EXPANDED PR00RAM OF TECHNICAL ASSISTANCE

FAO

No. 1706

Report to the Government of

BRITISH GUIANA

PLANNING AGRICULTURAL DEVELOPMENT

FOOD ANO A&RICULTURE ORaANIZATION OF T.HE UNITED NATIONS

ROME. 1N8

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REPORT TO TEE GOVERNMENT

OF BRITISH GUIANA

ON PLANNING AGRICULTURAL D VELOPMENT

by

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Rome, Juno 1963

FORZWORD

In accordance with the request of the Government of British Guiana for a short-term technical assistance mission in planning agricultural development, the Food and Agriculture Organization of the United Nations appointed Professor Rene Dumont \,ith the following terms of reference :

"TrJO-months' mission to examine the existing agricultural program and make recommendations with a view to a'?hieving

(i) more intensive agricultural methods,
( ) greater diversification of agricultural production
(??i) the extension of arable farming and cattle-raising in the interiorL

As the Government propose to revise and expand the existing Development Program (1960-64); expert advice is required to determine the lines which such revision should take in the field of agr"iculture, in order to achieve the maximum rate of growth in this secto:r."

The expert visited British Guiana in the summer of 1962. He wishes to thank the President, Dr Jagan, the Minister of National Resources and the various departments of the Ministry, the Central Planning Commission and the UN Soil Survey Team for their assistance and collaboration during his mission in the country.

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INTRUDUCTION; AN AGRICULTURAL ECONOKY INADE<lUATE FUR THE ACHIEVEMENT OF 3CONOMIC J:!DEPENDENCE

British Guiana is demanding its political independence. This independence will not be complete without much greater economic independence than now exists. However, the necessary degree of economic independence will not be easy to achieve soon, since it requires an acceleration in rates of development and smaller deficits in the balance of payments and in the budget, which should both gradu lly be made to balance. It is true that the recent growth in exports of Guiana agricultural products seems impressive at first, thanks to two main items, sugar and rice. But the growth of its population, by now definitely over 3% per year, is also very high. Wages seem to have increased recently more rapidly than labour productivity, which makes competiti n more difficult on export markets. Food imports are rising rapidly while capi output appears to be stationary for commodities intended for domestic consumption. Yfuere meat and ground provisions are concerned, capita production appears to have actually decreased; but no definite statement can be made in view of the present bad state of agricultural statistics.

In short, this agricultural economy is based above all - and far too exclusively - on exports, and esp cially on those of two co modities whose markets seem particularly vulnerable: sugar and rice. \forldwide overproduction of sugar has been almost charnnic since 1931, except for' the ,var period. The European Common Market and independence may soon make the United Kingdom's market less readily accessible to Guiana's sugar, at least under preferential conditions. As for the United States' quotas, they are bound tQ decrease and their price will become less and less favourable.

Rice is generally produced more cheaply in Southeast Asia. That area is slow in recovering its full productive capacity, but it could nevertheless become a large exporter again. Italy and, especially, the United States have greatly increased their export availabilities; the United States supplies India with rice. Once it has overcome the problems created by the establishment of a new agrarian structure, Cuba may become almost self-sufficient in rice in a few years, if it rationalises and intensifies fairly quickly; as it does not lack the space necessary for this purpose. Furthermore, Guiana may meet \i>'ithgreater difficulty in the future in finding outlets for its rice in the v/est Indies, in the absence of strong economic relations. The recent Trinidad-Surinam agreement is a further proof to this effect.

Therefore Guiana should try to emerge from its present economic condition of a "primary" producer by developing its industries to the utmost. In this sector, however, the limited market, the lack of capital and technicians, make the problem difficult, especially at the start. The creation of new industrial jobs is very likely to be below the natural growth of the active population for many years to come. Under-employment appears to have been constantly growing in recent years, and this seems to be the most disturbing feature of the economy, the more so as it does not seem to attract sufficient attention. it can be solved quickly only if, in addition to industrial developmentll, there is a rapid accelerated intensification and diversification of agriculture. This is necessary, particularly in order to reduce

1) So rightly called for by Peter Newman in his impressive report "The economic futuro of British Guiana-'.') published in "Social and economic studies> Univcrsity Collogo of .LÅfost Indies'\ .at the end of 1960 and discussed in the issue of March 1961 of the same review. Peter Newman does not insist sufficinntly on the parallel 0ffort that should be made in agriculture, especially at the start.

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imports, div rsify exports, improve _tho quality of food consumption, and build industries on the basis of domestic production of industrial commodities. Howovor, in many of its features the recent devolopmont of the agricultural sector has not moved in this direction.

Sugar yields have increased to the point where growth at the same rate is difficult to achieve. Rice yields, on the contrary, show a marked tendency to decline in quality as well as weight. At the same time, the constant expansion of areas devoted to rice, partly to compensate Lthe decrease in yields, tends to drive cattle away from the coast. In any case, it further reduces the already very low level of meat production, although milk has increased more rapidly than consumption. This prevents a rapid improvement of nutritional standards and causes deficits in the alance of payments. Import of foodstuffs totalled over 21 million dollars in 1960, which decreases the possibilities of buyingL capital goods.

In the first part He analys1 tho main products of the coastal region (sugar and especially rice, followed by cattle and coconut palm), so as to consider improvements that could be made immediately. In the second part we discuss the possibilities of other rcgi9ns in the interior of Guiana which we have u fortunately not seen adequately2,. The third part is a consideration of the rincipal means necessary for the essential acceleration of agricultural development. In the fourth part we attempt to collate the main conclusions. Finally, in a series of appendices, are notes regarding the areas we have visited, and some particular aspects of devc!opmont.

!J The U.S. dollar was worth approximately $1.73 /est Indies dollars at the time of the study in AuJUst 1962. Tho ÅI. dollar is worth 4 shillings 2 pence.

g/ Furthermore, where setting up of future agricultural production patterns is concerned, specialists in climate, soil science, phytosociology, etc. should advise first. Their conclusions may then be discussed by economists.

PART 9NE THE NEED FOR A RAPID IllT'JJNSIFICATION OF COASTAL AGRICULTURE., SUG.AR, RI..Q]L AND CATTLE, TO iA..."1:DS IGALMIXED FARMING

The first problem facing Guiana's agriculture is the choice between two basic directions for agricultural development. Tho first would intensify the agriculture of the coastal region, which is already provided, however poorly, ith a communications network. Tho second ould tackle the problem of developing tho interior. In the courso of this study, the dilemma presented in this absolute form v;ill be rejected.

Although sugar cane is very L,ell cultivatod, paddy fields leave a substantial margin for improvement. Furthermore, only a small part, one tenth at most, of the coastal region is under cultivation at present. Therefore the increase in acreage under cultivation could continue. However; where it requires very costly irrigation works, tho expense should be comparod with that of developing the interior. lo therefore suggest a threefold action hich only a bettor determination of the r0spoctive costs in tho future will make it possible to classify in an order of priority.

- Intensification of the coastal region already under cultivation, especially the areas not covered by sugar plantations
- Extension of acreage in tho coastal region whore reclamation cost (especially ,-,ater control and irrigation works) is not excessive in relation to the production potential>
- A cautious and gradual "conquest" of the interior, beginning with the regions readily accessible for transport of fertilizers and agricultural p.coducts, and choosing tho least infertile areas within this region.

A. Structure - f- .&r i.2..tu)r a;L Pr9duct ion J..n the Coasta l -og j. on

1. Sugar..p:'oduction, \7hich is alroa intonsivo, must lose tho .E).ant - .EE. mental

In his intcr.Jsting book "Dritish Guiana", A. Smith pays due tribute to the high degree of efficiency of tho sugar cstatcs, especially those of the Bookers group. Tho sugar yields per aLcro and per month arc among the highest in tho .lost Indies, and those fine results have required groat efforts in drainage and irrigation, that is, high investments and efficient agricultural practices. Scientific research at a high level was also necessary, and is associated with tho name of Dr Evans. However, the condition of these estates cannot yet bo considered cntir ly satisfactory. Sugar cane is providing fewer and fcuer jobs, and those romain mostly seasonal. Tho vrnrkors are usually employed part-time, so as to give some work to a larger number of people. Tho generalization of overhead irrigation would allow a saving of water and a further increase in sugar yields. Ho,rnvor, as it 11ould bo used only during tho dry cycles, which arc very irregular, it is likely to prove marginal, according to Dr Evans' estimates.

The plots allocated to the workers for rice cultivation are planted too late, as work on the sugar cane comes first. The contrast bet11een the high technical level of sugar-cane cultivat ion anu. the 101, level o.f rice cultivation is really too marked. the situation is still heavily influenced by the plantation mentality. The conditions of fodder procluction and ground provisions are even worse, very few ,rnrk:ers have a kitchen garden ,orthy of the name. It is true that the resp0nsibility for this situation is 1Jidely shared, but that of the sugar estates cannot be overlooked. Sugar cane cultivation by inclependent farmers is practically unknovm in Guiana but it will be examined in Appendix II.

/hat seems least acceptable is the almost constant under-feeding of the cattle, although cane tops are not utilized during the harvest periods, that is about eight months of the year. It is true that burning and the workers' practice of cuttins the cane too high as they are paid on the basis of cut ton; lower the weight and value of the tops. But the cane cutters, loaders and transport workers could be authorized to take away, at the end of every day, the tops that the estates do not use and which their cattle could consume. This is done at present only for fields near workers' villages. At the same time care could be taken to see that the workers do not let the leaves go to the mill, which lowers substantially the production of sugar. Of course this .vould lead to a considerable loss of fertilizer on estates that have no cattle, but this would stimulate them to get some, which would be the real solution, since the fodder value of the tops is much graater than their value as fertilizer. The savings resulting from cutting the cane at the proper height could compensate this loss.

The aorkers would also have to accept this new system, as well as the less pleasant work in unburnt fields. By benefiting from the tops for their cattle, and being better paid for cutting unburnt cane, they vould be less inclined to send the tops to the plant for the sake of earning a little more, and Guiana's economy Hould benefit considerably. Four acres of well-irrigated and fertilized cane could yield about 30-35 tons of tops. Rationally utilized, with the addition of a small supplement of nitrogenous feeu. they would make it possible to produce a bullock of abou.t 450 kg live teight. In this way the lOO,OOG acres of sugar cane in Guiana ,,ould make it possible to produce about 25,000 head of beef cattle per year, or a little more than the country's present output (1960, 22,500 head).

Of course, this would involve more work, but agricultural development requires increased employment, to the extent that this also increases output. The work would be a little harder, but the dr;; unburnt leaves would increase the humus content of the soil ma!dng the .tork easier later on. Therefore the "lstates could be requested to maintain, by 1965; one heall of beef cattle of any age per 10 cultivated acres. This density could be gradually raisccl to one heacl for every two acres (dairy or meat cattle) by 1975,

A second step forward, v1hich would be very important from the economic and social point of view, would consist of assigning a foreman on every estate to advise the workers on rice, fodder, cattle and kitchen garu.ening. He should himself maintain a pilot farm to serve as an example, \7ith O. 5 acres of rice, a model nursery (see Appendix III) 0.6 acre of foclder for cutting to maintain a good cow and her offspring, plus 0.1 acre of kitchen garden.

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A study of bagasse for utilization as fodder, alone or mixed with molasses for meat cattle is worth considering here, especially as Dr Evans notes a high proportion of fibre in relation to sugar. It has been exported to the United Kingdom, but its unit value is too low. This is not the case for local consumption, hm1ever, since it requires no such transportation. The surplus of bagasse is limited at present, but if a use capable of raising its value were found, other fuels - oil or wood - could be considered. Some eucalyptus and other quick-growing tree plantations quite near the mills could soon supply wood whose transportation costs would be greatly reduced (by canals). However, it is doubtful whether their use would be more favourable than that of bagasse, unless its value couldLbe considerably increased through its use, as in Cuba, as raw material for several industries (paper, fibreboards). This is a matter that is worth close examination. The mills are near enough to one another to concentrate a great deal of bagasse in one place if transport costs are lo ered.

In any case, all the development of the coastal region, all the intensification of production seems to de1end on a lowering of transport costs. In this respect the waterways do not seem to be used sufficiently and oonnections between them would undoubtedly make it possible to spread their use widely. greatly relieving the pressure on the road system. The latter is very diffiÅ cult to maintain on such shifting soils and in view of this as well as the la.ck of road taxes, it is in very poor condition. .1)good deal of caution is therefore necessary before deciding to abandon rail.transportation, and erhaps Lmore serious effort to modernize it should be made.

The main consideration is that the problem should heqceforth be approach:!d from the standpoint of the interests of Guiana's economyl/. The present directors of Bookers appear to have realised the need for rapid development in this direction. They can play a more active role in the agricultural modernization of the country (technical advice, distribution of fertilizers, use of by-products, etc ÅÅÅÅ.Å).

2. Rice cultivation is entirel_x unsatisfactor_y lack Bush Folder

The acreage under rice has grown very quicl:ly in recent years, but Pt'O-duction has not kept up ,ith it, as paddy yields per acre s em to have decreased since 1925 from 16 to 14 bags of 140 lbs each. Although they are increasing on the better soils 1hen the latter are properly cultivated, they are decreasing in many uthor places. New lands yield more, but when the drainage is poor, the drop in production can be rapid (Abary). There are also sharp drops un peat;)' soils, the "pcgasse" ,hich ,1erc formerly thought to be fertile; and especially on toxic soils. But the Soil Survey Team has definitely shown that if elementary good farming and fertilisation methods arc adopted, these soils can give good rice yields.

1} 'sxcerpt from Smith, :.ÅT, "British Guiana", pp.83-84" "The question arises as to when the interests of Bookers' shareholders coincide ,,ith the interests of the Guianese people, whether those interests are irreconcilably oppo3od, or vhcther some .verking compromise is possiblo which enables British Guiana to benefit from Bookers operations without paying an impossible high price in loss of economic independence.

1/ qo

From this we may conclude that rice, a comparatively poor, but floxible and sturdy crop, can, here as in tho Far East (North Vietnam for example) adapt itself very well to mediocre soils. The improved artificial pastures, having a higher production potential especially for millc, would on the contrary, justify the allocation of the soils. If this has not been done so far it is due to tho fact that people think only of tho very poor results obtained 1,ith natural grasslands. Of course the extension of tho rice acreage has spread it partly onto the poorer soils, but this is not tho only factor in tho lowering of yields. Tho farming technique gcmcrally used scorns faulty on a number of points, some of which have not been noted. They will be discussed in Appendix Ill. A recent example of a rice-growing settlement which requires urgent correction will now be examined.

Black Bush Poldor, located in the eastern part of tho country between Berbycc and L,corentyne, a littlo inland from the coast, is tho largest irrigation and drainage project carried out for land sottlomont, a "peasant" settlement in principle. It extends over 27,000 acres, and its civil engineering works alone must have cost about $14 million.[h] Å .{ith its throe rice mills, four schools (of a grandiose typo, but without any pupils), the pure water suppli s, a Community Centre, administrative buildings, etc., its total cost is close to i20 million, Hhich requires considerable returns.

We may take into consideration the engineering expenses alono, allocating 10% of them, or $1.4 million; for improvoment on tho private holdings of tho frontland, located outside the settlomJnt lots. This loaves j12.6 million for water control improvement and water servicing for tho crops of Black Bush Poldor itself. In order to be profitable, an invos mcnt must lead to an annual gross production of about a third of its cost. Therefore it would be necessary to harvest a crop worth about $4.2 million on this poldcr. In tho first year, 1960, at the village of Lesb holdcn, which was tho only one under cultivation, with loss than 2,000 acres of rice and 155 farmers, 35,000 bags of paddy were harvested. Tho yield sometimes went up to 22 and even 27 bags of paddy per acre.

In 1961, with 1,146 farmers and 17,000 acres under rice only 139,000 bags of padd/ were produced. But this was done ...thi procluction costs that wore almost all advanced by the Government through credit cooperatives. The latter g<1ve credit for seed and labour. Tho crop vas poor, tho above-mentioned 139,000 bags representing only 8.2 bags per aero. This is not enough, especially on now land. Actually, there was a larger output, but a substantial part was lost because of late harvesting, as the combines wore frequently out of order and there was complete reliance on mechanised harvesting.

(i) Mechanisation accompaniod by poor crops

Tho principle that all operations should be mocha.ni od has boon accepted, and this interferes with tho aohiovomont of full employment the contra.ct harvesters of tho first campaign have not yot boon paid in full. Since then, the Rico Development Corporation has undertaken tho operation of tho 22 combines. Those arc not onough, and above all their drivers do not scorn sufficiently exporioncod. Besides, daring tho harvest at Mibik:uri tho pauses scorn to have boon longer than the time spent in actual operation. This is likely to happen again during the noxt harv"'st. But there wore many other factors as well.

1/ The poldor's private road is tarred; which is not yet the case of tho country's main highway that runs along tho coast linking Goorgetmm uith Now Amsterdam.

Blast disease caused considerable clamago, and above all, \7oods wore no longer under control. During the export's visit in August 1962, too many fields were litorally overrun by them, and in 1961 this had slov1od dovm tho combines. "A combine is not a bush-cutter, nor a bulldozer", as Mr Thompson, Director of tho Land Sottloments, often says. This siti.n.tion is primarily duo to the fact that the \1ork is done too quickly, so that the preparation of tho ground remains inoufficient. Thero is absolutely no levelling of tho plots, so that much of the seed of tho paddies is placed in bad germination conditions. On tho high, and therefore unirrigated,sitos tho rice suffers and is delayed, and this favours weed grm,th :ion the low ground, the young rice plants, which arc too subm0rgod in vmter, die and leave largo gaps.

After the sowing, which is often done in tho manner described bove, the fartncrs did not weed, and only some of them used \mod-1-::illors. The lack of care after sowing is, unfortunately, general. In all those extensive **areas** we never saw anyone pulling out tho largest wo0ds by hand which at that stago and in that woed-infostec1 condition would have been an economically advantageous operation. The seeds of the weeds will multiply, and the invasion will increase still further next year.

It is the principle itself of this sottl0ment that appears mistaken to the foreign observer. If the purpose is tho completely mechanised cultivation of rice, it seems illogical to distribute cultivation plots of 15 acres per family, since they are much too small f.a.r.this technique. If, on tho other hand the aim is to create small family farms, only a gradually mechanised farming system would be worthwhile, to be adopted as the technical knowlodg0 and necessary capital arc accumulated. To pay for this mechanisation it is necessary to have a very intensive production with a high yield p0r acre.

In fact, intensive production is absolutely indispensable for such an operation to be oconomically profitable. 139,000 bags at $6.80 per bag brought in only $945,000 in 1961. In 1962, with only 12,000 sown acres instead of 17,000 as in 1961, it was hoped that tho output would reach or very slightly oxcood, 100,000 bags, or about $700,000. Even if we add a substantial allowance for returns on the plots of 2.5 acros attached to tho homes, the total will certainly not add up to a million dollars of gross income that is, **loss** than one quarter of tho level which should be roached as quickly as possible.

'Nevertheless, if cultivation wore carried out properly on levelled, prepared, woedod and fertilised land, it would be possible to h,rvest 300 bags per 15-acro plot in noxt autumn's harvest. This average of 20 bags per aero, on 17,000 acres alone would already bring a return of $2.3 million. ,1ith a spring crop raised on half of this area, of rice or a "dry" crop, giving a slightly lower yiold, another million dollars of returns could be add0d. If tho hou qhold plots are given special care, with intensive cultivation of vogctablesl!> bananas, food crops, and fodder for cutting or pasture for dairy cows, the goal of J4.2 million is by no means impossible. In any case, ,to 110uld have t0 acld an average $760 of returns per household plot of 2.5 acros. This calls for a much higher degree of intensive production than that achieved on the average on tho plots already being farmed, which arc themselves perhaps loss than a third of tho total numb0r. This figure is nevertheless not impossible to achieve. Mention was mado of a farmer ,,ho sold J1,000 of swoet potatoes last year. Of course; tho price will go down with increased pruduction, and it will soon be necessary to give serious attention to outlets and to marketing.

1/ In ord0r of importance, svreot potatoos, okra, bananas and plantains, cassava., tomatoes, popper, eggplant, pumpkins .....

Collective transportation of vegetables to the capital must be considered, as well as the setting up of a cannery. Okra (hibiscus esculentus) was selling at the settlement on 14 August 1962 at 10 per one cent, a ainst two per one cent in Georgetown. It would be logical to install a tomato cannery here. It should be stressed that this cannery would not work with the surplus vegetables that remain unsold on the city markets. It would require production especially designed and geared to it, supplying quality products suitable for preservation (with high content of dry matter) at a reasonable price for a number of months, perhaps the whole year round.

This goal of 760 gross income per househo d lot of one hectare would usually require one or two good milk cows per farm. Each animal would be fed on a half acre of Para-grass which would be planted cared for and renewed on low sites, since it can vdthstand immersion if it is not for too long a period. But the settlers, who are accustomed to free-grazing cattle, have refused to keep cattle enclosed in yards or tethered as this would require work to feed them Out of 1,172 settlers, there is only one farmer who has a dozen head of beef cattle, and he has no small stock such as sheep, goats or pigs. This figure is very revealing of the settlers' attitude to intensive farming. The ownership of a cow and the willingness to keep it in a stable should be one of the basic conditions for the selection of future settlers.

