LELYDORP PROJECT — A PILOTSCHEME FOR LAND-DEVELOPMENT IN SURINAM [1])

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CONTENTS

1. INTRODUCTION

Every year, figures are published by FAO about the world food situation. These figures indicate an extremely low standard of agricultural production and nutrition in wide regions of the earth. Moreover, in the subsequent years no improvement of any importance appeared in the critical food situation.

The land is least productive in the tropics. There are various reasons for this. In the first place the soil, as a result of leaching, is generally less fertile than in the temperate zones. Moreover, in tropical agriculture natural disadvantages such as weedgrowth and plantdiseases are felt more strongly.

Furthermore, lack of capital bars the way to better equipment of farms and the purchase of machines and artificial fertilizers ; and finally, the low standards of education and organization are serious handicaps for any attempts to improve agricultural development. Consequently, the agricultural production in the tropics is considerably lower than in the temperate zones. The yield of cereal crops per ha, for instance, are often not more than half of those in the Netherlands, while for tuberous crops and pulses the differences are even greater.

Taking into account that several tropical areas are densely populated and that this population, due to improved hygienic care, is still increasing, it is obvious that a very large part of the worldpopulation is constantly suffering from malnutrition.

Farming is the backbone of welfare in most tropical underdeveloped countries and farmproduction in these countries is low. Extension of agricultural "know

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how", provision of capital and equipment and better farmmanagement systems would make it possible to raise the level of productivity considerably of these areas. Therefore, in several tropical countries, including the Caribbean region, careful attention is given to the problems of farm production and farm-management.

As a postulate for a well-directed program for agricultural development a systematic inventorization of the land-and waterresources, a sustained programme of agricultural research and an effective organization of the farms and the farmers' communities is essential.

The following pages will give a description of the way in which endeavors have been made to tackle the problem in a rather unfertile part of Surinam. The main object of our study is the Lelydorp Project, which has been developed as a "pilot scheme" in the old Coastal Plain of Surinam. However, as an introduction an outline will be given of the agricultural situation of Surinam in general and of the region in which the Lelydorpproject is located, in particular. The Project is called after the village Lelydorp and the conditions in this region around the village may be considered typical for those of the Old Coastal Plain.

2. Agricultural conditions in Surinam

In general, the natural conditions in Surinam are favorable, compared with those in other tropical areas.

Along the coast stretches a broad plain, which consists, mainly, of heavy, rather fertile clay soils, and covers an area of about 1.600.000 hectares. However, most of this "Jonge Kustvlakte" (Young Coastal Plain) lies below high-tide level, and therefore requires to be drained (impoldered) before being taken into use.

Farther inland the Young Coastal Plain merges into a sandier, much less fertile formation of greater geological age, which likewise consists of marine sediments but is mainly situated above high-tide level. This is the so called Old Coastal Plain, which covers an area of about 450.000 hectares.

The two coastal plains occupy together only one seventh of the surface of Surinam. The remainder, the hilly, predominantly forested hinterland, has so far been little explored; its agricultural value is not highly estimated.

Surinam is thinly populated, and has plenty of room for expansion of agricultural reclamation. This is a second advantage the country possesses in comparison with several other areas in the Caribbean region.

An agricultural census is in course of execution. According to the latest data available from the Surinam Report for 1949, it can be assumed that more than 19.000 lots of land, with a total area of about 64.000 hectares, have been distributed for agricultural purposes, of which, however, only 19.000 hectares, or 30 %, have actually been brought under cultivation.

In addition, the plantations at present under exploitation cover an area of over 26.000 hectares, of which about 7.000 hectares (only 27 %) have been brought under cultivation. The economic position of these plantations is not particularly favourable, owing to shortage of labour and to high costprices. The estates need economic reorganization; and experiments are actually being carried out to make more effective use of technical modernization.

The average size of landholding among the small farmers of Surinam is less

than 3.5 hectares; whereof about only one hectare per family is under cultivation.

