países, sobretudo na América Central e do Sul. Espera-se que desses contactos possa resultar uma colaboração proveitosa de que colherão bons resultados os colegas estrangeiros, o elemento directivo do Centro e os estudantes.

A secção de pecuária estudou em 1967 — quando, durante um período de três meses, um perito de agro-pecuária coadjuvou o Centro — os relatórios da produção de leite das vacarias da Herdade Governamental de Surinam, durante mais de quatro anos sucessivos.

As pesquisas no campo da silvicultura começaram em 1965. Confere-se grande importância a dois projectos de execução mais demorada e que dizem respeito aos estudos de progresso e renovação nas terras baixas da floresta de Surinam infiltradas pelas chuvas.

As investigações efectuadas no âmbito da economia rural, começadas em 1965, incidiram sobre os problemas da administração das herdades no sector da lavoura. Para começar, foram examinados os arrozais de 2—3 ha, tendo sido a produtividade de trabalho nestas pequenas terras arrendadas, o principal objectivo estudado. Depois disto, foi aplicado um método de investigação comparativa para avaliar a influência da área da herdade sobre o rendimento da cultura do arroz. O trabalho concentrou-se sobre

três classes de herdades, avaliadas segundo as respectivas áreas, com uma produção de arroz equivalente a áreas de 1—2, 4—6 e 8—20 ha, respectivamente.

Atendendo ao facto de que o presente desenvolvimento dos pequenos arrendamentos está muito aquém dos actuais progressos verificados nos métodos da agricultura, a secção de sociologia tem, desde 1967, dirigido a sua atenção para os vários factores que influenciam os resultados do trabalho suplementar entre os pequenos fazendeiros do arroz.

O Centro tem editado, desde 1966, uma série de publicações científicas chamadas "Boletins Celos", que contêm os jornais originais e recortes de artigos escritos pelo pessoal directivo do Centro noutros jornais e revistas. Os relatórios anuais serao também incluídos nesta série de publicações. Têm, além disso, sido publicadas cópias dos relatórios trimestrais para as pessoas que desde 1967 estao intimamente ligadas ao Centro.

## INFORME SOBRE LOS EJERCICIOS 1965-1967 DEL CENTRO DE INVESTIGACIÓN AGRÓNOMA EN EL SURINAM

(Traducido por Sr. J. O. Luurs, Instituto de Estudios Hispánicos, Portugueses e Ibero-Americanos, Utrecht, Holanda)

Ya desde hace mucho tiempo que las ciencias de la agronomía y la dasonomía tropicales ocupan un sitio muy importante en la Universidad de Agronomía en Wageningen (Holanda). Sin embargo hasta hace poco tiempo la Universidad no dispuso al efecto de sus actividades de la enseñanza e investigación de una propia dependencia en los trópicos. La reciente fundación del Centro de Investigación Agrónoma en el Surinam CELOS, establecido en Paramaribo, ha modificado esta situación ahora por completo. Dicho Centro es un Instituto interdepartamental de la Universidad de Agronomía. Van cooperando en el mismo todas las secciones de interés tropical. Uno o unos de sus investigadores quedará(n) consignado(s) en el CELOS y ellos mandarán a sus estudiantes al CELOS. Por lo general vienen los investigadores al Surinam por algunos años y después son relevados por sus colegas. Los estudiantes son colocados en el Centro durante la última fase de su estudio por un período de medio año a un año. Toman parte de manera activa en las investigaciones y desempeñan actividades prácticas, a fin de familiarizarse con su futura esfera de trabajo.

El CELOS se limita en lo posible a la investigación fundamental en el terreno de la agricultura en el sentido más amplio de la palabra. En primera instancia tiene diez secciones científicas, a saber edafología, dasonomía, drenaje y mejoramiento de tierras, protección de plantas, cultivo de plantas, economía agrícola, ingeniería agrícola, fitogenética, sociología rural y ganadería. Cinco de estas secciones han sido puestas en servicio entretanto. Seguirán las demás secciones una vez terminadas las facilidades a crear a tal efecto.

El Centro aspira la cooperación con universidades y con centros de investigación, a saber en la América Central y del Sur. Se abriga la esperanza de que esto conducirá a esfuerzos colectivos para resolver importantes problemas, de lo cual se podrán aprovechar los colegas fuera del Surinam, como también los investigadores y estudiantes del CELOS.

La sección de ganadería dispuso en 1967 por un período breve de un colaborador que preparaba la venida de los nuevos investigadores y estudiantes. Además efectuó un estudio de la cantidad de leche recogida del ganado en una granja experimental gubernamental, sobre un período de los últimos cuatro años.

Ya en 1965 se dio comienzo a la investigación silvícola. Comprende, además de un número de pequeños estudios, dos temas principales, a saber la sucesión y la regeneración natural en la selva de la llanura del Surinam.

También la investigación de la economía agrícola se inició hace tres años y continúa con los estudios. Tema principal fue originalmente la productividad laboral en grandes empresas de arroz de 2—3 hect. Una vez terminados estos estudios se inició un examen comparativo económico en las empresas de arroz de 1—2, 4—6 y 8—20 hect.



Se empezó el examen sociológico en 1967. Está enteramente orientado en la práctica de las actividades de la extensión agrícola y trata de encontrar respuesta a la pregunta porqué en el Surinam, así como en tantos otros países, resulta ser más reducido el efecto de la extensión de lo que cabría esperar.

Se insertan las publicaciones científicas de los colaboradores del Centro en la serie de los boletines CELOS (en que figuran también los Informes Anuales). Además se componen Informes trimestrales, en pro de ellos que están estrechamente relacionados con el Centro.