Achieving such a production level will therefore require a complete change, not only of techniques, but of the general attitude of the settlers. Firstly, they should live on the spot, wholly devoting themselves and their families to this \vOrk and maintaining at least a minimum number of roodo. L cattle. Secondly, they will need better guidance. The location of the technical management ten miles away from the villages, completely outside the Folder (for the convenience of the officials who, in this way, have been located along the main highway) was a serious mistake, It involved a loss of time for even the smallest procedure, which has ('Wito rightly) irritated the settlers. Furthermore, a number of the candidates for the settlement were not real farmers but rather former estate workers, Accustomed as they have been to the regular weekly wage of the sugar estates and the corresponding regular expenditure, they remain on the lookout for all opportunities of salaried employment.

(ii) 38 days of work a year

In.view of this montality and a concept of entirely mechanized farming, the only logical solution would have boon the large farming enterprise, whether capitalist, ro--LP9rative, oration-managed, or run by the State. But this in turn requires very good technical management, with an efficiency comparable to that of the sugar estates, both from the standpoint of competence and of authority over the workers factors which are likely to be lacking. One of tho farmers questioned, who cultivates his 15 acres, had to sow twice following floods. ie mention in passing here that under an irregular water regime, without total control of water, re-planting is much more suitable than direct sowing.

On his plot of 15 acres this farmer had smwn 6 bags tho first time, 4 the second, amounting altogether to 10 bags of soed paddy, at no.20, or a total of $102. Labour, at $12 per acre, cost him $180. Rent, at $17,50

per acre, came to , 262. \,feed k:illor was J6 and transportation of his 125 bags of crop to tho rice mill rame to 320, Gathering of these 125 bags by reaper-thresher combine cost him $1.50 per bag, or $187.50. This brings total expenditure to $758. As his bags were sold for an average of $6.20 each ('ueat.ing having lowered the quality below average) his returns amounted to J775, or $17 more than his expensesJ It should bo noted that his returns correspond exactly to the polder's average, and that t e expenses were nearly tho same for all the farmers.

Of course:tho work done was not groat, since tho farmer sets it at about 38 days per year for 15 acrls, but these days brought a return of only 45 cents each.: So 38 days per fsmily per yea.r is all the work the present concept of extensive and mechanised farming was able to givo a settler farmer family. It is a marked failure for tho settler, but it is oven more sorious for the nation. Black Bush is at a real doad end, as tho situation is rapidly growing worse.

Tho minimum amount spent, not counting civil engineering, for installing 1,172 families, totalled 12.6 million; or over $10,700 per family. This makes an invested capital of (17,000 divided by 38) 447 dollars to provide one day of farm work per year. Naturally this figure is open to criticism since some of the farmers have put in a great deal more work on their household plots, and ,10 have already mentioned that some of them have obtained large vegetable crops from these plots. But out of 1;172 settlers, only 406 actually livo on tho spot, that is, one third. Much less than a third of these housohold lots arc really used, and then only to the extent of a bare fraction of their potential output.

The work provided for the workers outside British Guiana who manufacture tho tractors, combines, gasoline, weed killers, lubricants, etc. \lould perhaps be comparable (although it is very difficult to make an exact ostimato) to tho jobs created for the Guianesc in the paddy fields themselves. Ml: onncth Berri 11, in his int Hosting "Report on tho British Guiana Development J?rogram 1960-64" page 33, notes "The cost per family settled, both in acreage (17 acres) and in money (about $2,500) is very high. Most of the expansion of agriculture in acroago andin numbers omployed must come from individual initiative. It is cheaper •.• " \.That would Mr Bcrrill say, aft-er criticizing a cost of P2,500, if ho were to learn that tho total cost to tho state treasury for installing a family in tho Black Bush Poldcr amounted to $17,000?

It is into.L·esting to obs:::,rve that this figure of $17;000 is .:1lso currently reached in Israel. But for that price tho settler receives prossuro irri&ation facilities operating by sprinkling, complete drainage, a house, a planted orchard:; and rnrking capital. His annual gross output very quickly reaches a rate much higher than tho $5,uoo per yoar nccesJary to begin making tho operation economically profitable to t110 country.

(iii) Tt.e. situilti o!! i!3.daily r;ro 1ing yv0rse, water is .}:> ing sted

!"hat is even more important to point out is that the situation on Black Bush Folder is becoming critical. In 1961 every settler, practically automatically, received a loan from the co-operative a encies; enabling them to pay for the seed and labour. As the harvest was poor, repayment wa!/ also poor, and at].hbilcuri a quarter only of these loans have been repaid. This is easily understood 1ith the typical farmer's budget previously outlined. Therelore, this year (1962) loans were limited to the cost of seed only. Because of this; about a third of the land has been immediately abandoned and left fallow.

Nevertheless; irrigation continues, the \rnter pouring out everyi.rhere a.t heavy and useless expense. Since 1961 it is estimated that three times the amount of water really necessary for the crop has been pumped in the Canje. Not only does this increase pumping expenses? but it makes drainage more difficult, if heavy rains come) as the absorption capacity of the drains is rather limited. The present situation is moving torrnru.s a real technical and economic disaster t7hose repercussions might even damage Guiana's international credit standing. It urgently calls for drastic changes, and it is hard for a foreign visitor to judge \vhich ones uould be acceptable. Nevertheless?, 1e shall try to find out those which seem most imperative, particularly for technical and economic reasons.

First of all, ,vater must be economised, and there is only one way to achieve this, to make the users pay for it on the basis of the volume supplied. conomy of water is particularly necessary for the spring crop when there is a danger of salt rising in the Canje again. During that season it will have to be made more expensive. The administration cannot check on the amount of ,1ater received by each rice farmer, but it can install a simple measuring device, scaled according to height at each of the five main distributing points. Later on, s ch a metre could also be set up at each of the secondary distributing points supplying a "section" of 18 settlers. For each day or night (12 hours)of opening, delivering a given height of water at the measurement faucet, so rnany dolla1Ls Hould be charged, ,thilo at the same time general rent could be lowered by subtracting the present irrigation costs. The hours of opening, for a section, exce8ding tho average irrigation needs would be charged double, so as to further discourage aste of water. It should be noted that such ,,aste is encouraged by the officially favoured practice of letting the ;;at H "run"; and circulate in the fields hich is absolutely unnecessary. Fertilisation tests on small plots, as experiments in Australia and the Far East show, prove that standing water is not harmful.

(iv) Levelling, dykes, transplanting, rotation, etc.

This measure ,,ould sot off a whole chain reaction of improvements necessary to salvage a critical economic situation. In each section irrigation expenses uould be shared among the farmers cultivating the same area, while at the same time seeing to it that nobody wasted mter. In this way, it would be only the one v.ho i7asted water who would have to pay for it, ,,hereas at present all tho farmers responsible or not, have to cover the costs. This would quickly lead to real ..,nclosure of each plot by a watertight dyke, and vrnuld stop the present practice of irrigating abundantly the uncultivated plots.

!/ For tho entir-;--Poldcr- --;;f the ,p24l-500 loaned :in 1961, less than tll7,000 had been repaid in Au6ust 1962 ,1hen all the loans should have been repaid, as delivery of paddy to tho mills was finished.

'later economy could be greatly increased if the farmers carefully l0velled each of their plots. For this purpose they could subdivide the plots by small secondary contour dykes which? in the case of Black Bush, could be established for every three inches of difference in altitude. Within this framework, the removal of the rich surface soil from the high sites would no longer be so damaging to fertility, as it would not generally exceed a depth of 1.5 inches. It is important to keep to this margin as the subsoil is almost totally lacking in nitrogen and is sometimes saline.

Later on, tho amount of levelling work required from each farmer will decrease if he is given plots whose greater length is parallel to the contour line. In this way the amount to be terraced by each farmer will be very limited, as will the thickness of the soil taken off by levelling. This ,1ould lead to a different arrangement for the irrigation and drainage canals. Perhaps it will also result in setting up smaller villages, so as to reduce the distance from the home to the paddy fields.

Those sections of tho plots which arc too high to be readily irrigated by the present canal network do not need to be planted to rice at all. Crops requiring less water but more drainage would suit them perfectly, e.g. cabbage and other vogotablos and, later on, some industrial crops, perhaps cotton. Tho lower9 and therefore more poorly-drained parts, could be planted with large-sized plants which could be obtained, if necessary, by transplanting twice rather than by too long a period in nurserios. Each sub-plot9 located between the contour lines .1ith a differ0nce of threo inches in height ,rnuld be surrounded by a water-retention dy-:e. Such a dyke would rise everyv1here at least 10 inches above the surface of the paddy field L,,hich would have been levelled. In t1is Ray the paddy could be sparingly irrigated with comparatively inexpongive ,vater as the latter would be supplied at its cost price. The water level could be kept quite low and at the same time the completely horizontal ground would be entirely covered with water, hich is essential to avoid wecdgrowth.

If there should be a rainfall of, say, 4 inches, then, as the irrigation water would cover the levelled paddy-fields at a hGight of only two inches, there would be much less of a problem for drainage. The farmer, only too happy to receive free rainwater from the skies, .rnuld carefully keep it on his ricefield which would thus be covered by six inches of uater. The amount of water to bz run off by the drains ,7ould then be greatly reduced. In any ò.aso even if the very young rice should get a li ttlc too much \later in this way, tho running off of the excess could be done more gradually, and it would no longer accumulate in the low po nts as it does at present.

(v) <u>From levelling__!_2_transplantin__g_and_to_double-crE.E.Q_ing_</u>

This levelling1 stimulated by the ne3d to economise ater, ,ould then oncourage the practice of transplanting. It has been found absolutely impossible (in all tropical areas) to meet the costs of a real irrigation network with a sin le poor harvest of a cereal crop (and therefore relatively low value crop) per year9 e pecially if it i mechanised,. This is wel k1:wwn by now, and we recently pointed out a classic examplel/. Due to continuing deficits tho mechanised land sGttlement of Molado at the Niger Office (Mali) is at present undergoing total roconv rsion from mechanisation to draught

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l:Zs"ee Dumont, R/ "La reconversion agricole des Republiquos de Guinee, du Cote d'Ivoire et du Mali" J Revue "Tiers Monde", 1961 (Spring) Presses Universitaires de Franco7 Paris (96 Bvd. Raspail, I.E.D.E.S.).

animals, ,1hich proves that such a changeover is possible. Since Independence, the Mali settl.rs have been contributing t-- the improvement \rnrk in exchange for a s all indemnity, and are working harder than before, so that the cost of teri'acing a cubic metre has in some cases been loÅvered .fivefold. It is true that the United States and Australia are able to produce mechanised rice economically. But these are dcve].oped countries ,1here a structure for servicing tractors exists, .,ith spare parts and good trained mechanics. Guiana has not yet reached that stage.

Transplanting of rice by hand is time-consumingJ.}, it is therefore necessary to design, manufacture and spread the use of an animal-drawn transplanting machine on the Chinese or Italian model. 'hth a properly operated nursery, this machine raises yields (see Appendix III). Therefore it is much more urgent than the "combine" which merely saves ,L,ork, with doubly disastrous economic conseQuences in a country for \Jhich unemployment and lack of foreign currency constitute the t o most serious problems today the real bottlenecks to development.

Such a transplanting machine could be locally manufactured very quiclcly by small mechanised :rnrkshops \7hich would gradually clevelop into factories. It would make double cropping possible$ while saving enough time to allow for a proper preparation of the ground, .,hich is certainly not the case with double direct sowing. The two crops would generally be rice that would be inevitable in the low-lying a.ceas which are cheaper to irrigate and, above all, are harder to drain properly.

On higher areas, rotation ir. the ::a.meyear of rice and so-called "dry" crops, not immersed buts.limply watered) may seem profitable in some cases. On well-drained lands it is worth trying maize of course, such maize must be fortified, but that \70Uld be l18cessary with all forr,1s of intensive double cropping. In the low areas, the double rice crop would make a better protection against weeds possible. Later on, uhen livestock raising becomes sufficiently intensive to bring good returns on the outlays it requires? quick-growing fo lder crops (maize, sorghum) might be i:1lanted on well-drained paddy fields, in soils that are not too clayey. But clay and poorly-drained soils arc particularly suitable for rice monoculture.

(vi) Practical remedial measures

In British Guiana at present it is less imperative to make long-term plans in agriculture - vrhich may be very useful cls.::rv,here - than to quickly remedy the most serious errors in existing operations. If these continue even for a short time, they will mal:c impossible any correctivc measures. In the case of Black Bush Poldcr we therefore suggost the following measures? which may serve as a test of the real possibiliti8s for a rapid correction of the situation in Guiana :

(a) the appointment of a single dir3ctor, responsible for the whole project? and having authority over all its departments (land development, agricultural officer, cooporativc officer, d:caii1age and :i,rrigation, local authorities problem, selection of settlers ÅÅÅ) 'iithout a really competent director, vested Nith sufficient authority over the settlers, no real cor1Lection appears possible. It uould be possible to reinforce tho director's authority from the outset by issuing the following announcements? -.,hich would also indicate the main course the corrective /measures are to take

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It is claimed that not enough ,,orkers can beL found. At the same timG, expert studies show that there is an unemployment rate of 18',oamong the active population. But thG excessive dif[crc cG of living standards between town and country turns tho unemployed a,1ay from farm ,rnrk.

(b) within two years, at the latest, any settler ,1ho has not cleared, levelled; drained and planted the \7hole of his ho sohold piot \7ill be deprived of all rights to his sottloment plotb ..

(c) at the end of throe years, any settler v1ho ha.s not provided complete and correct cultivation of his paddy fields every y::iar (elimination of woods) ,Jill be deprived of his rights.

(d) Jithin four years, any settler Jho has not established half an aero of good fodder crop and acquired at least one dairy cou '.Jill be deprived of his rights.

(c) tho same will hold for any settler ,;,hohas not lev::illed his paddy fields at tho end of five years.

(f; the decision to make users pay for -..rntcron tho basis of tho volume used will be applicable as soon as the simple m::Jasuring devices have been sot up on each main distributing point and, later; on tho secondary points, and in any case \Jithin t\7o years at tho latest.

(g) a sharp increase in the number of shares nc'Jded to become a member of a co-operative. At present, membership is practically compulsory, but costs almost nothing and the settler docs not fool the slightest sense of obligation. For him co-operatives arc ''the Government's business". It is important to put an end to this state of mind quickly. The settlers' membership payments should amount to a third of tho va ue of the equipment. in this ,ay, they v1ill take good caro of it, which is not tho case at present.

(h) as a short-term measure, and to stress the now orientation and the firm stand of the responsible authorities, it would be best to refuse to rent tho combines for tho harvesting of 9lots excessively overrun by woods. On plots only partially invaded by -.,eecls rent would be authorized, but at a rate of 50 . higher, or L,i;2.25per bag. However) those measures '.10uld be practically inapplicable unless announced in advance.

A recent Government decision provides for combine harvesting of only two thirds of each settler's holding; i.e. 10 out of 15 acres. This measure uas taken on the basis of estimates sho lingthat this proportion of hand labour w uld ensure maximum employment and, particularly maximum earnings.

The subsidy for planting coconut palms should not be given in this caso 1 for many r::Jasons i c. g.

- the land is fertile and labour is under-employed, if settlers plant (as envisaged) 2 acres of coconut iroves j they arc certain not to find a ull-time job in tho paddy fields and tho remaining half acre. coconut provides little work.
- coconut palm is one of the few trees capable of Jrowing well on "sand reefs" of the salty coastal rogion, all Gfforts for coconut should ther fore be concentrated in this region;
- compact uninterrupted plantations arc necessary for adequate protection against insJcts and diseases.

-!e feel it would be preferable to increase e_mployment by more intensive farming, levelling and perhaps transplanting. Rather than mechanised cutting of t o thirds of the paddy fields, we ,,ould r commend an overall mechanisation that would save labour by t.10 thirds .,ith the use of less costly materiaL that is, the motor-mm,er and, later, the reaper-thresher. This would make it possible to recuperate the straw hich could be used for fodder and stable bedding.

Bla . Bush Polder. is he::idin g for disaster unless reallL. effective measuresY are taken at once.

(vii) Excessive priority given to rice cultivation

It will be shown in Appendices IV, V and VI that at Abary, and even more so at Vergenoegen and at Anna Regina, the situation is not as bad and is even a good deal better than at Black Bush Folder, although it is not yet really satisfactory. HOi,ever, an irrigation net,10rk often costing over $700 per acre cannot be paid for uith a single rice crop per year. Although in 1960-61 Guiana exported 15million of rice per year, it spent 8 million on the purchase of farm equipment a good part of which was for the paddy fields. And it also imported foodstuffs for a much larger amount, at least $21 million. Therefore the priority given to rice, :,hich brings such low returns for the last fifty years seems excessive and economically dangerous to the country's future. The irrigation and drainage of high lands woll suited to crops other than rice and ,vhich generally bring hig.1er returns therefore deserve priority. This calls for a thorough re-examination from a new angle of all the irrigatio projects currently under study

Priority should thus be given to the high, fertile lands which, because of their location, will be cheaper to drain properly. In fact, garden crops could be planted on them (fruits and vegetables, tubers and bananas) hich would replace imports, improve nutrition and even allm1 fer some diversification of exports. Zxperiments with industrial crops, such as cotton, will sho;;; ,1hether great hopes can be placed on them, although the cotton harvest is often hampered by the rains hich are irre6ular and difficult to forecast.

In the midst of all those doubts, one thing is certain. British Guiana imports large quantities of animal products, ospocially milk and dairy products -.1hich it could produce on the spot. If irrigation networks ,ore installed, especially designed for artificial pastures, tho cost of large-scale milk production could bo brought down to a reasonable level (Appendix VII). To achieve this result it is first necessary to completely modernise the present conc0pts of animal husbandry.

3. Livestock production is in an even worse condition

Stock-raising in Guiana's coastal region may be described as an "East Indian" type. The animals are hold more or less for tradition's sake, and are maintained as a form of savings against the time when an urgent need for cash may arise, or to provide do rries for children, .rth t:1is concept, numbers count more than productivity, and capital more than current income. The coastal region harbours far too many animals, not in relation to hat it could feed, but to its fodder resources. such as they are, being utilised at present.

1/ Naturally such measures can be diffGr0nt from those we arc suggesting, but they must in any case be carried out.

Cane tops arc buried in tho ground, rice bran and molasses arc oxported, and rice stra,1, 11hich constitutcs the chief cattle fodder of Southeast Asia, is burnt. Communal pastures are unimproved and over-grazed their drainage is often poor, thus, Hhilc rice is grov,ing grazing is done mainly on the marshes. Tho 101-quality fodd3r rouing in those marshes is more suitable for buffalo, raisocl for meat, 1hich is so highly appiL0ciatcd (tests carried out by tho Faculty of Agriculturo in Trinidad), than to iÅaquatic" sheep. Tho low protein content of tho fodder is unfortunately its chief characteristic. As is tho case for most tropical ani al husbandry, lack of protein is the foremost stumbling-block of Guianan stocl;:-raising, :follm-1od by mineral aalts doficiency.

This form of stoc:.:-raising produces mainly moat, but in such small quantities that there is very little economic incentive to stimulate its development. Furthermore, Guiana's peasant is first and.Jibremost a crop grmmr, not a livestock farmer. Thus, as soGn as a piece of land is sufficiently 1.lraincd, he would never dream of csta"Jlishing an improved pasture, but .,ill immodiately turn it into a paddy fiedd. In doing so, ho is only carrying on in a way tho sugar plantation tr dition, v1here the approach ,ms in tor s of exports and not of cattle for domestic consumption.

Nevertheless, meat and above all dairy products are imported in British Guiana in huge amounts. For those commodities there isL an existing local market that is assured and ""'uarant;30d for the future, uhich is not the case ,1ith sugar and rice. A greatly incro sod ration of animal prot in in tho diet seems to be the best moans of improving public hoalth and consequently tho quanti y and quality of productive effort that could be expended by Guiana's people.

Mille production appears of considerably groater cccncmic advantage. The best dairy livestock raisers in Jamaica, vith tho artificial pastures of Pnngola, fertilised .a;nd irrigated in tho dry season, man:a.iÄPo maintain one good c0\7 per aero. T:1is .figure is oasily surpassed by tho Bel Air dairy near GJorgotavm (Appendix VII), ,1ith co'.isyielding 700 gallons per year. On this basis ,10 can roughly estimate that 200_gallons go to pay for concontratod fo3ds, leaving 500 gallons of gross income, after deducting purchase of f.Jods. At SO cents per gallon (tho Netherlands price) this com.JS to $300 per acre. Rico can no longer be comparod. -.1ith those earnings, 14 bags at $6.80 per bag bring in ,i,95 per aero as a nation-\/ide average. Tho best rice farmers succcod in earning over $200 per aero only on exception--.1 occasions wh,:m they arc able to harv:)st t\70 good rice crops a year. But tho possibilitics of such results with livestock havo not been demonstrated in practice to Gui na's farmors and settlers.

The development of dairy production should begin ,1ith a reorganisation of the milk pasteurisation plant at Georgctonn. It could be based on the rocent study by Dr Lovie, FAO Marketing Export. Ao a general policy, first of all, the prcsont price of milk should b0 lo,orod during tho pericds of over-abundance, L-1hilc it should be maintain8d during the months of scarcity so as to give an incentive to regularisation of tho supply. Instead of throwing away excess milk, it could be made into po\1dcr. In tho long-term, development should be touards concentration noarer to the capital of production for consumption as fresh milk. This ,ould reduce the cost of distribution and improve tho quality of tho mill:. Quality should have a strong incidence in tho fixing of the purchasing price.