Rice covers the greater part of the agricultural area of the country. In 1949, 17.000 hectares had been planted with this crop, cocos covers an area of about 2.500 ha, then follows coffee (2.300 ha), citrus (2.000 ha), sugar (1.300 ha), and bananas (1.400 ha); moreover, about 2.000 ha of pulses, maize, groundnuts, etc., had been harvested as so called "second crops" partly on rice fields.

At first sight it must strike the reader as strange that so small an area per family has been put under cultivation on so great an expanse of reasonably fertile soil (paddy yields are from 3 to 3½ tons per hectare), which, in addition, is so thinly populated.

The explanation is, that drainage and impoldering operations in the Young Coastal Plain are fairly expensive, while efficient drainage on a large scale is beyond the capacity of the single farmer (VAN BEUKERING, 1952).

For these reasons in some districts, the Government took impoldering in hand while ample provision was made for these operations in the "Ten Year Plan" for Surinam (INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT, 1952).

Natural conditions in the Old Coastal Plain are considerably less favorable than those in the Young Coastal Plain. It is true, costly impoldering operations are not required, but the soil is not so fertile. However, the agricultural potentialities have, up till now, been very inadequately investigated.

3. THE OLD COASTAL PLAIN

3.1. GENERAL

Before an agricultural development plan can be carried out in respect of any area, it is necessary to form a picture of agricultural possibilities by making an inventory of its resources and of the present use of the land.

After this, it is necessary to ascertain on what basis, and with what means, these possibilities can be developed.

Accordingly, a development programme for the Old Coastal Plain will have to include the following:

1 a survey of the soil, water and other important natural resources, the actual form of landutilization and general economic and social conditions;
2 an agricultural and landeconomic research in regard to crops, cultivation technics, yields, cattleraising, laborinvestment, costprices and the best adapted types of farm;
3 a settlement project of limited extent (pilot scheme), in which the relevant problems (including those of community development) are worked out in practice.

3.2. NATURAL CONDITIONS

3.2.1. *Soil*

The Old Coastal Plain is an ancient marine deposit which runs parallel with the present coastline of Surinam, as a more or less fragmentary "second belt".

Two types of landscape may be distinguished in the Old Coastal Plain, both of which indicate its marine origin. In the north there is the predominantly sandy, somewhat undulating, old offshore bar landscape, and in the south the old tidal flat landscape, in which silty loams and clays play the principal part.

For the entire area of the Old Coastal Plain a large scale map gives the general outlines of the pedological situation (v. d. Eyk & Hendriks, 1952), while for the Lelydorp Project, and its surroundings, a detailed soil survey was carried out (Hendriks & Glavimans, 1953).

In the slightly undulating, sand bar-like country in which the Lelydorp Project is situated, the relief of the land plays an important role in pedology and agriculture. With respect to pedology, because the relief caused the formation of widely differing soil series; with respect to agriculture, because the nature of this terrain, in regard to drainage possibilities and the danger of erosion, necessitates the application of different forms of agricultural practices.

Agriculturally, the types of soil in the region can be classified as follows:

ridge soils: highly situated, with good drainage; predominantly lateritic, ochreous yellow, red loamy sands;

plateau soils: highly situated, with bad drainage, through which very extreme podsolic soils occured;

slope soils: situated at medium elevation, with reasonable drainage; predominantly greyish-brown sands and reddish-brown loams, the latter more particularly on the steep parts of slopes;

valley soils: situated low, with mediocre to bad drainage; grey loams occur, as well as grey sands;

swamp soils: situated very low, without drainage; consist predominantly of grey clays; locally small fens with white sandy soil.

Chemically speaking, almost all the Lelydorp soils are poor; contents of P and K, in particular, are low. The content of organic substance in the valley soils is fairly high, as it is also in the swamp soils. The pH value is lowest for the plateau soils, viz. 4.8.; for the remaining soils, it lies between 5.0 and 5.4.

The territory has been provisionally divided according to agricultural value, viz.:

arable land: preferably on the areas of ridge soil, which are sufficiently flat to prevent erosion;

pasture land: preferably in the valleys;

land for tree crops: especially on the slope and ridge soils;

rice land: in small swampy areas and in the valleys where irrigation has proved to be possible.

The very unfertile plateau soils have not been included in the above classification scheme; except for very small enclosures these white sandy soils are excluded for allocation of farmland.

The sequence of soils with different landuse possibilities has necessitated a system of mixed farming. This has the advantage of a more even spreading of risks for the farm and also a more even distribution of labor over the year.

Farm practices in this region are mainly concerned with the conservation of soil fertility. For this reason, the tree crops are undersown with kudzu, which by its dense cover protects the land against erosion and increases the humuscontent of the topsoil. For the same reason farmyard manure is applied to the arable land and the bananagroves.

The pasture lands are in itself insufficient to the cattle stock; an important

part of the feeding is provided by foddergrasses and kudzu (albumen content: 18—20 %).

As regards area, arable land occupies a modest place, which is limited (a) by the small area of suitable ploughland, owing to lack of fertility and soil erosion, and (b) by the quantity of farmyard manure which can be produced. By using kudzu as a green manure for tree crops savings can be made on artificial fertilizers, which are expensive for tropical farmconditions. The same applies to arable land with reference to the supply of farmyard manure. During sowing, the green manures are fertilized with rockphosphate, which initiates circulation of Ca and P from soil to plant.

3.2.2. *Water*

As was indicated in the previous chapter, the natural drainage conditions of the land are also an important factor in its agricultural use.

The drainage possibilities are determined by the numerous large and small swamps and marshes occurring in the Old Coastal Plain. Drainage can only take place to swamp level. For instance, to the north of the Lelydorp Project lies an extensive marsh covering 2.000 hectares. The swamp level of this marsh varies in the dry and wet seasons between 9.60 metres above S.P. (Surinaams Peil = Surinam standard level) and 10.40 metres above S.P., as compared with 10.00 metres above S.P. to 16.50 metres above S.P. for the surrounding country.

Efficient drainage to swamp level can be achieved by cleaning creeks and watercourses which became choked by vegetation. Additional drainage canals are necessary in order to drain the flatter parts of the region as well.

The fluctuations in the groundwatertable, also in regard to possible impermeable strata in the subsoil, have been under investigation since 1951. In this period no desiccation phenomena appeared, even not in the highest parts of territory.

3.2.3. *Vegetation*

The original vegetation of the dry and marshy soils in the Old Coastal Plain consisted of more or less dense rainforest. On the "white" soils this vegetation merges, via savanna woodland, into a shrubwilderness. Swamps are generally covered with grass (Cohen & v. d. Eyk, 1953, Heinsdijk, 1953).

A part of these territories was cleared in former years by plantation owners or natives; after desertion of the fields, the land was covered again with a forest growth of secondary nature.

A good picture of the vegetation in the Old Coastal Plain can be obtained from the aerial photographs (scale: 1 : 40.000), which are now being used by the Central Bureau for Aerial Surveys for the compilation of vegetationmaps. As regards to the Lelydorp Project vegetation conditions before clearance have been recorded on a more detailed map.

Preparation of this map afforded an opportunity of studying the connection between soil type and vegetation, especially by the occurrence of characteristic trees. The influence of former exploitation of the land (charcoal burning, shifting cultivation) on plant development could also be traced.

The pioneer vegetation arising after clearance can be studied, while observations are regularly made on the weedgrowth occurring when land is utilized

as ploughland and as pasture. In the case of tree crops, all natural vegetation is ousted by the kudzu.

3.3. Land use

3.3.1. *History*

In former times in some easily accessible parts of the Old Coastal Plain tracts of land were allocated as "wood plantations" for forest exploitation. Since the period of the emancipation of the slaves, these woodplantations, which had long been deserted, were transferred as "allodial property" to the former slaves. The holdings are exploited in an extensive way, mostly on the "shifting cultivation" system by their present-day possessors. In the area directly surrounding Lelydorp, plots of land are rented for permanent cultivation, but here, too, agriculture is on a very low level.