Tho milk for processing could be produced further a\1ay, and for this purpose ,Tc suggost a study of t"v7omain areas, one for tho near future r1ithin th,3 frame11ork of the Tapakuma irrigation project, or even near Mara (Borbico coast), the other, at a later date, around Ebini, near the Berbice Rivor in the interior.

4. Fodder improvement, the necessary basis for a new agricultural policy

:Lith :3lophant grass (Panicum purpuroum) in Puorto Hico, oven larger quantities of milk have b:rnn produced. The fantastic output of 2,400 lb. per acre in livc ,wight of boof m1s also 'lchioved thor.J, and tho 11orld record of 25 tons of <.lrymattor per year per aero ,ms sot. Yields in milk and meat t,,,oor threo times higher than those of the best producers in :astern Europe arc now possible in Guiana on condition that good animals entirely free from ticks arc adoquately fed. A tick elimination campaign in tho coastal zone, from the Surinam frontier to Charity, similar to tho one that was successful in Puerto Rico, ,rnuld greatly facilitatc a largo development of dairy production.

The first cornerstone of agricultural development lies in considoring fodder for cutting or p sturo grasses (Pangola, Kudzu) as real high value crops. "Grass is a crop". Tests should be made to determine the best doses of fertiliser and the optimum rotation of grazing land (21 to 30 days?) as ,Tell as the best fr:::iquency for cucting of Para, Elephant and Guatemala grasses intervals of 4 and 5 \L:ooks bet:1oon each cutting could be tried, but with heavy fertilisation, other:1ise the plants become quickly exhausted. Along Tiith those improved practices, t:rq:ri.calKudzu ,,ill groatly increase the protein content of the grasses, Hhich L,fill make it possible to clecroase the use of concentrates, hile at the same time incre,sing the use of fertilisers, which arc more economical.

The danger of the Surinam virus for the future of Pangola should not be exaggerated. There are other grasses that could replace it if no varieties of Pangola can be found hardy enough to ,,ithstand tho Å.rirus. Cynodon dactylon (Coastal Bermuda Grass), on the coast, has already proved to be one of the best grasses. Cut fodder is oven more productive than Pangola, but it requires more ,,ork vtays should be found to reduce to a minimum the time devoted to handling operations (Appendix IX). For this purpose, the coL,,s could be brought close to the cut grasG, or the latter could be transported in carts, which would rc ire small roads inside each farm, Ålhich is also ii1dispensablo for their real modernisation.

The second cornc:i.Lstone of agricultural dovelopr.ent ,.rnuld consist in the Qevelopment of an intensive livestock production in British Guiana to be considered as a real processing industry, capablo of uoveloping and utilising a number of raw rn torials in the same Å;,ay as an industrial plant. Hence, the sale abroad of molasses and rice bran in order to buy so much meat and dairy products should no longer bo considered a Sdtisfactory operation for British Guiana, it is the same as ma:dng a concession of all the bauxite instead of trying to process it into alumina and aluminium. The possibilities for the devGlopmont of livestock ?roduction in the coastal area Hill be discussed at length in tho various Appendices to this report (especially VII and VIII), and some possibilities for the "interior" v1ill be examined in the second part.

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5. T..A_E.s>_t2_ _i.,0?ar:tif_i_S?_ial past es_ Jitp _9_rop_s i_s essentia]._ to ..? Ä3-.i!l. f_u)..:!-eeÃ1.e..l .ine_mn-9-intep.A..t{i_c_at_io!!o{ agr_ic:):.fl)_ll.F_e

The full exploitation of the soil and full employment of labour would be more easily achieved by a close association of li restock (p oduoing milk and meat 9 fertiliser and :10rlc) .,ith cultivation (supplying the livastock \lith high quality cultivated fod.ler). So far those t\7o :dnds of activity have either been separate (cattle mmers possessing no land, or farmers v.ithout cattle), or else they have been set in juxtaposition, razing lands on one side, crops on the other. T11is has caused the yielJ.s of grass on grazing lands and of cut fodder t.o fall even more '1Uic1:ly than those of the paddy fields. This permanent separation could be abolished.

The rotation of grass with crops, the troJical "ley-farming" could frequently provide the ::ey to this problem. Ho\1ever, it is contrary to the pla.ntation mentality, ,1hich 'las rejected it a priori ,1ithout al,mys sufficiently examining this essential form of progress, even though it is sometimes difficult to put into effect. Fa.llo:1ing ap.iears necessary when the yields of paddy fall too low, and the rod rice multiplies excessively. The farmers are then satisfied (Appendix IV) to let cattle graze on the natural vegetation, Jithout trying to increase its quantity or raise its quality. An important task to be suggested to the experimental research station "Mon Repos" near Georgetown would be t'1e study of economic rotations of fodder and rice on clayey and peaty (pegasse) soils, more or less well drained. The ne\/ paddy fields yield considerably more; and the period under grass aould "rejuvenate" them, Å:1hile old pastures deteriorate rapidly and their production collapses.

Such a rotation is not always easy to realise, ns adequate drainage is still the indispensable preliminary condition for tho installation of a good pasture, this explains the difficulties met at Abary. "lb.ere possible, as at Ver.J3noegen, it should be done only by compact areas, other,ise the neighbouring rice fields would prevent a good lrainaga of the pasture. This would require a collective practice of rotation, a practice 1hich can be imposed only after the proposed technique has been successfully experimented on the spot from the technical and economic point of vi TI and a practical demonstration has been carried out.

In rotation '>,ith sugar cane, the flood-fallo,1 certainly offers many advantages. It could be usod, as in China, for fish production if tho ,mtar is not too highly toxic. To int3nsify this kind of production it ould be necessary to provide crops to feed the fish artificially; as in South China. \lhen tho uater resources have been stab:..lis8d so as to ansurc a regular supply, the uater,7ays uill 3asily be able to sustain this typo of fish breeding, rovided that those ryho pay tho costs arc assured of getting the benefits, it should be noted immediately that at present this scorns impos-L sible. The extreme poverty which results in potty thefts constitutas a major obstacle to any far-r aching intensification of Caribbean agriculture.

The third cornerstone of a full-8mployment system of agriculture could be provided by the d velopment of ground provisions. In adJ.ition to the local market, Guiana, which possesses so much irrigable land, could supply the Caribbean islands J.uring the s:rnsons .,hen tho latter cannot 'Jroduce these commodities, or only at excessively high prices. Yams edcloos, cassava, plantains, tannias, black eye poas, etc. could in this way be disposed of in large quantities. The .mste matter of th.::mecrops also provides fodder.

The fourth cornerstone \7ould be provided by 1ogs and poultry. !e have pointed out in Jamaica the importance of b nana tree trunks and loaves, -.1hich are rich in protein, for hcg raisingo Rice bran, copra flour, Kudzu and banana l0aves, together iith the waste from tubers ,hich are too small for sale, can supply fe,::idfor substantial hog raising. This ,7ould make it loss expensive than with the exclusive use of compound feeds entirely imported from the United Statesо It .,ould also be highly ,1orthv1hile to prepare supplements to these locally produced diets, -...::1idhould include min3ral salts, vitamins, antibiotics, and (if necessary) proteins.

Poultry could be readily expanded behind tho coastal area, on the \lell-drained white sand soils which arc very suitable for this production, or else to tho ,7est of tho Essequibo river ban cÅ

6. Coconut palm is too neglected

Although coconut palms cover largo areas, production remains entirely insufficient and the yield per hectare extremely low. Ho,,ev<n, in contrast ,:ith tho situation in Jamaica and British Honduras, British Guiana is outside the area r3gularly devastated by hurricanes, nhich should make these plantations more interestingo New planting is being carried out but not under tho best conditions. Tho recent ex eriments made in the Ivory Coast l/ hage shorm the great advantage of planting dwarf hybrid varieties with higher yields, a shorter period before bearing and smaller trees. This would raise the problem of thefts of the coconuts, hence the necessity of communal guardso Tho addition of nitrogen and especially of p tassn m has, in that country as in Dahomey, tripled tho yields of the young selected plants and c.bublod those of tho old plantations. Jamaica has also obtained highly successful rosults ,lith fortilisers, It has sat up pilot plantations throughout the 'whole of tho eastern part of tho island.

The ne,7 plantations grow more quickly if instoacl of im,rodiatoly estLLL ablishing cover plants (Pueraria, Centrosoma, Calopogonium ÅÅÅ), ground provisions were intercropped for tao or three yon.rs. This r,ould gi vu quick returns and sharply reduce the necessary investments.

Tho cover plants may be ostablish0d lator, and should make possible grazing by high-yielding millc cows, an interesting no i form of mixed farming. The visit of a French coconut spocialist, Mr Fromond, seems vor 1usoful for tho application of the most modern techniques in British Guiana J. It is therefore in Guiana IS into1Lost to take a chance on coconut, but not just blindly. In well-drained areas, this tree is capable of utilising, thanks to fertilisers, rather poor soils, oven if thay arc not ,,-,holly salt-froe. That is why ,1e have advised against tho extension of these plantations on tho best lands of tho Black Bush Folder (cL Section 2 (vi)),

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1) Coconut Balm Station of Port Bouet; Ivory Coast, Diroctor, Mr Fromond

g/ Mr Fromond can be reached at Institut de Recherches pour los Huilos de Palme et les 01Jagineux, 11 Place Petrarque; Paris 16, France.

B. Tho _'i.bsoluto lfocossit Coastal Iatonsification L hroug_h a Better pontrol of tater

Defonce against tho sea is absolutely inlisponsablo to the Guianan economy to protect tho country's only really fertile soil, but it involves very high general overhead costs, ospocially for protection dykes and drainage \"7hich must be paid for in any case, regardless of the 9roductivity of tho protJctod land. Those heavy costs have, so far boon greatly underutilised due to tho low l0vol of agricultural intensification, except for tho sugar estates. This is also due to th9 fact that only 10 of this coastal area (which is very variable in fGrtility) is farm,d at present. The remainder is lying fallm,, or under lo-1 quality .JOods or bad; marshy or overgrazed pastures uhoso productivity is often ridiculously low, osp::,cially in relation to tho country's needs.

Vast areas of alluvial marine clay soil along the Corontyne river south of Slrnldon are not yet exploited, although the study of the Intarnational Bank for Reconstruction and Dov0lopmcnt classified this as .,.priority development zone. In the northwestern part of tho country, southeast of Moboruma, there are also largo extensions of new and rich lands, but tho necessary drainage appears to be particularly costly.

In tho villages themselves especially those of tho frontland, there aro plenty of good, even 11011-dr.ined lands that continue to be unexploited or badly used. In Southern China, under such conditions, they ,ouldbe producing largo quantities of fruit and especially vegetables. This problem of kitchen gardens and orchards has not yet been given all the attention it deserves, despite some recant efforts in this direction. Other ell-drained lands, vhen covered by poor pasture (o.g. many village pastures such as those of Vorgonoegon Land Settlement, sec Appendix V) do not produce avon a tenth of their potential yield in cut fodder, Pangola or Kudzu if they Herc highly fertilised.

This is the sector in uhich offorts L;10uld be most immediately profitabla if a largor, more competent extension service ,1)re available and, above all, one more devoted to tho farmers' interest (sec Part Throe, Section 7). It should be combined Tiith a supervised credit system, such as is already in 0ffcct in some land settlements, and a strong cooporative orgc.1nisation, of ,,hich Vergcnoegen offers an example. The attention of the village councils should be drawn to the enormous possibilities for improving the village pasturGs. Their gr::iator output, of a higher q_v.ality, .:culd justify substantial grazing taxes, as the Oitncrs of the animals Å;1ould obtain hii;her returns. This may sometimes r)quirc tho addition of limo, rot,tion grazing, pasture guards, and lator on enclosures, as \loll as the use of fertilisers, although the latter 11ould only bo really LJrofitnble on .:.1Ltificial pastures of Pa,1gola for example. This basic progress is indispensable also to justify the cost of enclosure.

Hovrever, inadeq_uato water control obviously remriins tho main obstacle to greater intensification of a6riculturo on tho coast. The expenses necessary for total control in the coastal area v1erc cstimatod ton years ago at around j400 million (Hutchinson Plan), Tihich certainly justifies some hesitation in undertaking such largo-scale operations. ,1ith such oxp.:mditure in fact, profitability becomes highly debatable if agricultural int nsification should remain as lon as it is no.1. Th:raforc, a study of this problem should be

taken up again from a more rational standpoint. Instead of examining only neV7 projects; lil:o those of Tapakuma or Black Bush PolJ.or, tho best order of priority .for all tho uorks. to be carried out, on t!10 basis of their productivity, should be urg0ntly established.

This might sometimes load to tho conclusion that some improvements on old projects \:ould be much more profitable than n3v1 onos, .:1ndtherefore deserve priority. Ofton it is merely a matter of better maint0nance of existing works. There arc some points where bottlenecks could be oliminatcd ,1ith a limited outlay, thereby impr0ving the \tater control situation of large areas. An expert specialised in the search for those bottlenecks could travel throughout the countryside accompanied by local authorit:ms and farmers' reprcJontativos best able to point them out to him.

Another advantage of small and medium-sized improvoment .10r!m is that the former could wholly and tho second partly be sustained by local budgets. It ;;rould oven be possible to sot up four catoc:;orics of ,mtor control and irrigation .7orks. Tho small drainage and irrigation c3.nals on each farm should obviously be paid fer by tha farmers. Tho first category of small collective canals could be paid for by compulsory drainage and irrigation organisations. Those bodies could be formod by qn association of all tho farmers concerned in each irrigation and drainago district. Refusal.to do tho maint Jnance uork on tho part nssigned to a farmer vrould involve payment of a tax that would cover tho cost of hiring someone olse to do the job.

The second category of c nnls, hich aro the larger ones j would be the only one loft to'.bo paid for by the local authoritics. They should be authorised (as is still done in Europe to this day) to impose unpaid labour uotas, a sort of labour contribui;ion to ::rnsuro tho maintennncc of these canals. To demand a tax in cash from peoplo Tiho hnvo no cash income because of the lack of rogular employment, but vho for just that reason have plenty of free time, seems entirely irrational. The export himself partici 1ated \Then he as young in such :orlc quota::; for the maintcnanco of village roads, and European fe.rmers do so L,1illingly as they thomsolves dir::ctly benefit from the 11or!c. Obviously it would be more difficult to demand that the 1.rork be done without remuneration if thoso who carry it out aro not to benefit personally and directly from it.

Those who nre able to pay this contribution in cash may of course do so. But all th;:;sc taxes havo been put on a cash basis too quickly in an environment thnt is not yet sufficiently involved in a money oconomy to enable people to pay them easily. The problem has therefore been solved by leaving a large share of those costs to the, State, nhich in turn increases rural underemployment and, in vicv1 of the many demands on the I1reasury7 delays economic development. Therefore, to discourage payment in cash, the money tax could be set at tv1ice tho minimum wage / or 6 per man day and not c0ntributed in kind.

Such labour contributions could be advantageous if carried out 7 whenever possible, through tasl<:-.10rk1 with a certain amount of tcr1Lacing, for instance, corresponding to a 1Tfan-day. Tho use of drau0ht animals should be highly encouraged? and to thisL effect the loan of a draught animal per day could be made equivalent to a man-day. ThiG \Jould also shov1 the farmers n3w .tays of using their animals, particularly the donkeys which arc so despised at pr rn..Jnt because people do not know how to use them.

For the poorest QGOplo, a food r tion could be provided during the period of the ;;1ork. But hero ,e must sound a v,arning, this tax v7ould have to be paid by the land-holders first, and in proportion to the size of their holdings. But it ,1ould also be advisable to req_uire a certain minimum amount of uork from all the village inhabitants, as improved drainage benefits everybody.

Thus it would be the greatest error to neglect tho intensification of coastal agriculture, as it is tho only point ,,here important results can be obtained im111odiately and the currency problem relieved. HoL./Gver, if this involves no large-scale and costly projects; such as Black Bush Folder ,-,hose very low profitability no h3.vo already discussed, then it is justifiable to hesitate boh1eon those pro joct s and certain kinds of development of tho interior. 'To will cxemino some of tho latter chiefly from a theoretical point of vicYI. Nevertheless, a r3consideration of the Hutchinson Plan, in the light of ncv7 techniq_ues, will certainly be necessary in a few years. In tho prosGnt economic situation, it seems generally preferable to give priority to small projects ,1hich are often more profitable and ahmys q_uicker to realise, the full oxploitation of possibilities for small ,1atcr control and irrigation "i,orks can be immediate.

PA.EiT T /0 - D:TBLOPMSNT OF J'HE IllTERIOTI

1. Th0:re should be no haphazard sottlorn:,nt. of tho intcrior. zonin g of crop

The gr)r.ttadvantage of tho interior is that large areas ar0 ::i.vailablc requiring littlc or no p:celiminary largo-scale ,rntcr control and irrigation Lirnrks or very costly drainage. Of course, S\iampo are plentiful, but "'.hoy can al\mys be avoided at least in tho first stage. Therefore tho two basic obstacles to development of tho interior arc.

- the enormous cost of tho necessary communications not,10rk;
- the general, somotitlYlo extreme, poverty of tho soils

Tho so tno factors arc closely inter-related. Boc-=iuse of this alrnost constant poverty of the soil (o:xi: opt for certain alluvial rivor soils ,1hich arc very limitod) r0al development L,!Ould require a groat volume of fertilisors i dephosphorisation slag, nitrogen, sometimes limo, potassium and minor clements. They \iould be profitable only 11hero their transportation cost is not too high and tho shipping out of agricultural products from these regions, 1hich are too under-populated for any sizable local consumption, is also not too costly. This rules out any real development of tho Rupinini savannah for many y0ars; in fact, ,10 10uld easily post pone such development, in tho light of our present knoY1ledgo, tov1ards tho end of tho present century.

To start "iith, lot us make it clear that 10 can no longer hope to find any r0al and sizable agricultural 31 lorado in Guian::i.'n int.)rior, comp r'.1.blo to tho coastal area (so f0rtilo on its clays) -:hose production, taken by itself, '<IOuld justify tho creation of a ,id,:,spread, closoly-,JOvon communications n::itworlc. Should a road be created for a mining or industrial centre and a population centre be set up in the interior, it vould on tho other hand be wholly undesirable for this contr,:, to import all its food r0quiremonts from abroad, or oven from tho coast. In this particular case, a local rnarket is arising and a road exists. Hence an agricultural settlement primarily in response to local needs is necessary and should be assisted. The soil may be poor, but agricultural p.roducts ,1i11 find a good market as long as they arc not over-abundant.

Starting Ylith this first settlement, if its results ilith somG crops arc good enough nd tranportation costs not 3XCJSsivo, some oossibilities for agricultural exports b3yond the roquirornant s of the locnl market could be examined. If the centre is very far, th3 choico should f ll on high value products per unit of L,1oight, such 'ls moat or ,1cll-fcrment0d cocon beans. But, beyond tho regional demand, there should bo absolutely no bananas, plantains, root ond tuber crops nd other ground provisions; and, in gen0ral, low value crops.

If there is a main highnay, justified by other than agricultural considerations and crossing vast extensions of sands Tihich arG not too poor (bro\7n sands), some crops ,,ell suitocl to such soils, such "s pinoapple and citrus fruits,could be considered. These could be concentrated around a canning f ctory (slices, juice) if t:onsportation is not too costly. Unfortunately, these tuo products ara facing very severe competition in foreign markets; pineapples, particularly, iiith Ha mii, Singapore nnd Africa; and citrus \iith Florida, California, South Africa and tho -,7hole Moditerranean b2 sin.

Of course, tobacco and groundnuts arc equally suitable to sandy soils, and especially to brown sands. Tho demarcation of those sand aroas, which are less poor than others, is therefore necessary, this is tho purpose of the Soil Survey's work at present. Tobacco needs a high density of vrnrkers, and can remedy unemployment more quicl:ly than any other crop, given the same expenditure for fertiliser and drainage. For example, it would require about 150 to 200 man-days of L,10rk per acre, including drying, hand-picking and sorting, whereas sugar cane needs only 40 to 50 days. But it lso calls for highly developed techniques, esp:ocially in tho drying stage, to achieve good quality 1hich is the only kind th:,,t is econumically profitablo, and here too competition is keen.

South America, so underpopulated in general, presents many examples - particularly in Brazil - of haphazard, scattered settlements which soon become "senile" and whose economic consequences arc clisastrous. To mention only one famous example, 1ftor the first coffee expansion in the State of Sao Paulo the ruined lands wore practically abandoned and only very poor spontaneous pasture grasses arc to be found there nou. So the very expensive railways and roads have to cross V'.lst stretches of almost totally unproductive land before roa.ching tho no coffee arcas that is Lwhy the rail11ays arc running at a loss, even though they raise their rates. Tho now Guiana must absolutely avoid such waste, it cannot afford it \7ithout compromising its economic future.

Therefore tho development of the interior must bo based on long-term plans to be carried out in ,,ell-defined phases. Everything must move fornard simultaneously: roads, proccssing plants, and intensification of agriculture. In this way, all the resources available for the agricultural sector will be concentrated at a given moment on one or two regions. In this way the road will have enough traffic to justify its cost, 1.nd the farmer v1ho wishos to dispose of his production will have a processitl5 plant nearby. Around each plant it uill be necessary to achieve specialisation in the prodÕction of the commodity processed, so as to eliminate transportation costs. World competition is so strong that 11e must a.void making it even more difficult, for a country as poor as Guiana, by a dispersion of efforts that would be extremely costly.