It is quite obvious, that on these holdings the primitive form of cultivation will ultimately lead to complete soil exhaustion. Here and there, in some holdings, it proved to be possible to cultivate pineappeles successfully, and bananas as well, provided such cultivation took place in combination with cattle rearing (manuring and grass fallowing). With proper care citrus and cocos gave reasonably good results; on one holding naar Lelydorp a small young cocoa plantation looked promising, while an old oilpalm grove was still in fairly good condition in spite of years of neglect.

Attempts to settle Creoles from the town on the Old Coastal Plain ended in failure, as a consequence of insufficient preparation, injudicious choice of land, and lack of skill of the settlers.

3.3.2. *The present situation*

In order to obtain a clearer picture of the present situation, an agricultural census was carried out in the vicinity of Lelydorp. The intention is to follow up this census by a more detailed analysis of the farmmanagement in this area.

Each of the rented plots covered by the census had an area of 3 to 4 hectares. In order to characterize the types and the intensity of farming for the different populationgroups in this region the following figures may be given:

Average	Creoles	Hindustani	Indonesians
Size of holdings	4.0 ha	3.2 ha	3.0 ha
Under cultivation	33 %	51 %	12 %
Number of people per holding	4	8	4
Head of cattle	0.9	4.8	0.6
Number of poultry	14	18	7

The Creole farms consist predominantly of tree crops, chiefly cocos, followed by citrus and, in the last few years, some cocoa. Cassava, bananas and maize are planted between the trees.

The Hindu farms are mainly based on wet cultivation of rice, small quantities of cocos, citrus and vegetables as kitchen-garden crops. In addition, cattlerearing (milking and draught cattle) is important.

The Javanese farms are purely compound plantations, on the kitchen-garden

scale, in which coffee, cocos and various fruit trees find a place ; besides these, rice, cassava and pulses are grown in very small quantities.

The above shows that the population is more or less familiar with a variety of crops, while mixed farming is partially put into practice.

It is also obvious, however, that the income from most of these small units is extremely low, so that, in most cases, the farmers will have to find other sources of income outside the farm.

In spite of the present low farming standard, some of the better farms indicate that agriculture in the Old Coastal Plain can offer reasonable prospects provided the allocation of the land is carried out correctly, the soil is used in a suitable manner, the set up of the farms is adapted to natural conditions, some capital is available and the farms are expertly managed. It is on the basis of these expectations that the Lelydorp Project has been launched as a pilot scheme in the Old Coastal Plain.

4. The Lelydorp project

4.1. The development scheme

The Lelydorp project as a land development scheme started its activities in the last months of 1950. Its ultimate purpose is to demonstrate the agricultural and economic possibilities of the independent middle-class farm in the Old Coastal Plain.

The site of the Project, only a few kilometres off the main road Paramaribo to the airport Zandery and about 25 km from the capital city is very favorable for a development scheme. Furthermore, enough labor was available in the vicinity for the reclamation and cultivationoperations on the future settlement. Moreover, the site chosen for the project represents a reasonable picture of the natural conditions existing in the northern part of the Old Coastal Plain.

Originally, a highly ambitious project was planned in order to bring under cultivation, in a relatively short time, a great area of jungle on the Plain. (Langguth Oliviera & Van Lier, 1950). But after some time it was clearly indicated by experience that in the first place it was neccessary to obtain the requisite knowledge on a more modest scale before carrying out a large-scale operation. The soilpattern, as well as the natural drainage conditions, proved to be extraordinarily varied and complicated, while insufficient knowledge had been obtained regarding the most suitable agricultural utilization of these varying soil series and the farmtype best adapted to conditions in this region.

Thus, in the original scheme, the intention had been to establish farms of 16 ha in size, in which ample room had been reserved for annual crops to be cultivated mechanically.