By establishing "balts", that is, ontire arons specialised in a given orop that uould be predominant or oven exclusive, Guiana could soon become a real economic model for tho entire South American continent. A 11ithdrawal of sugar-cane production from around Georgetown ould make possible the establishment, first, of a green bolt of vegetables and orchards, then of a "dairy belt" for fluid frosh milk, and further off, a "ground provisions belt". This could be done by very gradual stages on tho old farmlang.s of the Coast whore a well-defined production structure is already deeply rooted, by giving assistance only to those who conform to tho Plan. The 3states have already sot up a very rational sugar belt around each sugar factory, as economic pressure is extremely strong in this field, and tho now rice mills logically tend to do tho same.

fuat appears merely advantageous and useful near tho Coast quickly becomes an absolute necessity for tho now lands of tho interior, as the costs of their development, as uoll as those of current production must be reduced to a minimum. -.rthin this framcnork, the regions to be developed first appear, in tho light of our present (insufficient) know1edge, to be the feu floodlands and esp ciaily the brown sands bordering tho main rivers, along their navigable parts so that they can be economically accessible, and then the "intermediate savannah" studied at Ebini.

2. Thc E ÃÃ<? ss of Ebini cr o.tiop 9 f. a. dai r.x.9p.t j l cbo}.:(?,.j1 !i
intormc diato sav3,nnah a

:.H L bini D.r Legge has created a good example of a pilot farm which dese ves sincere congratulations, and according to his estimate it is al'ready shoL.1ing economic results. According to him, an outlay of $8,750 is necessary to set u , fertilise and enclose 100 acres of Pangola pasture divided into parcels of 10 acres each. Capital necessary for the su ply of drinking water for the livestock and also for some (very light..-reic;:::tt)uildings must be added to this estimate of establishment costs. Above all, it is necessary to include in the running annual costs; overhead costs, technical management and the interest on capital outlay and on the value of the farm animals, iT,ich represent an outlay almost comparable to tnat for the stablishment of the pastufes.

Hence 9 while Dr Leese estimates 4 9100 of annual costs for 8,250 of annual receipts 1 if we include all these other expenses, the profitability of beef cattle is in danger of appearing very marginal, and not such as is li ely to attract private investors, particularly taking into account the recent appearance of the Pangola virus and the fact that other grasses, such as Cynodon dactylon, have not yet given adequate results, and also the problem of the animals' drin:dng ,ater, which at, pr sent is being transported by tractor from the river at a price that seems 9.rohibitive, (Credits should be given immediately for a pump and a pipe.)

The development through beef cattle of this region (1hich is intermediate savannah and at the same time close to a navigable river) should therefore be preceded by an even more thorough study of the soils. This would-,make it possible to determine where, .in these 4,000 square miles of intermediate savannahs, tae best sandy brown soils are to be found. Cheap water sources could also be sought, pref0rably through .Jells, if the water table is not too deep. If these arc lacking, cemented pools could undoubtedly be used, taking care that the ,,ater is disinfected before taking the cattle to drink. But some other solution might perhaps make it possible to obtain more profitable results.

A more intensive form of production (dairy production) along the Berbice River and its tributaries would be even more ,1orthWJjile considering. Pure, salt-free \.rater is available in abundance, making possible ov,Hhead irrigation without excessive expenditure. This would also make it i:iossible to maintain a high lGvel of grass production and especially of q_uality (high protein content). The installation of a milk condensary might be envisaged sometime in the future. It \/ould be able to cover the country's demand for imported dairy products, 1hich ,ill increase rapidly if the hypothesis of a steady economic expansion which underlies this entire study proves correct.

This project could begin to operate around 1970, if preliminary experiments prior to its implementation are positivo. The production to be planned at that time could be set at about double the amount of the presePt imports of milk by products, since it .,ill have to alloL.1 for thG rapid increase of population, as we;n as the n<Jed for improving intak;es of animal proteins. Milk is the cheapest ;1ay of supplying the latter, second only to fish and ,1ell ahead of meat.

The project could begin, between 1963 and 1964, by establishing, on either side of the Berbice River, pastures which uould be used chiefly for beef cattle. Such cattle require fertiliser, and refrigerated riberboat transport (or airplanos) for meat. From 1965, part of those pastures would be irrigated by sprinkling, and would be "planted" to Pangola; Tropical Kudzu, Cynodon dactylon and Para-grass. Mille would be produced on a small scale at first and processed into butter and cheeses (of the Dutch type for instance) by a small plant, in the beginning, uith rcftigeration facilities.

If this production gives satisf2ct.ory results, a dairy belt could be established on either side of the river; with a plant for making powdered milk, around 1975; later it could also make concentrated milk. Six million gallons per year should_qe set as the minimum target, to make the "condensary" profitableY. This target could be reached around 1980.

The target, fro 1970 on,mrds, would be one cow per acre, producing an average of 600 gallons of milk per year, or 700 gallons per lactation, with Holstein cows. These figures have already been reached in Jamaica, with Jamaica Hope, and greatly surpassed in Puerto Rico and Guadeloupe (sugar mill at Beauport). For 6 million gallons 10,000 cows and 10,000 acres would be required, plus a larger ar3a for maintaining the dry cows not in their lactation period, for raising.male steers for meat prodÕction and heifers to replace old cows and for increasing the herd. To achieve this target 1,200 acres of grazing land must.''be established in 1963 and 1964, and a thousand high-quality heifers must 1>q;Limported from the coast. The original breed would be improved by constant crossing (by absorption) with Holstein bulls coming from high-milk-producing stock. Therefore a nucleus of pure-bred Holsteins to produce these breeders should be installed near the capital city, and could be started off with the best cows of the Bel Air dairy.

If the herd is well tended, and ,,ith some new imports, it could reach 2,500 cows by 1970, and 5,000 by 1975. The 10,000 cows capable of producing 6 million gallons, that is, the plant's full operating capacity, could be reached around 1980. These figures are purely theoretical, and are intended to give only a very rough idea of the magnitude of a profitable project. Two dairy projects hav3 been outlined for the Coast. If their implememtation takes place, it will be possible to slow down tho rate of implementation of the Ebini project.

In this way the concentration of milk production would be done, in an j_n initial stage, on 10,000 acres, or less than 16 square miles, which might perhaps be spread over 50 or square miles on either side of the river. This would allow milk collection at a transport cost of 4 cents per gallon, if not less, instead of the 18 cents spent in Jamaica. In this way t\Jo milk-ings and two collections per day would be made, and there would never be more than a few hours, 5 or 6 at the utmost, bch;ecn the milking and the arrival of the milk at the plant. Its bacteriological quality would be much higher, and heavy losses would be avoided, particularly if the milk wero cooled immediately after milking. Tho lm1ering of cost and the batter quality v10uld make up for markedly inferior natural conditions, in comparison with Jamaica. Trio collection roads should be established on either side of the river, and collective overhead irrigation networks would probably cost less than individual pumping from the Bcrbice River (this would need to be studied).

Expert advi;e should be sought on this matter. The condensary of Bog Vfollc in Jamaica, which was set up in 1939 collects only 2.7 million gallons of milk a year throughout the entire island at the price of a million miles. of lorry travel. Therefore it uses imported milk powder or over half of its productive capacity. The Guianan plant could start off in the same way around 1975.

So far, only the creation of pastures on the savannah, where their. clearing is least expensive, has been considered. But tho proximity of the river affords such advantagcs, in the case of irrigated pastures for cows, that the clearing of forests, if they arc on bro·.m sandy soils; could also be examined. If shade is provided by hedges of Leucaona glauca (Mr Hale even advises their use for feed) and of Glyricidia (Quick stick) periodic cutting ·11ould also make it possible to supply a large amount of added fe:;d. Planting beforehand of Glyricidia (or of Saman) ':1ould ma.}:::it possible to use them, as in Cuba, o.s live stakes for onclosur3 .riring cheaper to set ug and maintain than deadwood fence pickets.

Should this "dairy bclt" turn out to be profitable after the first trial poriod, the projected beef-cattle belt may have to be pushed a little further avla.y from the river. The United Nations Soil Survey team has al:ccady found that at least 200 000 acres of intermediate savannah 110ar the Ebini River could be d votcd to beef cattle. At tho reasonable level of production foreseen by Dr Legge this uould correspond to 50 animals of 500 lb. carcass weight each per 100 acres. This would amount to 100,000 animals to be slaughtered per year from 200,000 acres, once the herd is constituted and operations are moving at cruising speed. If this target is energetically pursued as from now; it could be reasonably attained by 1975 or 1980. At that time Guiana would be a meat exporter, and the problem of the Rupinini savannahs would have to be re-examined.

This plan also requires that the problem of liver cirrhosis be solved. However; it does not appear to be serious, except on natural savannahs, as it has not yet been observed on the artificial Pangola pastures. ·1e are proposing only the use of such artificial pastures, even though they are more expen ive. As we have already shown, the cost of overhead irrigation, buildings, roads for milk collection, and the dairy plant must be added to Dr Legge's estimates for creation of pastures. Furthermore, a region thus developed will need to be connected with the coast by a proper road, extending the present road a·nd trail from New Amsterdam to Mara as far as Ebini. But the production level that can be reached would largely justify these expenditures.

The income to be expected from such a project should be much greater (we will come back to this point) than that of the large JOrks for water cnntrol and irrigation devoted to rice at present, especially within the framework of present techniques and the rather low yields. In this plan, ·11e assign a certain priority to dairy production, which seems much more profitable and is certainly capable of creating more jobs than beef cattle. However, once the "ope.ning up" of the region has been made for this dairy production, ,,hich will take up very little area, the overhead costs of the projected road and population centre vill be more idely distributed if a beef-cattle area is created around it,

Ho ever, if the market for milk should turn out to be better, compared to that for moat, in 1970, say, than in 1962, anothar more intensive project could be drawn up, in uhich milk would play a more important part. In any case, the Holstein steers should be raised for maat production, as the least expensive meat (especially ·hen increased employment is the primary objective) is that obtained as a by-product from clairy cattle, discarded co·,:JS, bullocks or steers of the mill: stock.

However, Guiana's situation is basically different from that of Jamaica where, for a better use of the scarce land and over-abundant labour, we would suggest the total elimination, as soon as possible, of beef cattle. In British Guiana, as in British Honduras, it could be considered a very profitable means of utilising the savannahs in those areas where fertilisers and drinking water for livestock could be cheaply supplied. There is plenty of land and it would probably be rather difficult to move manpower elsewhere.

The beginning of the scheme would be a pilot state-operated farm of reasonable size, based on the present Ebini experimental station. This would mean between 1,000 and 2,000 acres for intensive dairy production, with a milking centre for each group of 500 cows. An annex would be added for raising the young animals up to 2½ years of age, as well as heifers for replacement, bullocks for slaughter, and cows between lactation periods.

For meat-cattle, a reasonable size for a pilot state-operated farm could be set at around 10,000 acres, provided that each independent unit of 2,000 or 2,500 acres can have its own machinery and supervisory personnel (enclosures, pastures). The technical and health management, along with the repair workshop, would cover the whole 10,000 acres, but the slaughterhouse would be projected to serve the entire region, and its capacity should expand with production. Besides an animal husbandry expert, the permanent presence of a veterinarian for this group of farms seems indispensable to its success.

This is in fact an agro-industrial project whose success depends chiefly on the competence of the technical personnel employed. Without highly qualified technicians, it would be best not to attempt it; it would turn into a very risky venture, and an enormous amount of investment capital would be wasted[1].

3. The Rupinini savannahs (South-western British Guiana)

We did not have the time to go and study this problem on the spot because it seemed to us of little importance in the near future. We had already formed an idea of its possibilities through our visit to a nearby area of the Venezuelan "Gran Sabana" far south of Ciudad Bolívar and near the frontier of British Guiana. This impression is entirely borne out by the soil specialists.

This land is too poor. On the chart entitled "Broad-soil associations of British Guiana" by Eitel H.G. Braun, 1962, the whole of the Rupinini savannahs is classified in group 5: Lateritic regosol, concretionary latosol, ground water laterite and hydromorphic soil. This group's agricultural possibilities are practically nil, in the state of our present knowledge. The region bordering the lower and middle Berbice behind the rich clays along the river belongs to group 4: "Sandy regosol and sandy yellow latosol, with inclusions of hydromorphic soils". Mr Braun estimates that in all of British Guiana there are perhaps 55% of sandy brown soils in this group, with sure agricultural possibilities which we will specify in Part Three, Section 3.

1/ The only critical comment received to date (1/11/62) is the one from the FAO soil chemist, R.B. Cate. It is extremely interesting and it has certainly been taken into account. Regarding this Ebini project, Mr Cate writes: "Why emphasize mixed farming in the coastal clays soils, which are well suited to monoculture, and not on the brown sands, which are so well suited to mixed farming? It also seems to me that the brown sands should be considered for cotton, peanuts, soya, cocoa, coffee, black pepper, etc. rather than just cows, which after all are among the few 'crops' suited to the coast." This opinion merits close attention and may lead to reconsidering my conclusions.

Another fundamental reason for giving preference to the Ebini sector is that the Rupinini savannahs are too distant to allow the shipment of fertiliser at low cost. Only mining resources attracting a large population would make profitable a development of agriculture. At present, only the experiment with cashew nuts seem worth trying, as we have already suggested for the Pine ridge soils of British Honduras. If such an experiment turned out to be promising, a plantation centering around a shelling factory could then be envisaged.

The only mode of utilisation at present, that of cattle, has been introduced only because of the low establishment costs, in steppes that did not need clearing before utilisation. But these ranches represent one of the most extensive forms of production in the world with an extremely low output per unit of area on one of the world's poorest soils. The Rupinini Development Corporation maintains a herd of 23 to 24,000 head there. In normal years the number of brandings varied between 3,700 and 4,750, and the sale of animals ranged from 2,034 to 2,159 animals per year. Only young males and some discarded heifers are sold around 4 years of age, weighing on the average 450 lb. carcass weight, and the old cows are not used at all.

So the number of head sold per year is one per square mile, the area exploited being 2,195 square miles, and does not even come to 10% of the total herd. This proportion could be substantially increased if the cows were slaughtered for meat while still young, for instance after production of three calves; this would make possible, with better care, an annual slaughter rate of at least 15% of the herd. Still it would be necessary for the cows to be a little better fed, their mortality rate lowered, and their fertility appreciably increased. It is by no means certain that in this inaccessible location all of these measures are economically justifiable[1].

When the scanty natural vegetation becomes too coarse, it is set afire to provoke the emergence in the dry season of young shoots which are less lacking in digestible proteins than the old hardened, lignified and silicified grasses. An extremely low output is thus obtained at the expense of national resources as these fires undoubtedly diminish the usable flora, compromising their capital value[2].

When the projects for Ebini, which have been very roughly outlined here, have entered the phase of active implementation, and if the first stages of expansion prove satisfactory, the advisability of continuing such extensive livestock raising in its present form in Rupinini must be reconsidered,

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1/ Not having been on the spot, I am not in a position to give an authoritative opinion on these problems.

2/ See Dumont, R, "Terres Vivantes", Plon 1961, to be issued in English by the Merlin Press. In Chapter 2, the extremely low production of the "llanos" of the Orinoco with 4 to 5 kg. of liveweight meat per hectare and per year is underlined. In the case of the Rupinini Development Corporation we fall short of 2 kg., a record for its low level, but in a much poorer environment. The difference in the agricultural potentials of the two environments seems higher.

especially if it is proved that this deteriorates the flora, and therefore the national wealth[1]. But there are other considerations, such as investments already made, which would have been more productive with intensive exploitation around Ebini. At thetime they were made such possibilities could not be seriously considered. There is also the need to bring the Amerindians of the interior into a more productive money economy, but this seems easier to do through cultivation of many small, rather fertile patches of land than through such extensive livestock raising.

In the meantime, greater attention could be given to mineral deficiencies and to minor elements. Sheep appear at first sight better suited than beef cattle to such poor, and especially such irregular, fodder production, provided the lambs are born at the beginning of the big grass-growing season, so that the ewes can have abundant and good quality feed during their lactation and dispose of grass which still retains its feeding quality during the fattening period of the lambs, which could be sold at around 6 months. Very good veterinary care would be necessary but this would be easy to achieve. At that stage, some supplementary fodder crops, rich in protein, could be considered profitably.

But all of this seems to have much more chance of success around Ebini. Even soils poorer than brown sandy soils would undoubtedly be cheaper to intensify at the present stage, partly due to their closeness to the river, than this inaccessible region. It would thus seem necessary to reconsider this entire problem of the development of the Rupinini savannahs. A thorough study of the question is necessary. Meanwhile, this is the reaction of an elderly "ranchero" of Rupinini after a trip in the Cayo region of British Honduras: "If I were ten years younger, this is where I would settle. At my age it is too late to start out afresh". The full meaning of this statement is better understood after visiting that same Cayo region.[2] The problem of the forests seems much more important for Guiana's economy than this extremely extensive livestock production.

4. Guiana's forests can produce much more

Exports of forestry products, including balata, totalled $4.4 million in 1960; but $1 million should be deducted for imports of wood and wood products, leaving $3.4 million net forestry exports. In 1957 the total was only $2.5 million, but since then the situation has improved both as regards exports and imports. Nevertheless, according to Mr Low (and this seems obvious) much more could be done. The neighbouring West Indies all suffer from timber shortage and a large part of their supply comes from North America and Europe, that is, from sources further away than Guiana and therefore with more costly transport.

For a long time, Greenheart (Ocetea rodiaci) was exploited almost exclusively, like Mahogany in British Honduras, and with the most primitive methods; every tree cut down that had the slightest defect is still left on the spot! On the other hand the sawmills are very out-of-date, which leads to poor quality of sawn wood. As a result a high proportion of it is exported as logs, without a sufficient "added value" in the form of labour input.

1/ This deterioration of the flora is questioned by Mr Cate. It is definitely proved in Madagascar, where it leads to the predominance of Aristide.

2/ The Cayo region offers much better natural conditions than those of Ebini. If Ebini and Cayo lay within the frontiers of the same nation, we would never have ventured to make the proposals described in the preceding section, for the Berbice river banks.

A great effort has been made at the state-operated plant of Georgetown to promote the utilisation of Guiana woods other than Greenheart. As a result, the latter has fallen from 90% to 60% of exports. This should be followed up by further efforts for the rapid modernisation of the saw mills, which would justify the allotment of government credits provided they are soundly utilised.

However, another possibility deserves to be explored, aiming at massive exports of a large variety of woods, both as regards species and dimensions. In British Guiana, in contrast to Equatorial Africa, the great majority of trees remain small in diameter and could be used in large volume "in some bulk-processing plants which can utilise the majority of the trees, irrespective of species and size". The manufacture of wood fibre, fibre and particle board seems to have great prospects.

The utilisation of forest products should no longer be considered in isolation, as other sources of cellulose exist nearby. Sugar-cane bagasse has already been mentioned, and rice straw could be added. Mr Le Cacheux, in his interesting "Report to the Caribbean Commission on a preliminary pulp and paper survey" (FAO, 1956), estimates production of this straw at 293,000 tons, which seems too high, especially at the time of that survey. The 260,000 acres of 1961 (counting their two harvests) can supply only around 100,000 tons of really available straw. This is only on condition that the cutting of the rice by reaper-binder is generalised (as recommended elsewhere) since it would be best to leave at least as much on the farm (fallen straw, fodder and manure needs).

The manufacture of wood paper pulp, alone or mixed, therefore deserves a special and very thorough study, since it requires a large investment of capital: in fact, between W.I.$50 and 60 million would be needed for a plant producing at least 100 tons of pulp per day, which is the only kind that would be profitable. Mr Le Cacheux prefers the banks of the Demerara from Mackenzie to Georgetown to the famous Bartica "triangle" where the bulk of forest exploitation is concentrated at present. Obviously we cannot solve this problem, which urgently calls for a thorough study.

Mr Le Cacheux recommends: "that more thorough investigations be carried out into the complex potentialities of British Guiana for the manufacture of paper pulp and paper. In this field the country offers most promising prospects, both technical and economic. The establishment of a plant for the manufactufe of high-quality bleached pulp is particularly worth careful consideration". We think the time has come to actively carry forward research in this direction, so as to move on as soon as possible to the stage of initial implementation, in the form of specialised plantations, if the conclusions of the study show this to be economically promising.

The time has also come to call the attention of Guiana's forestry experts to modern concepts of intensive forestry[1/]. Eventually, an artificial forest planted in a readily accessible place can often supply bulkwood more cheaply than a natural forest, just as improved pasture is more profitable than rough natural pasture. A recent study in the Ivory Coast has shown that 250,000 acres planted along the rivers would produce as much as the 12 million acres of natural forest which at present, as in British Guiana and British Honduras, are merely "skimmed" of valuable species.

1/ For documentation, the Forestry Division, FAO, Rome, could be contacted.

Guiana's forestry services have in fact already moved in this direction-V. Six years ago; 170 acres of Pinus Caribbea were planted on white sands five miles from Bartica, after cutting doun the iallaba. They plan to extend this plantation "to the easily planted and readily available intermediate type of savannahs, which normally carry a very poor and relatively useless type of grass cover".