However, it was found that these comparatively unfertile, sandy soils, through repeated mechanical tilling and planting with annual crops, quickly lost their texture and reserve of humus. Only the best of these sandy soils proved capable of retaining their fertility, with the condition that a carefully tested rotation system was applied and organic matter was provided. It was therefore desirable to give the annual crops a more modest place in the cultivationscheme, and to restrict them to the best soils.

It was found, however, that this change in the type of farm also meant that the size of farm could no longer be maintained. As farms of 16 ha, chiefly planted with perennial crops which cannot be cultivated mechanically, are too

large to be handled by one family, the size of the Lelydorp Project's standard farm was reduced from 16 tot 11 ha.

Furthermore, it did not appear desirable to adhere rigidly to a specific size and type of farm. For it is by no means certain yet what sort of farm is the best adaptable for family farming on the different soils of the Old Coastal Plain.

It was therefore considered useful to include also smaller holdings of 8 and 5 ha in the experiment, while, owing to the good growth of fodder grasses, it seemed desirable to make provision for farms on which (intensive) cattle rearing would occupy a prominent place.

These considerations — the result of experiences in the first two years of the Project's existence — are expressed in the following development programme:

1 The independent middle-class familyholding procuring a decent and stable living for the farmer and his family, will constitute the farming unit in this region.
2 This means that besides the plantations, these farms also take a definite part in the commercial agricultural production of the country. By doing this the commercial farm will improve Surinam's exportposition, because in that country estate agriculture is challenged by serious difficulties.
3 To ensure lasting production, it is necessary to maintain and increase the stock of organic matter in the soil; the mixed farm (crops and cattle) was therefore deemed to be the most suitable type. For this reason, the cultivation of annual crops as an important component of the farm's activities was rejected.
4 The economic basis of the farm will be formed by the cultivation of perennial export crops and the production of milk and meat from livestock. The limited cultivation of annual crops will be directed mainly to supplying food for the family and the cattle.
5 The farms will be mechanized as far as possible. Opportunities for mechanization are limited by the subordinate place of arable farming in the system; however, it was considered important to introduce — as far as economically justified — mechanical labor also for secondary services: transports, water-pumping, light, a.s.o.
6 The farmers community will be organized in a manner commensurate with its size and level of prosperity. Such organization will comprise administration of the community, as well as development of economic and social interests.

According to details given in the following chapter, by the end of 1954 a number of 35 farms will have been parcelled out, viz.: 15 farms of 11 hectares, 8 of 8 hectares, 7 of 5 hectares, and 5 cattle farms, each 10 to 15 hectares in extent. At the same time, an area of 60 ha will have been planted mainly with oil palms, as reserve, which area will, if necessary, also be allocated as farms. Besides, 60 ha have been permanently earmarked as experimental fields for research purposes. From this it will be seen that, excluding forest reserves, buildings, roads, creeks, swamps, etc., the directly productive area of the Lelydorp Project will amount to a good 450 ha.

4.2. Land clearance and organization of the farms

At first, landclearing, and subsequent cultivation, took place more or less haphazardly, a fact which caused some difficulties, when the land was parcelled

out. When pedological and topographical maps became available, it was possible to consider the future utilization of the land already before its clearing.

Most of the clearance was done by axe and fire. Deforestation with heavy mechanical equipment, such as bulldozers, proved fatal to the texture of the soil and the conservation of the humus.

Parts of the forest which were meant as a cover for shade needing crops such as cocoa and coffee, were not felled wholly, but only thinned out selectively.

Immediately after clearing of the remaining forest, a first crop of maize or beans, together with green manure crops, were sown in those parts of the area reserved for tree crops. Kudzu was used as a ground cover for the future oil palm, citrus and cocos plantations, and Crotalaria for cocoa grown with banana trees as a temporary covercrop. The future pastures were planted immediately with grass, and all stumps of trees were digged out from fields destined for use as arable land.

The agricultural use of the land in regard to the complicated soil pattern, the slopes and the drainage conditions, required careful consideration. Also the location of the farmhouse, cattleshed and waterwell, had to be properly figured out.

The average 11 ha-farm comprised 3 ha of cocoa, 3 ha of oil palms, 1 ha of cocos, 1 ha of citrus, and a total of 3 ha for ploughland, pasture and farmyard. Each farm was stocked with eight cows and four pigs. In determining the organization of the farm in regard to the area allocated to different crops and the number of cattle, an estimation was made of the labor requirements of different farm activities. For the same purpose a tentative prospect was made of the future market position of different farmproducts.

After the farms were completely set up, they were kept for another full year under the control of the central management, until the planting could be considered successful and the cover of green manurecrops had closed. They were then handed over to their future holders.

By the end of 1953, the area of land under cultivation in the Lelydorp Project was as follows:

Oil Palms	115 ha
Cocoa	59 „
Cocos	32 „
Coffee	3 „
Oranges	18 „
Grapefruit	9 „
Lemons	8 „
Arable land	60 „
Rice	13 „
Pasture	65 „
Compounds	16 „
Reserve	23 „
Total	421 ha

Furthermore, 125 ha of bananas and 24 ha of pineapples had been planted as a temporarily catchcrop between perennial crops and on future ploughland.

4.3. Costs, regulations and expectations

It was not considered right to make the farmers in the Lelydorp Project settlement defray all the expenses connected with the settlement.

In the first place, the scheme is a pilot scheme and as such relatively costly. Moreover the Project was altered considerably while it was in process of execution. Wisdom is bought by experience; these costs should not be charged to the individual participants.

In the second place, the Lelydorp Project is an experiment to use on a much larger scale; consequently it can hardly be justified to recover the total costs of the Project from the farmers of this settlement.

In the third place, the State profits both directly and indirectly from the Project (taxes, secondary revenues, increase in national income, improvement in export position, etc.); therefore the State should pay part of the expenses (general costs).

Accordingly, the farmers were only charged the cost of clearing the land, making it ready for cultivation, and planting it, together with the cost of farmhouse, cattleshed, and the livestock placed at their disposal.

The investment costs for the various farms are as follows:

Size of farm	11 ha	8 ha	5 ha
Cost of			
Clearing and planting	fls. 11.000	fls. 8.000	fls. 5.000
House	„ 4.000	„ 3.000	„ 2.000
Shed	„ 1.200	„ 1.000	„ 800
Cattle	„ 2.000	„ 1.600	„ 1.200
Equipment, Tools, etc.	„ 200	„ 200	„ 200
Total	fls. 18.400	fls. 13.800	fls. 9.200

Since the planted crops require most attention in the first and second years, the farms are kept under central management for about one year after planting, before being allocated. Thus, investment costs were increased, so that the farmers were charged fls. 20.000, fls. 15.000 and fls. 10.000 respectively on receipt of their holdings of 11. 8 and 5 ha. Also hereafter, these farms will continue to cost money, for they cannot be expected to show a profit until the fourth year, when the tree crops begin to produce. As in the first few years there will probably be no profits, the farmer will receive a fixed weekly wage, which will be added to his debit account.

In the first few years semi-annual crops may contribute considerably to the proceeds of the farm; bananas providing temporary shade for the young cocoaplants will also contribute to production during the first difficult years.

The farmer is charged interest at the rate of 4% of the capital invested. But for the first three years, when the farm is still being built up, payment of this interest is remitted. Furthermore the farmer and his family enjoy free accommodation, and free food from the products of the farm.

Repayment of the invested capital takes place gradually, according to supple regulations which allow for the possibility of accelerated payment in times of good harvests and prices, and retarded payment in the case of bad harvests or low prices.

Any calculation of the financial return from these farms is, of course, speculative. In the first place, it is not possible to base all estimates of yield on actual production data, no more than it is possible to forecast the trend of the prices of the products.

According to a conservative estimate, the gross profit per hectare per year may be fls. 500, in which calculation neither the labor of the farmer and his family, nor income in kind (food) has been included. On this basis, it seems possible to pay off the debt in 15 to 18 years.