A warning note needs to be sou qed. More serious study is needed before this question can be decidedg/. The purpose of these large-scale plantations is to provide regular supplies to a large paper-pulp factory. This factory would need waters cheap power, and especially very cheap transport for timber from the forost to the factory, which the Scandinavian countries achieve by floating. Therefore piantations along a "floatable", if not a "navigable"; river are particularly advisable. However, must be located outside the flood zone, as pine is absolutely unable to withstand immersion.

Planning land use in the intermediate savannahs is urgently required. We have already called for at least 225,000 acres for a beef cattle belt (more will be needed some day, in the event of a rapid shift of sugar from the coast). So it would seem that at least 3,000 square miles would remain available for the Pinus. But both milk production and Pinus must be as close as possible to the river, and the plant uould contaminate the waters that should irrigate the pastures and supply the animals' drinking water. On the other hand, as we have already shown (page 30,footnote) and will sliow 19-ter on (Part Three, Section 4) a number of other important crops can be planned for this r gion such as fruit, vegetabless tobacco and perhaps cotton. Hence it would be advisable not to allocate too much of it for wood plantations, as this would push meat cattle still further inland from the river, That would raise the price of fertiliser transportation and require further roads. Ho ever, we must not forget that trees too, under a modern forestry system, would greatly benefit from fertilisers. After the famous "6rass as a crop" slogan the modern forester must think of "tree as a crop".

Under this concept of intensive forestry, it is out of the quastion to relegate as a matter of course the very costly artificial plantations to the poorest and most remote soils. Such a plantation represents a large investment that Nould be made more profitable by rich and accessible land. It 17ould seem .,.orth.,hile to separate the livestock sector from intensive pine cultivation, so we do not reject, priori,Bartica as a location, as it seems to offer great advantages, especially at the start. In fact, the ,allaba, which is already plentiful there, could provide the timber for the pulp factory until the pines reach maturity, i.e. some fifteen years. Furthermore the possibilities of supplying dry pressed bagasse and pressed rice straw to the factory at cheap transportation cost should also be tal:en into consideration.

This project seems to me particularly advisable, since the FAO experts estimate that there is likelihood of a world\/ide paper shortage in about fiftoen years. The growth of the Scandinavian and Canadian forests is not compensating their rate of exploitation. The rate of growth of these "cold" forests is very slow, compared to that of tropical forests.

1r-cautiously, in proportion to the creuits allotted to them.

?/ Our hesitation in the face of the cost of such plantations has increased, after seeing in British Honduras possibilities for obtaining pine rather cheaply through natural regeneration and the control of bushfires. But the advantage of the greater proximity of these artificial plantations and of the rew1ction of transport costs in general may perhaps eventually compensate for tho cost of their establishment. This requires a preliminary costing study by experts.

This type of forest plantation work seems more likely to make proper use of the urban unemployed population, and especially the young elcment, than the land settlements. Indeed, these young people do not seek a farmer's life, \lhich is too hard and offers them too little/security with the harvest risks. Mentally they are chiefly wage earners.l looking for regular fixed pay Mr Loi, also suggests planting trees behind the land settlements, because of the manpower available during the agricultural dead season.

All of this ill need a great amount of long-term capital at low rates of interJst. Their low profitability has led Mr Downie to advise against such plantations in British Honduras. The ideal .Jould be to make this interest payable only at the time when timber exploitation begins. In such a case it would be possible, -..1h0ut running a great risk, to repay a loan of 31,000 at 81,500, 15 years later. Invostors willing to accept such conditions \/ould still need to be found.

fuere only one dry season occurs, teak plantations are worth considering for long-term supply of highly valuable furniture timber. Forests ropresent, especially on a long-term basis, one of Guiana's greatest agricultural assets. If all these projects turn out to be profitable and are implemented, forest exports could exceod other sources of agricultural income, provided that, as from no\71 forostry is allocated more substantial means for the plantations.

The future of tropical forestry, like that of livestock production, has been greatly underestimated hitherto, since it has been conceived only in a highly extensive, very primitive form. As soon as modern and intensive production techniques are employed, Hith equal supply of capital; competition rlith temperate regions will Hork in favour of the tropics. This is already clearly noticeable with regard to sugar and vegetable oils.

5. Development of the river banks.

During the eighteenth century those were the first areas to be cultivated, but were later abandoned in favour of the coast because of the former's lo,7er level of fertility, ,1hich deteriorated rapidly v1ith lack of fertiliser. However, they offer the advantage of higher altitude in general and thus of easier drainage than in the coastal area. On the other hand, pump irrigation is sometimes more costly. Their value on the whole decreases very rapidly towards the interior and as one moves away from the rivers.

With a widespread use of fertilisers, their utilisation, especially for intensive pastures and for certain non-irrigated crops, such as vegetables and industrial crops (cotton and peanuts) is .1orth considering on the most fertile parts. Certainly the alluvial land as such is rich, but it generally constitutes a very narrou strip only and is subject to more frequent alumin toxicity than the brmm sands. As soon as one goes beyond this strip one quickly comes across the sands of group 4 previously mentioned but uhere the proportion of hite sands is often very high. It is therefore necessary to seek organic soils first, particularly on either side of the Lower Demerara, then brown sands, whose importance uc have already particularly stressed in Ebini. In short, here these brovn sandy soils are near the rivers, they appear to be by far the most promising.

1} But Perhaps, Ur Cate points out, they v1ould prefer to earn their ,,ages "on coastal and brm1n sand farms"?

The already available data of the soil survey will be very helpful in selecting priority sectors. In the light of our present knowledge, tree crops, along with pastures (see Appendix IX) appear to be the most advisable. In this case too, "zoning" should be carried out, concentrating around a canning factory the whole range of fruit (and perhaps vegetables) needed to operate the plant almost all the year round, so as to repay rapidly the establishment costs.

Ou:c studies have been too limited to enable us to discuss any further this rather complex problem, as the soils ar very varied. Nevertheless, from all we have seen, and especially read,.!! our impression remains that the development of the best parts of these river banks, and especially that of the intermediate savannahs, constitutesthe logical first step to ards the development of Guiana's interior. To skip these stages and go directly further inland as has already been done in the case of the Rupinini savannahs, would seem economically extremely dangerous, the more so as the nearest soils are often the least infertile ones.

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l} Particularly Simonson, Cliffc:cd H., "Reconnaissance soil survey of the coastal plain of British Guiana", ICA, 1958, pages 209,-214.

PART HJ1i]E HQ':/CAN GUIANA'S AGRJCtJ'hTURAL. DEVELOPMENT BE ACC]LE!.{ATED?

1. Reorg?nisation of the mechanised. farmin g economy on a sounder basis

The increase in productivity, which is indispensable as a prior condition to the rise in the living standard, requires a high rate of investment as well as a more efficient use of resources. The development plan being drawn up aims at allocating the scarce resources, especially in capital and technicians, at points where they can be most effective. The fertile lands, another scarce factor, are also to be more fully utilised. Hence the initial operations may be aimed at the quickest increase in production, while cutting costs as far as possible so as to allow a higher investment in the future without lowering current consumption.

Such a course of action is made more difficult for Guiana's agriculture because of the high degree of mechanisation of its two main crops, sugar cane and rioe, particularly as it is not accompanied, in the case of rice, by sufficient intensification to justify the cost of mechanisation. This has already resulted in a lowering of yields and quality, while production costs tend to increase. This situation is aggravated by the fact that modern agricultural machinery is purchased '1ith hard foreign currency, while rice, as well as almost all the sugar produced, is sold for soft foreign currency. This early mechanisation (which we would be inclined to term premature) is accompanied by unemployment.

The primary objective, along with increased production, should be full employment affording everybody usaful uork and, if possible, also highly productive jobs. In the case of a number of useful agricultural land improvements, labour productivity still runs the risk of remaining below the present wage rate. The latter is comparatively high, in view of the high efficiency achieved in sugar production, but the small independent farmer L11ill not always be able to pay such high wages.

The study of Black Bush Folder has shown that the land settlement projects cannot create enough employment in the paddy fields In 1958 imports of farm machinery ($15.3 million) were much higher than rice exports (9 to $13 million from 1953 to 1959), but only i4.8 million in 1958, which was an exceptionally bad year). Some of this imported equipment is used in sugarcane production, but we have not been able to gather enough data for the breukdown.

It is out of the question, in Guiana as in Africa, to demand the impersonal, harrassing and poorly or wholly unremunerated effort that has been required from the Chinese peasants, especially as the recent agricultural results obtained in that country are rather unsatisfactory. Here present living standards are much higher, and machines cannot be excluded as they are already being used everyv,here. The events of February 1962 have shown, if proof were necessary, the sharpness of popular reactions.

Hm1ever, there remains a possible margin for change in emphasis within this mechanisation itself, as it cannot be allowed to lead to the complete failure of Guiana's agricultural economy. It still appears possible to discourage what we would call ultra-mechanisatio specifically, the rice "combine" or the mechanical cutting machine for sugar cane. This can be achieved by requesting, firstly, (for renting of combines) rates equal to their real operating costs, including all overhead and depreciation costs. Secondly the subsidy on agricultural fuel (gasoline and oil) which enables some families even to go to the cinema on their tractors and supply their cars ,7ith it, could be cut. In addition a customs duty could be set on costly automatic harvesting machines, which are the ones that create unemployment by simply reducing the amount of work ithout increasing the output in any way.

At the same time, ilhat could be termed a 75,J,mechanisation which, on the contrary, makes possible an intensification of production, should be encouraged. The reaper-binder and the thresher make it possible to dry grain better, increasing its quality and reducing losses and at the same time recovering the straw. For smaller farms, the animal-drawn or motor mower could cut rice, which would then be bound by hand. These machines could be bought at not too high a cost by groups of 5 or 6 neighbouring farmers, each of whom cultivates 15 acres of paddy.

The value of a motor mower would be enhanced by the fact that it can also act as a tractor for hauling carts over the roads or boats on the canals. It could also, every morning, cut the fodder (Para, Guatemala, Kudzu, Elephant) needed for the dairy cows of these groups of farmers. It would be possible to take a large step forward in this direction by reducing or, even better, entirely aholishing the government credits granted for purchase of the machines which are "premature" under present employment conditions.

On the other hand the government could aid 75% mechanisation such as motor mowers and reaper-binders. But, even in this event, i would do well to limit its loans to two-thirds of the value of the equipment under consideration. The farmers, thus obliged to contribute a substantial part of the cost, would be directed towards productive investments and this would increase the rate of growth of the rural economy. The farmers would also take better care of machines that would have cost them a greater personal effort.

2. Overall emph fais on intensificati9E oxe_ ll thro t]le elimination of 11colonia types of._waste; a land tax

European society developed primarily thanks to its industrial revolution, preceded and supported by a long phase of accelerated agricultural progress which was itself h0lped forward by a previous policy of conservation of resources, sometimes carried to the extreme of avariciousness. Colonial society, on the contrary, has been characterised by waste in a framework of over-exploitation of the soil and labour. It is easy to understand this attitud.e on the part of the wealthy people i,vho earnQd their money so easily. Tho chief conce:maf'.rthe majority of the South American large landowner.a seems to be precisely "not to have any worries" on account of their lana17. These enormous properties, stretching over thousands and tens of thousands of acres bring thorn little per acre but a great deal taken all together. The sldves and the poor people also wasted a great deal lacking as they did any hope of improvement in their condition.

Guiana is actually a very s.-.iallcountry, practically limited as far as agriculture is concern0d to 2,500 square mihs of its coast? or 56,; of Jamaica's area, and even less in terms of population. In ependent Guiana must seek first and foromos to eliminate its main forms of waste.

There is a waste of organic material if forests arc cl0ared by fire, which also burns the humus of the top soil. The large and medium sized timber could be taken away in the coastal area where there is a market, and the small branches, t igs and brush could be reincorporated.in the soil by pressing them down uith a heavy cylinder equipped with cutting irons of the "L,rnuaise brush-clearer" type This cind of mechanisation which improves the soil is justified, i7hereas a bulldozer levelling everything indiscriminat0ly should be considered destructive.

There is also a ,,aste of fodder, of ,,hich that of the cane tops is the most outstanding. :ve have shown that rice stra\7, uhich at present is burned, can be used as industrial raw material (pulp, fibre , as fodder and for mixing with manure, or it can even be directly incorporated in tho ground. Other wastes of organic matter (animal and human excreta and green manure) and of fodder are countless.

There is a waste of the livestock capital, or the animals, when these are given only a maintenance ratinn that keeps them alive and are given almost nothing for production of milk and meat. Sometimes it would be enough to add just mineral salts and some proteins to double or even triple this production. There is a waste of labour when a single person guards only t o or three animals, whereas a village guard assisted by trained dogs as in Europe during the nineteenth century could guard all the cattle of a village, which would also e:1.able all its children to attend school.

Soils are wasted when they are tr,ated like a mining exploitation, without a resti ution of organic and mineral fertilisers, or when they are leached by over-abundant irrigation, in which ease there is also a waste of water. This becomes even more serious when it is a question of pumping the v1ater (and of double pumping if it is necessary to re-pump in order to drain), as there is then the adlitional aste of power.

This enormous mass of multiple wastes is practically encouraged by an improvident fiscal policy and especially by the absence of a land tax. Its collection in France t rards the end of the 18th century, under the influence of the Physiocrats, gave agri ?-,1ural progress a decisive impetus. "-lehave already point od out elsewhere£/ that the extremely lo\7 land tax, along with the persistence of a quasi-slavery, vms a basic cause of the immense backwardness of South America's agriculture as compared ith that of North America. This in turn contributed to industrial backv1ardncss and both then combined in their reciprocal effects.

1/ See "Terres Vivantes"s op. cit. Chapter I to VII (Colombia, Venezuela, Brazil, Chile, Mcxico, Cuba).

y id. op. cat.

The tax that leads most to intensi ication is not one levied on production, as in the case of export taxes, or those of the Soviet Khollchoz the best is that based on the initial production potential (class of soils, climate, water regime). In this way, those uho cultivate poor soil ell will pay less and will be rer1arded, but those v1ho cultivate rich soil badly or not at all uill lose and uill eventually have to leave their land in better hands.

The tax should also take into account to a large extent the collective works such as roads, drainage, in order to pay for at least part of their cost. Lastly, it should increase in proportion to the size of the holding so as to avoid under-exploitation of the large estates, which is all too frequent in South America. The present tax rates are absolutely ridiculous. On paddy fields \lell provided with nater control systems, $2 per acr.e would seem to be a minimum. This could then be increased by a tax on proximity to a road, which would at last make it possible to provide proper road maintenance. Such taxes would oblige landowners to cultivate more intensively, as vie have already seen in British Honduras.

The mo is truo of tho rent ofthe Crown Lands, which still remains purely nominal. A lower rate was justified at the outset to encourage pioneers but since then the State has carried the cost of roads, protective dykes against the sea and even most of the drainage. It has the right, therefore, to recuperate part of this outlay from its landowners and tenants,

This is still further justified by the fact that there is a very rapid rise in real estate values at present. This giveLg tho landovmers added income, acquired without the slightest effort or even the smallest amount of investment work on their part. Instead of lingering on in a stage of precapitalism it ,rnuld be better to have producers, investors and capitalists earn more money, so as to encourage them to invest more and achieve a transitional form of dynamic capitalism.

3. Reduction of. tho cost. of fertilisers.:..\Iith_ advanced technology the .y are_ often cheap r than draina

With land taxes and an import duty on ultra-mechanisation (ultra for the present stage of Guiana's economy); the resulting income could serve in part to lower, for a short time, the cost of fertilisers delivered to farmers. Such a subsidy seems useful on a temporary basis in order to encourage wider use, since at prasent, with a fairly adequate control of .-,ate-r, and satisfactory farming techniques these fertilisers constitute the chief bottleneck in Guiana's agricultural production. Their lo.-, consumption, apart from the sugar estates, leads to very high distribution costs, yet the importing firms earn very little even ,,hen retailers sell at very high prices to the individual farmer.

There is another solution that may seem preferable to a subsidy. The Bookers group orders directly, from the ICI, for oxample, or from Barbados for lime, very large quantities. The price, as deliver,d to thoir plantations, does not seam to be oven half the retail price paid by farmers. It would be possible to request this group to place collective orders for the supply cooperatives. Once tho fertilisers are delivered to the headquarters of the Bookers Estates, they ,rnuld be transported by the cooperatives to their local .1arehouses uherc they \1ould be available to the farmers at much lo\1er rates.

There should be no misunderstanding, however, Fertilisers are often the last factor to enter into agricultural progress, as they are so costly. They become highly profitable only when the other factors of improvement have already been introduced. Otherwise, fertilisers may provoke an increased gr0\L1th of weeds that have not been removed, or they may be washed away by over-abundant irrigation, Therefore in Section 7 v,e are setting the work of the Extension Service on a short-term basis as tho most urgent. The action in favour of the large-scale use of fertili 3ers would logically fall in second order and in the medium-term perspective.

dithin this latter parspective it is permissibie to a3 icn eserves priority under the coming plan (1965-69), coastal drainage or the development of the intermediate savannahs by means of fertilisers. Cer ainly the profitability of beef cattle has appeared marginal from the viewpoint of the private intrepreneur who would have to carry alone all the costs o establishment and production. However, this is absolutely not the case with drainage which invalid.ates any comparison from the viewpoint of the real economy.

'i{emay take the case of the recent extensions of th,, T::i.pe:rmmc:project. The State is paying all the installation, irrigation 3n drnin3 e cos s, without seeking any reimbursement from the beneficiaries, Total costs amount to about $700 per acre. This is being dono for land to bo pu under rice with an average output of 15 bags per acre, plus one-t:1irl1 of a second cro , say about 20 bags of paddy per acre or H36 per year in gror:;s 1Leturns - 19% of the investment - which is certainly not enough. The intcrr.1ediate savannah would require $87 per acre for establishing the pastures; to this we \"Jould have to add the capital cost of the livestock, but in the c::i.seof the paddy fields we must also include the cultivation expenses. Tho ..:Lomer require more capital, the latter more v10rk:, i7hich puts them wit 1in easier reach of a peasant economy. Taking everything into account; the pasL:,u.r.Jeui 0h the animals would require perhaps $200 per acre and the ossible g:'0S3 output in meat cattle would amount to $82 (Dr Legge's osti a7.e). ti8 operation obviously appears to be much more prof:iytab13, ,Tith a gros.i prodt.:ction amount.:.. ing to more than the invested capital!/.

This v10uld lead us very far. By way of support we o_uotc Cli::ord H. Simonson's studyY on the "soils of the v7hitG sand fo!'m<1J.ion, llnit ":"! Ebini Association" g "With advanced technologys many of t.he soi2.r, noulcl he..ve rather high agricultural potentials, As \"Ith the fo!'cstec. :'IJ-'soil,.; they havi;J considerable in common Lti+,h AOme soils of the sout.h.-""'L1tP.:'n Un-itod States ,ÅÅÅÅ horizon similar to Ruston and Orangeburg ÅÅÅÅ L':cvLtrle ::. J.;he range of lighter Norfolk soils. The Norfolk-Rus".;on-Orar..;c'i-Lrs- soils are considered to be among the most productive ones of the Scut:iern United States". And also. "'Tith advan ed technology, the forest8d rsd scils should have rather high agricultural potentials ÅÅÅ Th0 ab,rv9--m0r,:ioned (comparable) US soils are considered to be among tho mos profitqb2.e crop producers in the South United States. LJhere well managed. they provide a good living to the farmer. But where poorly managed they a.ffon'. only a meagre living. They receive large amounts of commercial fertilisers hen used for the production of tobacco, cotton and truck c-rop::!!:

1/ In the case of dairy production, the investments ncce;,sary would be decidedly higher, but the value of production would al8 increaso.

g/ "Reconnaissance soil survey of the Coastal Plain of B:ritish Guiana", ICA, 1958, pages 548 and 521.

This seems all the more interesting as the soils suitable to cotton on the coast would be feu, formed by clay on sand, and would often have to be d,3voted to vegetables. The "cotton belt", so necessary to Guiana as a basis for industries (fibre, edible oil, oil cakes for feeding of livestock) could perhaps be found here, if there is a dry season to facilitate the harvest. In view of all these many "agricultural" prospects, it nould seem wisest for the time being to eliminate any idea of la ge-scale pine plantations for supplying a paper pulp factory, as described in Section 4 of Part Tv,o, throughout all of this intermediate savannah. Such tree plantations should be limited to the needs for furniture ·:;ocidand, in that cnsc, they could be placed on soils that may be fnirly poor but easy to develop and accessible.

4. Better water contro for 2rops other than rice

We have shown that at Black Bush Folder the return on capital invested in irrigation and drainage is much too low. 7e have just seen that the recent extensions of the Tapakuma project, costing $700 per acre, \Jill probably bring more, but gross returns amount to 19% of the investment, at most, \7hich is still insufficient. No.1here in the world is an irrigation netvJOrk really economic, if it r sults in the producticn of a single cereal crop, hence a rather poor one, per year.

Therefore tho old irrigation net,10rks should be examined first, in order to achieve double cropping, v7herevor economically possible, obviously with the help of fertilisers and better care to eliminate weeds. This uould mean tuo rice harvests per year on the low lands ,Jhich are difficult to drain here enough (but not too much) uater can be supplied during the dry season. One could perhaps consider alternating one rice \,ith one dry crop on the same field each year, for instance maize, legumes, or sweet potatoes. All of these crops, and maize in particular, would require the use of fertiliser. The legumes uould provide higher returns and much more work for the Guianese per acre than rice.