In a few years' time, further data will render a more detailed financial report on the Lelydorp Project possible. In that report it will then be possible to show what the Government's (or other investing authority's) outlay and income have been as compared with those of the individual farmer. A more precise judgment can then be given on the correctness of the principles on which the farms were established; whether this type of farming warrants conservation of fertility and permanent agriculture in the future, in addition to producing a reasonable profit for the cultivator; and whether continuation of investment on this basis is ultimately justified.

4.4. Agricultural research

From the very beginning agricultural research occupied an important part of the developmentprogram of the Project. The investigations included several crops and cultivationtechnics on the different soiltypes and under different draining conditions in the area.

As regards annual crops, the growing and planting season, cultivation technics, weed control and the influence of fertilizing and manuring were particularly investigated. On the better soils pulses, such as soybeans, groundnuts, and blackeye peas, proved to thrive, sweet potatoes produced reasonable yields, and water melons gave excellent results.

Generally speaking the semi-perennial crops did better than the annual crops. Experiments on plant arrangement, fertilizing, and varieties produced valuable information. Bananas, pineapples, cassava and foddergrasses proved to produce good to very good yields if reasonably treated. Experiments for the most suitable rotationscheme were also included in the investigationprogram of the annual and semiperennial crops. In a number of plots kudzu and grasses will be included as regenerating crops in the rotation scheme.

For the perennial crops experiments were carried out, with various stocks for citrus, with shade elements for cocoa, and with various green manures. On the eight important soil series of Lelydorp, experimental plots of about 25 trees of each perennial crop are demarcated, in order to follow the development and the production of the trees in the different classes of soil fertility.

As regards cattle the increase in weight in zebu calves and Creole cattle is being investigated and very good results are recorded. Determinations of crude fodder consumption, milk yield, fat content of milk, and manure production, take place regularly. Endeavors are made to obtain progeny with better milk yield, and adequate resistance to tropical conditions, by artificial insemination of zebu- and Creole cows with semen from Friesian bulls. The question of storing farmyard manure has also been taken in hand.

The range of pasturegrasses requires improvement. For this purpose, six pasturegrasses are now being compared on several types of soil, and propagation fields have already been laid down. Rotation of pastures and better care of grassland are put forward.

Finally, a model farm is managed by the Projectadministration itself, to enable advice on a practical farming basis, with the help of visible, tangible examples, to be given to the farmers, in addition to oral information.

4.5. Economic research

From the very beginning since reclamation operations started at Lelydorp-project, statistics have been collected concerning labor and cost prices for all subsequent activities such as forest clearing, drainage, road construction, house-building, cultivation, maintenance a.s.o. As soon as the area is divided in separate plots, every future holding is considered as a unit for which a separate administration is conducted.

When the plots are allocated farmers take part in the administration by recording the hours spent on varies farmactivities in standardized daily reports.

In addition, more exact and detailed data are collected on the model farm administered by the Lelydorp Project itself.

All products destined for sale are marketed centrally. All such necessities as fertilizers, cattle fodder, implements and tools are provided via the stores, and tractor hours and other services rendered by the Project administration are recorded.

In this way all factual information is collected regarding the building up and management of the settlement and the farms. The financial results can be followed from month to month and the monthly statements of account be checked by the farmholders.

Finally, a well deviced registration of costs, income and labor will make it possible to draw conclusions for the establishment of the right system and necessary investment of settlement projects elsewhere in the region and for the type, size and eventual rentability of farms best adapted to existing conditions.

4.6. The community

An organization of a settlement of farmers, such as the Lelydorp Project, is naturally met with more problems than the organization of a plantation. After all, a large-scale single estate can be administered more easily and more efficiently centrally than a collection of small farms.

The difficulty is aggravated by the fact that the farmers in the Project area are of widely different racial origin. Of the fourteen farmers already settled there, six are of Creole descent, four are Hindustani, one is Javanese, one Amerindian, one Eurasian, and one European. We expect, however, that the obvious common economic and social interests of these farmers will make a sound and fruitful cooperation as a group possible, the more so because they are carefully selected. Although agricultural abilities constitute the main criterion in making the selection, personal qualities are also taken into consideration.

For this group of farmers cooperation is necessary especially for marketing their products. This question is the more pressing because commission agents form a powerful group in Surinam. At present, collective buying and selling is still under the strict control of the Project administration, but the influence of the tenant farmers is bound to increase gradually. Perhaps it will also be possible to organize product processing (e.g., of palmoil, cocoa) and mechanical cultivation (tractor pool) on a cooperative basis. The idea of concentrating maintenance of roads and drainage, as well as the administration and exploitation of public buildings, under a "Water Board", or similar local Authority, is being considered.

In addition, a central shop, a policlinic and a school are already in existence, while a social centre is also to be built, in which it will be possible to concentrate communal life, direction of the settlement, advice and information,

contact with the outside world, and recreation. In such a centre the sense of solidarity will have a genuine opportunity for development and expression.

5. The Lelydorp project in its setting

Although, as has already been said in the foregoing chapter 4.1, it will not be possible to give a more definite verdict on profits from the scheme until some years have passed, present experiences justify the expectation that, provided the farms are well managed, the financial returns will be satisfactory.

The human element has been taken into account in considering the factor of "good management". The farms of the Lelydorp Project require considerable higher demands as regards proficiency, organizing ability and labor performance than the average farmer in the Old Coastal Plain appears capable to satisfy. A large number of those farmers from various population groups, applied to have a holding allotted to them under the scheme. Visits were paid to all the applicants on their own farms, and their professional capacities and personalities assessed, with the result that only one tenth of their number could be considered eligible for a Lelydorp farm.

The conclusion can be drawn that the types of farm projected in the Lelydorp settlement are *at present* beyond the power of the mass of the rural population of Surinam to manage. For the same reason it is certain that the Project cannot yet make a contribution towards relieving the towns of their surplus population, as was originally one of its aims.

In order to speed up settlement in the hinterland the idea of introducing less exacting types of farms might be considered. In order to retain, as far as is practicable, the agricultural and economic advantages outlined in chapter 4.1., it will be desirable to maintain the mixed type of farm (crops and cattle) with cultivation of one or two perennial crops, and to reduce its area to 2 or 3 hectares. But in our opinion this smaller type of farm (unless laid down as an intensive vegetable or fruit farm) will not satisfy the optimum standard of an economically independent middle class farm which we wish to attain.

It is to be expected, however, that this smaller type of farm will be more in conformity with the present low level of agriculture in the Old Coastal Plain. It is perhaps a transitionform to a higher type, and, as such, there is a place for it in the pilot scheme.

In this way the importance of the Lelydorp Project as an experiment is more clearly emphasized; an experiment in which as many types of farm as possible must be developed.

In addition, it will be possible to start reforming already existing and badly managed agricultural settlements in the Old Coastal Plain, according to the principles of the Lelydorp Project. The opportunity for doing this is apparently present in the area immediately surrounding the Project.

Moreover, in the opinion of the writers, it will be possible for the Project to become a centre for rural development in the broadest sense of the word. As the foregoing chapter 3.3. may have shown, farm management in this region leaves everything to be desired. Real understanding on the part of the farming population are a sine qua non for a radical reform of the situation here. If this understanding is absent, any large-scale agricultural development scheme is bound to fail. Understanding and knowledge must be imparted by means of demonstration and education. The Lelydorp Project as an example of good

management offers in this respect a very sound starting point. On the basis of the Project the Extension Service can, little by little, systematically raise the level of agriculture in this district. The Lelydorp Project can, at the same time, lay the foundations for long-term scientific research in the Agricultural Experimental Station.

It should again be stressed here that the Project can only provide the basis and working principles for developing the small independent farm in the Old Coastal Plain in particular. Some general conclusions regarding land development in general may be drawn from this example. However, next to this, the launching of other experimental development schemes of this nature, in other parts of Surinam, may be recommended.

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