In fact, to continue a policy primarily oriented towards rice is to run counter to considerable difficulties. 'Ve shall shovr in our conclusions that it is much more profitable to reduce the .main imports of foodstuffs. This uould call for t\10 priorities. the first granted to livestock production, the otyer to market gardening (vegetables and fruit). Therefore we suggest that the land of the new irrigation projects should be placed preferably.

- under pastures for dairy cattle, first priority;
- under market gardening production (vegetables and fruits), second priority,
- for lands suitable for double cropping, under one rice and one dry crop in the same year, third priority
- under double cropping for rice, fourth priority.

This implies the rejection, on principle, of any project unable to produce more than one rice crop per ycac, except in veryspecial cases where the cost of water control would be extremely lov1 and vlhere it would appear uneconomic to attempt any other crop. Certainly the increased drainage uhich double-cropping would require ;.7ould be more costly, but tho value of the crops obtained could incrc se much more. ThoMa. ng-Abnry (M.ARDC)project is already being orinntod in this direction. It is necess,ry to soc to it that the farmers established in the area of tho netvrork follo\1 tho directions laid down. and tho payment of taxes corresponding to development costs ,1ould provide a strong incentive tO\mrds this.

An attempt must also be made to reduce establishment costs, especially by refusing any compensation (a nen ordinance is necessary for this) for lands needed for the building of canals and other hydraulic L.orks, roads, community centres, schools, etc. Ho:,ever, to avoid injustice, the loss of farming lands thus caused should be shared among all those concerned, in proportion to their previous holdings.

Lastly, it is possible to consider, on the model of some developed countries such as England and the Scandinavian countries, a repayment of a substantial part of the capital req_uired for irrigation and .-1ater control ,10rks by the lanclmmers. This could be done cl1iefly by means of a capital tax on all holdings above (for example) 20 acr3s. For the monetary value of this improved land;,,hich has increased so greatly in recent years, enables the landm,ner to pay it. The taxpayers' money must not continue, in an independent Guiana, to go indirectly into the large landowners' pockets through irrigation and water control improvements 1>'hich set off a rapid rise in real estate values. There could also be an annual tax to be paid by everybody, but it would increase more than proportionately with the area m1ned, as the large landCMl er can provide himself with better equipment and produce more. In case of need and if he is not ,,illing to invest, he can sell part of his land, which in this way would go to farmers capable of getting more out of it than he himself does.

The farmers in an irrigated area should also follow a standard farming plan in order to provide the frequency and quantity of irrigation suitable to the crop raised in each area. Consequently, to economise Hater, it should every-,1here be paid for according to the volume utilised. Since it is impossible to measure individual utilisation, a tax must be paid first of all by the group of farmers cultivating all of the area supplied by a pumping station, then the cost of the canals as they become increasingly smaller would be distributed among the group of farmers concerned. The collection of these taxes may be carried out by compulsory farm associations but the "local authorities" „hich are institutions and bodies already well :;:no n in the country may also be placed in charge of them.

In the latter case, it 11ould provide a good means for practical and effective decentralisation and for increasing the role of the village councils by giving them economic responsibilities. This would finally force the people to face the harsh realities of development, of their real problems, whereas at present they still have the tendency (which is typically colonial) to leave everything to the government, from 11hom they hofi to get many advantages, preferably ,1ithout giving anything in return .Å

Te may take the MARD scheme as an example. Flood control; which each landholder cannot individually carry out on his mm land, can be implemented first. By doing this the waters retained are made available for irrigation. Bu the distribution to the fields as well as drainage could be economically (but not technically entrusted to the local authorities who would be author-L ised to contract loans for this purpose. The national budget would be relieved by the corresponding amount.

Y Cost of drainage by pumping is subsidised up to 90% at Buxton with 30 per acre of subsidies and $3 of taxes.

It would be a mistake to try to reclaim land in the coastal area at all costs v1hen a large part of the intermediate savannahs can provide :it more cheaply without drainage, Also,as long as the banks of the Lower Corentyne and of the Berbice River still have reasonably good soils that are easy to drain by gravity, why undertake the very difficult development of poorer soils located further away from the rivers and much more difficult to drain? But 1 parallel with the revision of the irrigation policy, that of the land settlements, must also be reconsidered.

5. Modernised land settlements

The settlement, at a high cost to the national budget, of families of landless workers, who perhaps do not get even 40 days a year of work on their 15 acres of paddy fields 7 with farming practices even below those of the verage farmer 1 should not be the result intended by the state settlement projects. To allocate plots of 15 acres to be cultivated by mostly absentee farmers ·ith the help of tractors and combines seems even more irrational as almost all of these so-called farmers prefer fixed wages to the status of farmers and to farming. The highly mechanised techniques and the aspirations of the would-be settlers make the large-scale enterprise more advisable,

It seems therefore that there is a great deal to reconsider. A law for uncultivated lands, similar to the English law of 1938, should make possible the allocation of abandoned plantations without buying them from their owners, by virtue of compulsory renting on a long-term basis and at moderate rates (which the law would impose on the landowner who neglects his holdings;. In this way state funds would no longer be immobilised in such purchases and would be entirely devoted to development. Particularly for paddy fields and to the grsatest extent possible, the plots should be laid 9ut parallel to contour lines, even though this increases the distance from the farm. The cropping system planned should give priority herever possible to livestock production and market Lgar.dening.

The selection of the future settlers is of primary importance. The fact that a person is landless in no'way implies that he is capable of being a good farmer. However, only the good farmer deserves government aid since he alone will be able to make good use of the enormous installation costs. The best criteria for selection would be to make the c.ndidates work as labourers for wages for at least one agricultural ca paign, although three years would be better. The most competent and the most courageous would be selected.

This procedure would require a pilotstate-operated farm at the centre of each settlement to hire the wage labourers and also serve as a demonstration centre for modern techniques. This would be particularly necessary for new and unknown techniques, such as for beef cattle at Ebini, or for dairy cows as envisaged in a sector of the Tapakuma project or to the south of Skeldon. However, a note of warning should .be sounded this state farm must not be too large; the gigantic si?,.e of the "Granjas del pueblo" is already causing. many difficulties in Cuba.if The farm manager could receive a premium of 5% of the gross returns as an incentive to take personal interest in good management. The lack of standard working "norms" and of task work on the Cuban Granjas appears to have increased rapidly the number of bad workers and idlers, The work should therefore be paid on a task-i7ork basis y1henever possible.

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ij Dunont, R, "La Reforme Agraire a Cuba" (Land Reform in Cuba) 7 Tiers-Monde, 1962.

The settler to be chosen on the basis of his work performance and his personal qualities would be asked during his training period on the state farm to save a quarter or a third of his 3arnings. Only those who agree to save art of the capital required for their future farms rlOuld be accepted. Once established, the settler would be provided with a farm plan, tied in with a program of gradual land improvements to be carried out each year as a condition for l::eeping his plot. '.ifhave already outlined a very tentative scheme of this kind with regard to Black Bush Folder. In this way, public investments would be supplemented first by the settler's savings as wage labourer and afterwards by large investments in labour every year. The latter would undoubtedly be accepted more vrillingly than in China, as they would in no way be excessive and ould be of personal and direct benefit to those performing them for themselves and for their children after them.

6. <u>The E roblem of the co-operatives related to that of rural investment should be re-examined</u>

The co-operative movement is an important element in agricultural development; particularly production co-operatives. Guiana's co-operatives have so far been set up by the administration and financed by it almost entirely, i.e. spoon-fed. The farmers join them because this is the only nay of obtaining "government money" (Thrift and Credit Co-operative Societies) or the government combine (Machinery Co-operatives). To them the co-operative is nothing but an appendage of the administration and is certainly "the government's business", hence something definitJ ly alien to them. The true spirit of co-operation is even more lacking in these organisations because the farmers have not made enough sacrifices for a co-operative which, because of this very fact, does not seem to belong to them, to be really their own.

It is necessary to start out anew on another basis, in order to change this state of mind rapidly. The joint supply and market co-operatives, those responsible for treatment of crops against parasites or for joint use of farm machinery; and the credit co-operatives aro at present more readily acceptable to rural public opinion than joint cultivation cooperatives. So it seems that a stronger cOGperative netvvark of the first t:,Lpes should be the point of departure.

By "stronger" we mean that the farmers, in order to establish their co-operative, would have agreGd to make real sacrifices. This would require the payment of substantial membership dues which would no longer be ridiculously low; as they are at present. In Africa member farmers themselves cultivate, free of charge and .JOrking in shifts, the :tield (or plantation) of their co-operative in addition to their own fields. The net returns obtained from the crop in this ay are paid into the co-operative every year in order to increase its capital, and to make new investments. This example seems all the more worth introducing in Guiana inasmuch as it may gradually accustom the farmers to accept the idea of production co-operatives At Tapakuma, some of these production co-operatives are at present turning into Land Societies, this indicates that people's minds arc not yet prepared for them.

Another way of approaching co-operatives would be through the co-operative for the joint use of farm equipment as it could be combined with teaMs for agricultural mut¥ 1 assistance carryying out in common the work on the team members' farmsll • Lastly, the launching of these production co-operatives would be easier if they were started on new Crown lands, far from the already assigned farmer holdings, for instance, around the Ebini station. The first co-operative members would then be, in keeping with Mr Thompson's very interesting suggestion, former workers on the station. For three years on wages of $3, 34 and ,5 per day (this is an isolated sector where -,;,rages are above average), they would be obliged to save $1.50 a day as a condition for joining this cooperative.

In this way it would be possible to extend larger loans of public funds to them. The allotment to each worker of 50 acres for intensive agricultural use, capable of producing 25 beef cattle per year or a gross output of $3,750, may appear at first gla.nce a reasonable objective. In fact, experience alone will enabl"e us to det3rmine the size of the farm, and the large farm of 1,000 acres with three workers outlined in my report on British Honduras would have a much higher labour productivity.

These fifty acres would not provide enough employment eventually, but in the beginning there is all the installation work to be done. Moreover, to endow each person at the outset with a capital higher than that required by 50 acres of intensive pastures would mean favouring him too much. However, the technique of beef cattle production absolutely requires the large-scale form of enterprise. Therefore, the possibility of intensification by a shift to dairy production or of further extension through the resources acquired by the co-operative must be seriously considered for the future. There.is another possibility of intensification; by putting some of the land under crops. But we shall leave this to the future. All of these decisions obviously hold political implicati ns.

Two other groups of co-operatives seem to deserve special attention. The first is that of irrigation and drainage co-operatives, which would be given the duty of collecting maintenance taxes and of supervision of the network and the use of water by the farmers, under the technical direction of the competent body. Some maintenance works could be done by labour contributions, instead of requiring cash payment for everything even during the agricultural off-season, or after a poor harvest.

The second group would consist of the credit co-operatives which, as Black Bush Folder shows, require increased precautions. One of these could be the joint guarantee or security provided by the group, all of whose members are held responsible for each individual member's debts (on the principle of the German Reifeisen credit institutions). Credit would always be extended in kind in the form of labour, supplies of seeds, fertilisers and herbicides. When granted for land improvements, a part of the credit could be used for the payment of labour, but the farmer should carry a substantial part.of it. Such credits would be granted in installments following inspection of the work already completed and with close technical supervision. Above all, they would only be partial, i.e. the credit agency would never

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U See Dumont, R, "Revolution dans les campagnes chinoises", Editions du Seuil, 1957.

provide more than ;::part of the necessary investment or cost. ":Vhere the farmer himself has invested nothing, he tends tc be less interested in the success of the operation. rhat is why all along Guiana's coast we see too. many combines left exposed to the destructive effects of rain and mud, without care or attention, as they were bought with loan funds.

Co-operation inane country should be closely associated with an inurease in investments. If the latter continue to be financed by the state only, their flow will be altog1t:11er inade{!uato to cope ,.rith the needs of development and with the explosive population grovrth. This involves a very different coneept from that of the Europ,aan consumers' co-operatives, which aims primarily at enabling the consumers to make small savings in the form of a distribution of profits.

Co-oparatives in new countries should never carry out such re-distribution ut should dev0te all their resources and all their savings for new investments. In the USSR resources for investment were at first achieved by means of compulsory deliveries of goods at low prices, but the utilisation of these resources was not left in the hands of the farmers, as they were chiefly intended for industry. Today, the Khol kb.)z must, in addition to the 12% 3hare of its gross income earmarked for taxes, devote 13 to 30% of the same i.ncome for its own investments, which are thus compulsorily fixed at a high level. The Chinese example shows us the danger, in a baclcv,ard economy, of eglecting too much agricultural investments. On the other hand, P. Newman ':las shm-m the urgency, and we might say the priority, that must be granted to i r.dustrial investments. The best way of reconciling these two objectives :ould be to stimulate the farmers themselves to provide (as they have not done so far) the larger part of the investments necessary for the development of agriculture. Only the sugar estates have done this, thanks to their high ·.egree of technical efficiency, on the one hand, and the artificially high price of sugar pail by the British consumer on the other,

It is commonly said that farmers do not have funds available for investment. This statement should be qualified. Although there are poor people in the countryside, unsuspected savings also accumulate, usually in unproductive forms and it would be important to put these funds back into circulation.[1] This woul enable Guiana's farming population to develop agriculture by its own efforts.

Some f rmers of the Tapakuma project asked the Government to build them a roa.d. vVhon they finally understood that there were really no more cre its available, they were quick in raising the necessary funds th mselves. It is this new state of mind, one of self-help, that it is most important to develop in the countryside.

7. A. neral extension service, or one based on. th -9:.iJfer& ll o uct.s.?.

The expert's trips through Guiana were organised on the land settlements or the experimental stations so that there was no opportunity for a prolonged discussion with the personnel of the extension service. As is the case almost all o er the world, the personnel is not numerous enough in view of the size and the difficulties of the job. Their technical qualifications seem to be generally quite good, although not aluays comprehensive enough. It does seem that here, as in other under-developed countries, the lacunae in economic kno·,1-. ledge are grlater 'than in technical knowledge and make it impossible to dra,..,up realistic "farm management schemes" or farm plans adapted ix, tm real, possHiilities. of each category of farmers. As the extension personnel have hardly ever worked with their hands, they are not always sufficiently interested in reducing the effort required by a given type of work, either by improved hand tools or by a more widespread use of draught animals. Above all, the supremacy of rioe cultivation seems too deeply rooted, and an attempt to :further truly intensive livestock: production on the basis of artificial pastures and fodder crops does not seem energetic enough.

There is a trend of opinion favourable to the creation of an extension service which would be specialised according to product nd whose expenses would be covered by a consumer tax and especially by an export tax to be levied on the g ven product. This would ease the national budget, and the factories utilising the product would participate in the management of the personnel paid in this way and would be directly interested, as they are personally concerned with the problem of supplies. Ho,rever, there are several drawbacks in a system like this, one of them being that a de facto priority would in this nay continue. to be granted to expo t commodities, on which it is easier to collect taxes. By the same token, insufficient attention would be paid to products for local consumption intended to improve national nutrition as well as to reduce imports. Mixed farming and modern livestock production which often constitute the essential basis of progress, are closely interrelated with production for local consumption and would also suffer.

Two alternatives emerge. The first lies in creating, in addition to these services specialised according to product, a general service more directly aimed at production for local consumption, e.g. ground provisions, vegetables and fruit and espscially at p oblems connected with livestock production, i.e. artificial pastures fodaer crops and intensive stock-raising tech iques. The other would be to incorporate these product specialists within a single general service, so as to preserve unity in the directio and policy of extension and avoid exposing the farmers to multilateral advice, which experience has proven can be in many instances conflicting.

e are inclined to choose the second alternative, and two conditions appear essential in this case. The extension service would have to be relieved of any fiscal or repressive duties (enforcement of compulsory measures for crop protection); and it would have to be separated from all welfare, community development and other so-called "social" operations. The extension service should gain the farmers' confidence, hence it should al\rays present itself as their friend and supporter. Hmleve:r, it must be concerned nith raising their living standard through an increase in their production to be achieved at the lowest possible cost. the framework of the extension services' ,mrk is primarily technical·economic even though it must necessarily be carried out Ylith a full understanding of the multiple human problems posed by development. One of the basic reasons for the very poor results achieved by the present extension services is the inadequate technical ualirications of the rural population it deals with. Agricultural training is so far practically non-existent, and it should be provided for urgently.

8. AzF i cult }'.?. l trainin .,g at all educational levels[11/]

The training of the farmers of the future is based on a satisfactory development of primary and secondary education in rural areas. As such training has to be adapted to the actual level of education of the population, in the present conditions of British Guiana it cannot progress unless the basic educational level is raised. HoHever this is a two-way relationship. General education, especially at the primary level, should play an important part in providing the necessary background for agricultural training. This orientation or bias towards agriculture should aim at developing in the children an understanding of the problems of their environment affecting plants, animals and people. This implies not only a closer adaptation of basic teaching tm1ards the elements of the environment, but also that this teaching should have a definite practical aspect in the cultivation of plants and raising of small animals. The teachers required for these rural schools should have a specially adapted and extremely good training.

Nevertheless; the above requirements do not imply that the rural school should actually train for farming at such an early stage,nnd consequently no expensive equipment or specialised staff should be necessary. The purpose should not be to provide farm training as such but the basic understanding indispensable for future agricultural training. Educators should study this matter very carefully.

In countries where secondary education is still very limited, particularly in rural areas, and where the bulk of agricultural production is carried out by a population with a low level of education; it cannot be expected that graduates from secondary schools villas a rule engage in farming. For this reason it is not advisable to emphasise too strongly the training in agriculture in general secondary schools. However, these sohools should, as in the case of rural schools, t ansmit a thorough understanding of the problems of agricultural and rural life and make students aware of the resources and possibilities for agricultural development. This approach would create a favourable attitude towards specific agricultural train ng for those who, after leaving school, wish to engage in farming. They would thus have an excellent basis for making full use of the agricultural training to be provided by practical fa m schools established for this specific purpose.

The practical farm schools should operate in very close coordination 1vith the agricultural extension service and should offer training .in very specific matters and in a very practical way to those young farmers willing to go on in this occupation and having the possibility to work as farmers. This ould mean that every farm school should be able to train, through well-planned short courses a greater number of farmers per year, and at a lower cost than at present. The expenditure incurred for this kind of training would be 11ell invested. Hm,ever, the efficiency of this kind of teaching would depend on a well-trained staff. The number of such schools t roughout the country would naturally depend upon the total number of farmers and more particularly upon the number showing interest in such training every year. As this kind of training is intended tohelp the producer in his elforts, it is desirable that every future farmer pass through different basic courses during the period of his training.

1/ Tii ;-se t-io --ires.3nt;-th ;e.co;;e;dations of the FAO Division concerned ,,ith Agricultural ducation, which do not coincide Rith the author's opinion on this subject. Professor Dumont's views, however, were already unofficially presented to the Government in his original draft l'eport.

xtension personnel would then receive further training in the agricultural school established at Mon Repos. It would be best, during the immediate future, to undertake above all a priority training program for training good technicians, since this is the category for which there is the greatest need, instead of embarking prematurely on the training of poorly qualified graduates of a so-called university level because of the lack of a s fficient number of teachers..

In a few years no agricultural certificate, including university degrees} shou-ld be granted at the end of' the study period to anyone unable to give evidence of having performed a least six months of actual practical manual work on a farm or in an agricultural enterprise. In the case of candid.ates for future settlement, this remunerated and prolonged training period would be combined with compulsory savings. There is no need to hide the fact that the enactment of such a program require a profound and thorough change in the mentality of those who determine the educational systems at present. This is one of the fundamental requirements of development. If teaching continues to consist primarily of studies of Marlborough's army, the rivers of Scotland and learned dissertations on Shakespeare, Guiana's economic future will be jeopardised once and for all, as the development of a small country is not easy, especially when so many bad habits have already been formed.

9. Disparities betue er; J own and countryside . the I1ee <! % 0 . yi ider market

We can only mention, .,ithout taking time to discuss them as fully as they:.deserve, these two questions which, however, are of fundamental importance. The increasing inequalities of.imcorne bet\!een the town and the country and especially oetween small farmers and civil servants (for the employees of Georgetown are much less well paid than those of Xingston) is a serious phenomenon. It is leading to a dangerously increasing dislike for farming as a profession. 3xcept for a fewwealthy rural lando\mers, no hope of social dvancement ithin the farming sector itself I ists at present, the only hope is the town, and especially the civil service:1/. This state of mind threatens to lead to a dangerous stagnation of Guiana's agricultural economy, for at the beginning of development agriculture alone can play the leading role, although this is not the case later on. China's difficulties have once a0ain borne this out, if further proof 11ere needed.

The great majority of expenditures for social development are allocated to the towns and their attraction increases much more rapidly than their employment opportunities, the result is urban unemployment, which is particularly sharp in Guiana's capital. This is even more serious in that, at the same time, the manpower which would neverthe!ess be indispensable to intensify agricultural production cannot be found to maintain the drainage system, open up new land for farmings and .1eed and ha.rvest the rice crop in time. Rural living standards cannot be raised very apidly, as investments are necessary first. Therefore, a relative reduction in urban privileges needs to be consider d.

A nation's development, especially in the industrial sector (which is the real basis of its economic independence); is more difficult the smaller the market it has to supply, i.e. a limited number of inhabitants with low purchasing power and this is certainly Guiana's present situation. Its participation in a broader economic group would greatly facilitate its development. But this problem is essentially political here ,1e can only mention the existence of this additional bottleneck, which is particularly dangerous at the beginning of development.

1/-s - Durnont, R, "L'Afrique Noire est ma.l partie", Editions du Seuil, October 1962.

PART FOUR: TENTATIVE CONCLUSIONS

1. Sugar production.

Sugar production seems technically satisfactory, but .Lits high production costs justify concern for the future, especially after 1970. At that time preferential quotas which alone mako it profitable at present 1 may be eliminated. If sugar prices remain as low as they have been lately on the orld market, the situation will become critical. The high wage rates have led to large investments in the mechanisation of both cultivation and processing, which investments must now be recouped.

The spread of small farm cultivation of sugar caneLwould result in a substantial lowering of costs only if the farmer and his family accept returns far below thos3 of the present agricultural hired labourer, since the productivity of labour ould go down much more quickly than the capital invested. Only an elite of intensive farmers using flood-fallows for hand-cultivated rice and the cane tops to provide fodler for their cattle could perhaps -.Jithstand the competition. Still, it Lwould also be necessary to retain an efficient large-scale enterprise framework for water control, spraying from the air for plant protection transportation, etc.

It would seem wiser, therefore, not to count on sugar alone any longer in the future. If there is the chance of its becoming stagnant it can no longer 11ithout risk remain uppermost among Guianan agricultural products. L/hile there need be no attempt to decrease it prematurely, it ,vould be advisable to increase rapidly seve al other productions.

2. Rice produc i_ n

1'he position of rice is not as good from the technical point of view. Its economic position is perhaps equally prGcarious, should the trade ties between the L,lest Indies and Guiana be weakened. The yields in bags per acre are steadily going down. The nation-,.fide averages in recent years are as follows, 1926-50; 15.8 bags per ncre, 1951-54: 14.5 1955-60: 13.9, and 1961 (a rather poor year) 12.9. The land recently put under cultivation is, on the average, of poorer quality, uater control is too often inadequate and, above all, mechanisation has led to the 11idespread practice of direct sowing instead of transplanting "lhich usad to produce more. Reaping by combine leads to losses, especially when there are not enough machines and. the breakdowns are frequent.

Mechanisation has reduced sharply the quality of the rice 19 to 27% of "super" in 1943-45, 6 out of 8 years (1953-60) with less than 1270 of "super ', Drying of the sheaves obtained ,Lith the reaper-binder and threshing Tiith a threshing-machine (or 75 mechanisation at considerably lower cost) would raise the quality and make possible the use of the rice strawiJ for fodder; industry and manure. Mechani:ation provides only 38 man-days of agricultural work per year on 15 acres for a family whose installation costs totalled $17,000 (Bhck Bush Folder). The r3turns on 8.2 bags per acre in 1961 paid only for rent and mech nisation expenses and barely brought in more than J50 in gross production per acre, or 4 to 55; of the total investment, with a net output for farm labour nil or even negative.

1/ Often burned at present!

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Although rice brought $15.4 million through exports in 1960, it was necessary to import $15.3 million worth of agricultural machinery in 1958 and e.4 million in 1960, a large part of which as for rice. There is no assurance that Guiana ,1ill continue to compete easily on the rice market; therefore, sources (or savings) of foreign currency other than sugar and rice must be sought for Guiana's economy. The el'.siest and quickest way seems to be to out imports.

3. Food I rn OS'st

The main food imports in 1960 were as follows (million :r. I. dollars) Å

Dairy products	5.67
Meat, meat preparations	2.05
Fish	2.37
Animal feeds	1.44
Lards	0.19
Total animal products or feeds	11. 72
Cereals	5,33
Vegetables	2.96
Fruits and fruit products	1.24
Grand Total	21.25

Except for heat flour, some cereals and a part of concentrated feed for livestock, the r3st can bo produced locally or some very similar oommodities can be obtained in Guiana7 and this can be done with less imports than for rice cultivation. So that the net benefit of such outs in imports would be even greater than inoreasLs in rice exports and the market for these products is already available at homo.

All the more so as exports of plantains and other ground provi ions can be increased from Pomeroon and the North-west to the Jest Indies thereby . increasing Guiana's export trade. In fact, for these perishable and bulky products, as well as for timber, the proximity of the market is much more important than.for rice, and competition from distant sources practically impossible.

We therefore urgently recommend that a very serious effort be made in the sector of vegetables, fruits; pulses, citrus, bananas and plantains, and ground provision crops in general.

4. Animal husbandry

Another bad effect of the unconsidered extension of low-yield rice is that it has reduced the cattle population of the coastal area, Since 1947 the cattle, sheep; oat and hog numbers have tended (according to not very reliable statistics) to decrease in absolute figures and consequently even more so per capita. Although the slaughtering of beef has increased recently, this is probably due to the fact that slaughterings have encroached on the capital and are not being confined to the disposable yearly output, particularly with regard to draught cattle, which are rapidly giving way before tractors and trucks.

Livestock production cannot become profitable uithin the present framework of poor, overgrazed and often marshy natural pastures. The animals receive a bad diet v1hich barely keeps them alive, btyt are not sufficiently well fed to be able to produce plentiful supplies of meat and millc.

New production should) ue believe, begin primarily on artificial pastures (Pangola, other graminaceous crops, or :Cudzu, should the Pangola virus become dangerous. Their high cost of establishment L.rnuld be better paid off by milk than by meat. It would cost less however, if male steers of the dairy stock were r.ised for their meat, .:i.ndif the meat of cows that were still young enough were used as a kind of by-product of dairy production Å .le therefore advise for the coastal area the setting up of this combined and improved mill -meat production, in the follouing three main areas.

(a; on either side of the Demerara East and iest coast) to supply the capital and its heavily populated suburbs ,,ith high quality fresh millc, this production should bo concentrated nearer to the consumption area

(b) on the ssequibo coast, within the Tapakuma project, 5,000 acres should be set off to maintain, before 1970, 4,000 cows, each yielding1400 allons of milk per year (therefore 500 per lacL tation)L so as to supply a small factery for cheese, powdered milk and butter.

(c) on the shore of the Cor ntyno, south of Skeldon, and along the Berbice near Mara, another somewhat similar prmject could be installed b".?fore 1975. These tLrvo projects would mako it possible to postpone the larger one proposed for Ebini, which would reach its full production capacity by 1980.

The possibility of supplying tho country uith powdered milk at very low cost would justify some hesitation before undertaking these projects if this supply wore guaranteed for the future.

1/ 1,25 acres and 400 gallons of milk per co.rare very modest figures. In Jamaica good pastures feed a cow per acre with 600 g'"lllons per year. In Puerto Rico, with elephant grass stable-fed, 2,400 lb. (live weight) of beef cattle per acre per year have already been reached i.e. 1,300 lb. of beef or J400 per aero. 7ith this cut fodder it is possible to feed 2 coi,s per nc.:rc and obtain 1,200 gallons of milk (this figure has even been exceeded at the sugar mill of Beaufort in Guadeloupe). At 60p a gallon of milk that would make $720 of returns per acre. An excellent cane harvest, or 40 tons/acre brings $400; highly intonsive millc production brings in almost double highly intensive sugar cane) highly intensive maat brings almost as much. But all of this remains almost totally unlrnO\m in Guiana.

5. Small livestock

Small livestock production can and should acquire great economic importance. The problem of hogs and poultry is subordinated to the possibility of getting choa 0r fcGds, and especially proteins. For hogs at the present stage the proolom Lmay be partly solved on the farm itself by fodder crops. For poultry, ready-made food is alre dy much more advantageous, especially in la:cgo-scale, technically very uell-managed poultry farms. But the ra matcri ls for those compound fo,ds should bo produced in tho country itself to a much greater degree; while care should be taken at the same time to cut transportation costs and handling. Sheep, which are more prolific in the tropics, can become very profitable if the ewes arc selected for their milk output and arc much better fed (proteins, mineral salts). Control of parasites should not be neglected as it is ;roll under \my nov,. Goats of the milk-giving stock, if well fed and immune against brucellosis, can becomo the real "poor man's cov,s".

Tho modern. concept of animal husbandry rests on the promise that thero arc no longer any frJe-wandering animals, causing heavy damage both to crops and to wator supply systems. Grass on the roadsides should no longer be grazed except by .:rnimals tethered to a post. All \"mndering animals should immediately bo seized and sold (even if tho ouner is known), as an example, nith tho profits going to the budgets of the local communities.

6. Settl_.ement of_the i!l_e_ri_or._ pee!._ ap.d dairy_cat!).

The lands of the intorior are generally poor, or even oxtromely poor. Therefore their developmont requires cheap transport of fertiliser and sometimes lime. Apart from the supply locally of mines and industries in agricultural products (Mackenzie), the primary effort should therefore be concentratod near to navigable rivers. 'Ye have suggested, around Ebini, 10 000 milk co,;:rsgiving *600* gallons of milk per year (700 per lnctationJ for 1980, to supply a condonsary of the size of that at Bog L.falk (Nestle) in Jamaica. Its production ,1ould be for the local market, since for exports of milk by-products, Puarto Rico, Jamaica. and. especially Mexico, Colombia and Venezuela are in a decidedly better position than Guiana (drier; m ritime or mountain climate ith a distinct winter season and richer soils).

But ith regard to moat, ith tho use of a grass as productive as Pangola in case of the latter's failure, the intermediate savannah would seem in a position to become competitive oven for exports, and there is a world beef shortage. However, natural conditions here are decidedly less favourable than in a number of other countries of Central America

(Honduras nd British Honduras)) or of South America (3 l rge part of Brazil). So we hnve limited the target, after having suggested at first much higher figures, to 100,000 slau htorod animals por year towards 1975 or 1980.

'Ino dairy bolt we have proposed L,rould run along the Berbico (sprinkling irrigation nd milk collection roads). The beef c ttle sector would bG located on both siles of this river, preferably near the bro,rn sands (see tho rosults of the Soil Survey for more specific location).

The real agricultural development of the upinini sa.vannahs (.rith at present a cou per year .nd per square milel) can legitimately be postponed to tho encl of this century. in any ase it ,rnuld be far too costly at present.

This modest scheme for moat production has been established on the assumption of a somewhat prolonged availability of a market for sugar. Should the difficulties in this field precipitate, a much quicker development of beef cattle should be considered if such production is found really economic, on condition hov1over, th.at thore ,1ill be available a sufficient number of very good technicians and h8avy invc3stment funds. Nevertheless to count on beef cattle alone to replace quickly sugar exports in tho event of a serious decline in tho latter v7ould probably be far too optimistic. Guiana should try to make the most of all its assets and it should diversify its exports still further.

7. Bana 3ocoa. Cashev, Nuts Fish Pineayples, Peanuts J obacco Citrus Fruit

It wou+d therefore be very advisable to develop for export also other products, at present considered secondary. Thus, the banana project to. be carried jointly ,Iith the United Fruit branch appears to be very promising. Cocoa has shown excellent results on one of the Bookers plantations at Vreodesteyn along the west coast of the Demerara river. The economic returns arc still doubtful for such a firm, especially because of theft of the p1oduce of the first inter-planted crops which are necessary to recoup more rapidly investments on these plantations. In ell organised peasant cultivation such a crop would be profitable if the qua1ity were high.

Cashew nut has a large outlet on dollar markets) its oil is in heavy demand and it can grov1 oven on poor savannah lands. 1,000 tons per year \7ould be needed to supply a small shelling plant. 'le suggest two trial plantations one intensive uith experimental use of fertiliser in quite removed areas along the Berbice river and on the very poor intermediate savannahs, nd the other extensive, in tho Rupinini savannahs, \Iithout fertiliser. This L;rnuld supply a.cloquate lrno\/ledge on which to base the choice of a location for a possible shelling plant in the future.

'ie merely point out, .-itih the necessary compet_ence to discuss it the extreme importance of the problem of fisheries. Intensive fish brooding would bo technically possible in tho lakes, reservoirs and canals, if the fishing could be properly controlled. The potential for sea fishing scorns far greater than present production. Cheap fish f our could first supplement the human diet and especially t.hat .of children and pregnant and nursing ,,omen, nnd then provide cheap proteins for hogs and poultry•

1:1ealso recommend trials of pineapples, peanuts and tobacco and an attempt to develop citrus fruits. But the whole of those development$, if the tr:L:1ls pr.eve positive, should be organised, planned and carried out around· processing plants•. In this nay, tha.nks to the lowering of collection costs competition ,rnuld become possible, even under slightly unfavourable natural conditions. However, this is absolutely on condition that the technology, as such, is of the very highest quality. Poanut s grmm on sandy soil v1ould provide, in addition to oil, oil-cakes viith a high protein content, both for dire.ct human consumption and for animal feed (especially milk co\ls, hogs and poultry).

All of this will still not be enough. But other hopes may arise from the industrial crops sector and through better utilisation of the present forests, particularly for paper-pulp production.

8. Co_:tt_t_ri J.s_to be continued an il palm to be tried

With modern insecticides, cotton, at nn equal technical level, can bring three or four times more income per acre than paddy. The goal of a ton of unginned cotton per acre can by now be envisaged on soil·s with a go9cl structure, adequately irrigated but avoiding any excess of waterll. The· ground should be levelled, but in such a way as to enable all excess water to run off in the same directi-on, with a steady slope and not absolutely horizont31, sit is for rice. Perfect drain go and plant protection re.the indispensable conditions to the success of. cotton; ,7hore it ou:n be harvcst•Jd in tho dry season.

'..hh a constantly humid but n vertheless quite sunny climate, or with an undexgr.ound ,mter lcve,l nt a. rec.sonablo distance from the surface, neither too near nor too far, African oil palm (Elaeis guinecnsis) is >1orth trying provided that a large amount of suitable l nd can be found in the r dius of an oil mill. It ould be best not to go beyond a radius of 8 miles by road to supply an oil mill processing 1,000 tons a year. Ho over such a mill could be supplied from n greater distance with water transport if the plant"l.tion were set up along a river. Once again, we would give priority to the development of the b·st soils along the river banks.

1/ The :i.verago is around two tons, both in tho south-·,rnstern United States and in the Soviet Union.

Enormous resources of Guiana's forests

".lith gross exports of :;4.4 million and net exports of B.4 million only, forests come far behind sugar and rice, as they have barely been touched, just ·'skimmed off"; and the processing of timber once it has been cut is not carried far enough, the quality of the sawmills and therefore of the sawn wood is very 101.1.

The exploitation of the great bulk of treea for wood fibre, fibre and particle boards, and especially for paper pulp, can provide great resources, especially if we add sugar cane bagasse, rice stra,1 and, some day perhaps, some reeds (utilisation of marshes too costly to drain).

The returns from timber vrnuld increase even more quickly if large-scale Pinus Caribbea plantations set along navigable or floatable rivers were to supply the paper-pulp factories, and if other quick-growing high-value ·,/Ood plantations proved economical despite their very long gestation period.

10. Development--El:. a..!!J subj eE,.tt2 .J; p.lavSl. ilability o.! hj g h l yFal ifiec! Guianese .technicians 1;: ee Annex I)

Good use, the full utilisation of available capital, depends first of all on the abilities of those using it. Of course, there are foreign technicians, but they would be too expensive to obtain and are not available in sufficient numbers. An immediate and absolute priority should theTefore be given to technical education.

In addition to its usual, specialised sphere (in technical and vocational institutes), the training in technical subjects should enter on a large scale into the regular teaching programs at every level, elementary, secondary (classical and modern) and advanced or higher education. and into all faculties including lav, and letters, which can no longer remain isolated from active development.

Practical agricultural orientation with some manual labour providing the basis for school meals should be introduced in all the r.ural schools. Iron- and wood-working, and later on mechanics :-,ould likev1ise logically be placed in the urban schools, first on the elementary and later on the secondary level. The technical, economic and social faculties should be created first in the future university. The granting of agricultural diplomas should be subject to a year of practical manual work in the field. This would give a generation that :rnuld be more efficient in carrying on extension work, particularly if it has a clearer view of social problems and a sound educational background on the basic economics of agricultural activities.

On Independence Day ,,ar should be declared "on poverty, hunger; illness and ignorance". To be won, this war would require an effort far beyond that which is being exerted at present. First of all, everybody must be a.Jle to find .1ork unemployment and under-employment should be reduced quickly if the body of measures proposed above, or other•similar measures, ar rapidly ad?pted. ,,1atev8r the effort undertaken in t::ieprimary sector - agriculture, an1•1al husbandry, for sts, fisheries - it :,ill never be enou h to ensure an adequate Jevelopment of Guiana's economy; because of the handicap of unfavourable natural conditions. "Therefore, a great ei'fort in other branches of activity, nnd esp cially industry, must be adled to it .1/

Y See Newman, P. -;The E;o mic Future of British Guiana'\ op. cit.

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APP:WNDIX I

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Head I - Agriculture

Subhead 1: Beef in Intermediate Savannahs

More credits should be given for this project and trials for a dairy sector should be added.

Subhead 2: Dairy credits

More credits should be given, provided techniques are modernised (see Section 4, Part Four)

Subheads 3 and 4: satisfactory; no remarks.

Subhead ,g These credits should be considerably reduced or even abolished and the resources released transferred to Subheads 1 and 2 above.

Subhead 6: Yes, but less credits for buildings and offices and more for the recruitment of personnel as such,

Head III - Irrigation and Drainage

We are absolutely in disagreement. This is a continuation of the same errors as those which led to the present situation at Black Bush Folder.
The old irrigation and drainage networks first should improve with local participation in t ese works.
New networks should be developed but first for higher value crops than rice, i.e. vegetables, fruits, ground provisions, possibly cotton and above all artificial pastures, especially. for dairy cows. This leads to a compl te revision of the present conceptst better drainage is necessary and irrigation water should be saved.

Head X - Land Development

La"le observations as for Head III. ThLe most urgent wo.rk should b aimed, first of all, at intensifying production in. the old lan- settlements, before new ones are created. Furthermore nevr Oi.es should preferably be suitable to the crops mentioned unde: Head III.

Head XVI

Subhead 1: Foresl,

These cr,dits are entirely inadequate if a scheme for a wood pulp factor is envisaged (2,500 acres :per year of new plantations).

APP.L 1"])IX II

TR.L PROBL::J:1.OF TS: C, f'L-F.ÅtLL- E.SFB.mL\ BUXTCN TO Fl1.,,IS,,.N'Cl

(t..r1.STD0.1-.ST, DU"I.RARA)

e visited the plantations at Beterverwagting, and spoke to the cane-farmers in this village, and to those ,1t Buxton. On the whole it seems that the cane-farmers have yields of cane per acre which amount to two-thirds that of neighbouring states (25 metric tons against 37 per acre). In Jamaica, the small farmers' yields arc even lov,, r, as low as half or ovEn a third of yields on the estates. It is a fact that their fields are very often on the hills, hence on land which is poor r and drier. Here the natural conditions of the two categories of cane-producers ars more or less comparable, the peas nts cultivating old estates abo.ndoned by the plantor.s, but adjoining estates hich are still under cultivation.

This diff rance in yields can easily be ac0ounted for as cane-farmers are hardly able to practise flood-fallov,, and they have neither mechanical tillage nor pump ir1igation, nor aerial spraying of fertili ers and pesticides. ThGy are only nitrogen fertilisers, in smaller quantities than on the estates, and not always at the best time. But they normally use neither phosphates nor muriate of potassiumm. In the long run, the variation in yields is in danger of becoming even greater,

However, the 400(?) cane-farmers at Beterverwa ing and Triumph, cultivating 750 acres of cane, could Cbrtainly make far better use of their lands. A few of them practise flood-fallow, and these ould plant a rice crop: this has already been done, producing interesting results -- 75 bags from 3,5 acres. Th estates could be urged to sow rice on their flood-fallow, If this were harvested by hand or collected by the small motor mower operated by hand, the essential advantage of flood-fallow -L- -- the improvement of soil structure -- could be retained Å .1/ Such a crop might be grown on a system of contracts between the plantation and the workers, on terms to be decided.

Those who harvest the cane, especially when assisted by cheir familiesL, Lor the same a5ricultural workers ev("ry season, could refrain from burning the cane before cutting. This would allow them to us tr.e cane tops, to fatten thin sattle. From a field with a yield of 25 tons of cane per acre some 8 tons of tops could b6 harvested. This is oqual to the nutritive value of over one ton of cereals per ac1e, or more tban thel average Guiana paddy field. This would enable th nut weig t, of these animals to be increased by 200 to 250 lbs (in beef e uival t) at 30 cents per ib., i.e. 60 to 75 dollars per acre supplementary ret rns, and therefore much more than a poor paddy field, at 8 bags p0r acre. This would amply repay the extra work entailed by tho non-bur ing, th g thGring of the tops, the distribution of these to the cattle aft(,r choJ?ping and admixture of molasses.

i} Point queried by M, Cate.

This extra work could moreover be fully componsated by the use of pack-animals, carrying the canes and the tops from the place whore they arc cut to the canal, where they could be loaded onto barges. Allowing this work to be und0rtakGn by men indicates a lack of imagination. On a l rge estate, the size of the problem makes it perhaps vory difficult to solve by using pack animals, but this does not apply on tho small-farm scale.

Thu young stE'LErsL fattened on these tops could b(used for this work, and in this way they would be on tho spot GvEry day, eating the tops without having to carry the top to them, and directly manuring the fields. They could follow the curved path of a cultivdtion bed for its whole length, so as not to cross th many cross-drainage ditches. The very light work thus demanded of them would certainly not prcv nt thoir fattening. "here thore are sufficient numbers of donkeys, it would bo more convenient to use these, as th0y arc more docile and more easily trained.

It is notL a question of replacing machine power by animal draught but of transferring to animals, whenever possible, work which is st.ill carried out by men. However, it is necessary to find out whether the cane-farmer is really a farmer. Many of them hire labourers to do their work for a Wijge, and are thus employers of labour. They have no. desire to be real peasant farmors, similar to the luropean púasant who has to make a daily effort to take good care of his cattle. This intensive-farming mentality, linking stock-raising and agriculture, seems to me to be essential to thG succGss of any agrarian reform, which envisages the taking over of cane production by the farmers,

Thus we cannot advise the breakdovm of the plantations into cane-farmers minifundia, as this would involve a sharp reduction on yields. Co-operative plantation managem nt, keeping the pros8nt framework, seems to be an altogether less dangerous solut on. But the habits contracted by state workers, who put in loss Lwork than is done on the plantations, make it absolutelyimpcssible to advise this solution at the morne.nt. In orde.r to be succ ssful, it would be nec6ssary, above all, to have a corps of technical porsonnGl who are both competent and devoted to the service of Guiana people.

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APP1,NDIX III

IiliiPROvug,_NT OF ItICE CULTIVATION rC_THODS

(a) Nurseries. This aspect is fundamGntal but seoms most imporfectly handled throughout this part of America, from Brazil to Mexico. V:o advised M. Poonai, of th& 1'.::Repos Centr::i.l xpcriment Station, to obtain a recE:nt book by a French agronomist on tho north-western 1'"..adagascar alluvial coastal plains, which ar uit similar to the coastal plains of British Guiana Å .1/ The technique which might be worth trying consists roughly of the followingg

- Sowing far more sparsely, som0 500 lbs of seed per acre of nursery. This depends on the size of tho scGds,rathcr more being sown of larger seods.

- Giving thE. nursery strong doses of phosphatts (if lacking) and rGlatively stiong do.s0s of nitrogen. Pre-gc..rminated grains should be: sovm on the surface of damp soil, which should be perfectly 1GvÃlled, and not under water. Water. should be added gradually, as the small shoots begin to grow.

- Transplanting the plants after 28 to 35 days, according to the season and the variety. If it is necessary to transplant onto plots under a deep layer of water -- which is not advisable -- it is better to carry out a double transplantation, to obtain sufficiently tall plants which will, however, not suffer from having been too long in over-dense nurseriGs. This double tra.nsplanting gE-n.rally increases yiE.lds.

- Transplanting at the rate of plants per hole in rich soils or soils with adoquate nitrogen, the distance bE.tween holes varying from 25 to 30 cm in these cases (all this should be checked locally).

(b) Control and Gconomy of water. The, low differences in yields sometimes noted here, in comparison with those in Asia, bct,1cen sown and transplanted rice, seGms to stem from impcrfoct nursory procedure, in most cases. Transplanting is very valuable protection against weods and pink rice, as it allows the pre.limina.y. germination of weed se&ds and the des L uction of weed shoots by tractors with cage-wheels. Similarly it allows economy of water and insecticide throughout th month spent in the nursery. Such economy will be of greater interest to the rice-grower when he will pay for the irrigation watGr in accordance with the volume usvd. Y Without this measure the incredibl6 wast6 of water 11 continue. The farmer who pays for th& watGr according to the volume used will construct bunds in order to economise, and to kGep more riin water, as in China, in August, for instance, v,he,n tho rice nocds deeper water -..ndth0: rd.ins are about to stop; there would thus b ths double 0conomy of pumping and drainage.

1/ M. Dobelmann - "Station Agricole de N'1arovoay, N'lajonga, r:a.dagascar "La Riziculture a r'!adagascar".

Y See the suggestions made for Black Bush Folder.

(c) Lev6lling of thG plots is fundamental, both for weed control and to give the optimum depth of water to the rico Avorywhere. Some agronomists are loath to advisú this, because if too much surface soil is taken away, the yield droÕ;quickly, unless vast quantities of fertilisers ar used. If the top-soil were put asid before the extra layer o:r soil was takún awa , this disadvantage could be avoided; the operation would, however, b come much more costly. e have already suggested a compromise, by first sub-dividing the large lots by contour bunds, these contours having a diff0rcncG in l'.aght of only 3 inches. Levelling would then take place within these:: sma.11 plots, involving the taking away of far less top soil, 1.5 inches at thG utmost. The bunds would be narrowex, but could-be crossed by tractors and combines. They should be at least 10 inches high, to hold enough water before and during the flowering of the rice.

(d) We advise a trial at semi-mechanised transplantation, using draught oxen. Recúnt Chinese and Italian transplanting machines, if successful here, would allow a great reduction in transplantation work. By advancing the date of the latter, tho proportion of early-transplanted fields would be increased, v.ith the probability of higher yields. 1/

(e) Fertilisers. When all the othGr factors -- control of water insects, discaseS:-weeds are present (otherwise the eff ctiveness of fertilising becomes clearly inadequate), fertilisers greatly increase yields, even on the best soils. However, rice which is broadcast sometimes see s t benefit less ldequately Er6 fertilisar than t ais l ted rice. If the latter comes from over-crowded nurseries, fertili Led and transplanted too late, it will also not justify the use of fertilisers. Their use is to be adbised first in the nursery, as it is more effective there, before being applied to the paddy field(lack of adequate nutrition for young plants, as for young animals, cannot be remedied easily.) But when all other factors are present, f0rtili93rs should receive high priority. On the whole, they are used far too little in the paddy fields.

(f) Under-employment and mcchanisa At Black Bush Folder we saw the most serious case; high public expenditure resulting in too little work for the settlers, and leading to employment for foreign workers producing tractors and combines, rather than for Guiana's rice-growers. By spending foroign currency on these machines, which are too little used during the course of a year, thcrs is less chance of obtaining factory equipment, which could v,ork for 300 days of the years, under a roof. A study of the situation at Black Bush Poldor advised to allot 15 acres per family, and showed that the greatest employment and highest income would be obtained by allocating 5 acres to manual working and 10 acres to mechanised working. This calculation was based on present yields, and would have to be modified substantially if transplanting were practised efficiently with more intensive methods. Moreover, it seems rather

i} M.R.B. Cate writesg "You lay far too much emphasis on transplanting. The highest national average yield in the world is Australia, where all rice is broadcast". Italy and Spain have hightr yields than Australia, and the state of technical knowledge of Guianan small-farmers c nnot be compared with that of the Australian farmer. This is Lwhy, on this point, we would maintain our position.

unrealistic to have one third of the v;ork carried out manually and tv10 thirds mechanised for each crop season. Manual work is not interesting unless really intensive methods arc used, along the lines of Chinese technique.

Other solutions seem more advisable. First, a greater intensification of rice growing, such as is outlined above. Then the combination on each farm, of paddy with non-subm€.r·ged crops ("ground provisions"), and perhaps dairy production. 1/ Dry crops, where good drainage exists, could finally alte nat· indqub]ecropping in the spring on the same soil with the rice (black eye peas, etc.).

1/ This dairy production, however, would b0 better carr·iod out in speciali ed farm.s.

APFJlrnIX IV

HAIU.ICONG-ABARY RICE DJJVELOP1lENT CORPORATION

Set up in 194.3 when it .ms necessary to increc.se the area under rice at all costs, the IJARDC served as a test case for mechanised riceLLgrowing and in this respect scorns to have done valuable service. But the economic results have been very bad. Tho rice mill u s incurring deficits as it was not running at full capacity. Yields of rice; starting at some 18 bags per acre, dropped to about 8 bags in 195.3-57, ith a high proportion of pink rice, sometimes more than .35 . It was then decided to restrict the area under cultivation to 2,000 acrosl/and to introduce a two-year fallo system on tho plots in the ,10rst condition, vhcre yields had dropped to the greatest extent.

This t\,o-yoar fallo\J, uith cattle browsing on the pink rice shoots and ,10ods, allov1cd yields to rise again to 15 bags per aero \7ith just 1% pink rice over an area of 440 acres. A three-year fallow would doubtless have been oven better, but this spontaneous fallow, sit stands now, remains practically unproductive and is thus a heavy burden on tho costly irrigation system. On tho otho 1hand the bad drainage excludes the rotation with improved pastures.fl or any other crop but rice.

;7ater control is an essential pre-r.3quisito to any degree of intensification. Tho e is just a single canal for both irrigation and drainage, which docs not enable any real control of the vatcr to bo obtained. Transforming such a defective system Tiould seem to be a very costly business. Research to find a semi-aquatic fodder plant more resistant than Para grass to submersion would be useful to utilise th0 most flooded fallow.

A most distr,ssing spectacle is that of the herd of extremely thin cov,s which give a negligible production. One hundrod cows produced for sale no more than .3,.300 gallons of milk in 1960-61, or 150 litres per cow per year, and the condition of the calves shows clearly that they do not get too much. The basic ro son for this is that the cows - in August 1962 - were put out to pasture for four hours only, from 11.00 to 15.000 hours, just in tho hottest part of the day and on very poor, marshy grassland. NeverthGless, thore '.ms plenty of good quality Para grass on the bunds the "volunteers" from tho test field opposite could supply rich fodder and the nearby mill rice-bran. There was no sign of the care in tending the cattle ,1hich is sometimes found on the small Indian farmsY there is barely a thought for anything but incro::tsing numbors, at tho expense of their feeding - and hence, eventually, of their production. Even the rice straw a very rough form of fodder, could be usod either as fodder or buried in tho soil to improve it; but it is burnt!

Y On 144 acres only fertilisers \Jore applL3d and thosG had an average yield of 18 bags.

2} Where there is not too prolonged subversion, artificial pastures of Para grass could be tried.

JI Seo Appendix VIII

Th0 high proportion of pink rice mGQ.ns th:it the rice !!Till must bleach the rice strongly, putting it through the mill four times, and this takes m1ay the bost part of the grain as far ns human nutrition is concerned. Lihy not sell on the local mnrlrnt, 'lt a lo\7cr price, a sort of "national" rice nith n certain)roportion of pink g1Lains, uhich is better for the health than tLc over-blcachod rice? Rice chaff is bur.nt } 1hon it could be used to improve the structure of clay soils.Ñ]. Tho 1shcs are thrown away, whoreas they have a certain value as fertiliser dospite thair high silica content. Finally, although tho 1'IARiiChas boon established at Abary for nearly t,,onty years, no real villago has yet been ost:-,,blishod ,7ith a productive belt of garden-orchards.

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g/ Soc Dumont, E. "La Culturo du Riz dans le Delta du Tonkin", Paris, 1935.

APP JNDIX V

v.:JTIG:'.illTOEGENAND SETTLJlrE:NT SC:a:illi.v1E

On a total of 3,500 acres, of uhich 2,085 under rice, 185 settlers have been settled. Ho\1ever, 75 only are farmers real peasants. The majority are there.fore part-time farmers, and it is just this category.,hich is 10,10st to make progress all over the world. Public funds should therefore not be used in increasing their number, as they are already numerous enough. The real farmers' plots often cover 18 to 25 acres. Ten of them have already bought an individual tractor, which has caused a quick decline in the use of draught oxen (40 pairs). This mechanisation sets a strong economic problem as these small farmers are not able to recoup their outlay on their own small plots. Hence they also work their neighbours' land, but compe.tition in this sphere will soon become excessive, for over-mechanisation is already being felt.

The three agricultural machinery cooperatives seem more rational; they possess a tractor each and consist of 5 to 7 members. A larger cooperative, with a number of tractors of varying sizes and even a combine, might be envisaged some day in the future. There are private entrepreneurs for harvesting and threshing who fix rates per bag, whereas, when harvesting areas uith a heavy crop, the cost of harvesting per bag quickly decreases. It would be useful to vary the rate in this direction or to fix it per acre, 11hich would favour farmers.

L The land is held on long-term leasehold, which seems to us to be far better than freehold, whose often uneconomic and sometimes disastrous consequences we saw in Jamaica. The lease rate varies from 15 dollars an acre on clay soil to 11 dollars on begas3e soil and 9 dollars on toxic soil. This range does not seem to be sufficient, as it is commonplace to harvest t.10 or even three times as much paddy per acre on clay soil. As many cultivation costs are constant per unit of area, the range between lease rents should be even larger than that between yields.

Encouragement to practise rational rotations should be given by a marked 101,ering of rents for lea.sing land under other crops (black eye peas, etc.) than rice, or under fodder crops. But t,.1is L.10uld have to be organised on compact areas in order to ensure adequate drainage as the optimum water regime is no longer that of the paddy fields.

Again, the weakest point lies in the pastures and fodder crops for cutting which separate the village from the paddy fields. These have strongly deteriorated and have a very low productivity. It culd be necessary to improve their drainage, quite an easy matter in this case as a satisfactory drainage net rnrk already exists. It uould also be necessary to provide maintenance .rhich could be clone through compulsory organisation among farmers with the authority to carry out the t0:.sk not done by defaulters at the latters' cost. As a consequence of this poor fodder, if 40 settlers sell milk the quantity supplied daily on the settlement \rnuld vary from 60 to 100 gallons, or 1.5 to 2.5 Jallons per cultivator. If it is true that there

are over 600 head of cattle inchrli.ng at least 300 coL,1s this yield, even bearing in mind producers' o n consumption is clearly insufficient. It is also a result of the practice - '7hich is so ,-;idespread throughout tropical America - of miEcing the cows only once a day, ,1hich cannot be reconciled with intensive dairy production. The calf should be separated from its mother a few days after birth and soon be put onto artificial milk.

The farmers' president very willingly admits that on well-tended Para grass he cut eome 100 lbs. of grass every day from a plot measuring 44 square feet. This would indicate a very high production potential, if his claims are correct, and he obtained 30 tons of fr-esh grass per month per ha. or maybe 3 tons of dry matter. The ,rnrld record observed at the Puerto Rico experimental station of 63,000 units of fodder per hectare make this figure possible. It canno be maintained very long without large applications of fertilisers, which is not done here. Pangola has never been tested. A fodder demonstration plot, to be established by the Department of Agriculture, appears essential and urgent for each settlement. It is necessary to make a display "at home" of the great possibilities of modern technology. This should be the task of an overseer in each settlement sector.

The fact that it was possible to hand over the rice mill to the producers' cooperative seems of the greatest interest, a cx3 ple o be followed. But this is only possible ith an able president and a good director Horking as a team.

Although 70 settlers have received land for ground provisions, only 30 of them cultivate it so that, \Lith the generalised u.se of the tractor and combines, there are too few settlers who achieve full employment on their own land. Stable manure is not collected adequately. Instead of burning the rice straw, it should be utilised partly as fodder, partly to mix with manure. The latter could be used mainly for the cultivation of vegetables, which could replace part of the pastures if the remaining part were turned into artificial pastures on an intensive basis with high applications of fertilisers as in the paddy fields.

Rice chaff could be used to advantage on these gardens and fodder plojs, as it makos over-heavy soils lighter and retains moisture. Irrigation water is wasted her3 too, as a consequence of bad levelling; the practice of constantly renewing the water, and also of the system of rating which we have already mentioned. However, in spite of tho above observations; good ,rnrk has been done at Vcrgcnoegen, and this has to be pointed out.

APP-JNDIX VI

TAPAKUMA. PROJECT AND ANNA REGINA-SETTLEMENT
(ESSEQUIBO _COAST)

"When the last estate on Essequibo Coast closed down in 19?5 this uas regarded as something in the nature of a major catastrophe.Y The region has since then rightly been looked upon as a depressed area, ,ith a great deal of rural unemployment. And the lack of any irrigation network has hitherto m3ant that the rice harvest depended essentially on rainfall, and yields were as irregular as the rainfall. But this is one more proof of the weakness of a rice economy, Rhen rice is almost t e only source of revenue of a region.

Nevertheless, these difficulties have played an important role as incentives and a number of farmers tend their paddy fields more carefully than in the other parts of Guiana's coast; neither is mechanisation as accentuated as in other parts. The difference in yields between transplanted and broad-cast rice .seems, on account of the care taken, much greater than elsewhere. We were impressed by a small farm at Taymouth Manor, VTffere, of a total of 5.5 acres, 4 acres are planted each crop season, with an average of ?5 bags per acre (autumn) and 20 bags per acre (spring) with transplantatio . This gives 180 bags per year on 5.5 acres, far more than the uutput at Black Bush Polder on an area almost three times as big. The practical and economic possibilities of the intensification of rice production arc thus amply demonstrated.

The Tapakuma project already supplies irrigation water and good drain-age, hence a correct ater control system at a rate of 2.68 do;lars per year per acre at Anna Regina. There is also a lease charge of 12 collars per acre. As 18 plus 12, i.e. 30 bags (or a value of about 200 dollars) per acre can be reasonably expected, this irrigation tax seems inadequate. It ought to cov r not only all the maintenance costs but also a moderate rate of interest on capital expenditure. This capital expenditure in the recently irrigated sectors reaches about 700 dollars per acre. Otherwise, as at Black Bush Folder the result will be a subsidized agriculture, and the burden of this subsidy ucighs too heavily on public finance and hinders all other possibilities of development.

Furthermore, rice alone hp,s receiv0d the fill attention of the authoritics and the projects of cooperative pastures have unfortunately been abandoned. Certainly, in the present state of mind the cooperative pastures system uould seem premature. Modern artificial pastures, the only type of pasture of interest, demands high expenditure and the distribution of this, as well as of the returns, among the beneficiaries> would be too difficult. Unlike paddy fields, poor natural grasslands cannot bear a rent of 15 dollars per acre (inclusive of irrigation charges). The outcome is that livestock production is in great danger of decreasing even more, as a result of irrigation.

/ .Smith .R, British Guiana, op. cit.

g/ In spr ng 1962 j as many as 28 bags per acre were harvested.

It would therefore be necessary to tackle the problem of irrigated pastures once again from a completely fresh angle, that of artif.;_cial, intensive, fertilised pastures with high productivity. The high cost of water control and irrigation works makes it imperative, in order to ensure their profitability, to establish these artificial, high-productivity pastures. '.leenvisage (sec A pondix VII) a Pangola pasture (or one of Cynodon, if the virus becomes 'r7orse, 1ith strong nitrogen applications, able to support one quality cow per acre with 500 to 600 gallons of milk per acre from the beginning.

Jo at one time intended to propose the setting up of a dairy zone in the Anna Regina "D" zone 1 inland from the coast, as this has been recognised as "unsuitable" for rice-growing. By so doing, v1e would have accepted the traditional priority given to rice. If this concept of cereal priority were at last abandoned, it would be acknmrledged that a properly cxploited dairy farm brings higher returns than a paddy field. Therefore, pastures for dairy cows should be given priority and should be established on the land most suitable for growing good pastures and also on those areas best connected by good roads. The fact is that milk is collected every day, while paddy is collected only twice a year. Milk is a far more delicate and perishable food, and this leads us logically to choose the site of the future dairy plant alongside a_ ain road Tiith the pastures for dairy cattle well grouped around it.!/

Such a decision would suppose that everything would be done to see that this dairy bol should succeed. Now, there are still a number of difficulties, such as the standard of education of the farmers and the number of quality dairy cows already available. It is urgent to start ork on overcoming these two bottlenecks which are fundamental obstacles to the development of any modern stock-raising sector. In lact, progress in stock-raising will be the kay to that of the whole agrarian economy and ultimately of Guiana's entire economy.

Apart from this dairy belt which in any event is quite localised, the allocation of 10 acres of paddy fields and of 2.5 acres of dry land would enable a family to be fully employed. If therG uere two rice crops per yearwith transplantation and very careful cultivation wi h the rest of the land as kitchen garden, family income and employment would be satisfactory 1 higher than that of a Black Bush Folder family, ,ith its over-extensive and ovcr-mechanised. and therefore over-expensive cultivation of 15 acres of bad paddy fields.

!/ Another dairy zone could then be sought in the hinterland of Black Bush Folder and of Mara or south of Slcoldon \Jhere the rich alluvial soils have not yet been put under rice.

APPENDIX VII

THE BEL AIR(BookersJ. DAIRY ON THE OUTSKIRTS OF GEORGETO[7]N

At the present timo there are 80 co,,s in lactation on 80 acres of artificial Pangola pasture. 0\1ing to the foar of the Pangola virus sprcading, no overgrazing is desired but one may normally keep more than one dairy cow per acre. Four pounds of concentrates arc added every day, plus one pound per gallon of milk abovo 4 gallons. In this way it has long been possible to support 70 dairy co s on 60 acres. The dairy farm is on lonland 4 feet below high tide; drained only by gravity, and therefore badly drained. Pressure drainage uould improve the \mter regime here, but this vrnuld be rather costly. It is, ho ever, used for sugar cnne which, as wo shall see, yields far less than milk. The co-.,s splash about in these submerged pastures, which sometimes damages their feet.

The average yield is 20 pints per cow in lactation per day in the dry season. It drops to 17 pints in the rainy season ,,hen walking in tho marshy pastures tires the cattle. lhth 300 days of lactation and 18,5 pints on average, about 700 gallons per year and per aero nould be the average yield. But it is necessary to add to this the gras lands supporting the dry cows, which make up a large proportion of the herd as there are 18 months between calves, or 8 months vlithout milking. At 12 cants n pint delivered to the plant, or 11.7 at the farm gate, there is a gross milk income of 820 dollars per acre, far higher than for sugar cane (300 to 400 dollars per acre) and not to be compared with rice (barely 100 dollars),

This comes from a very high, too high price for milk. However, evon in Holland the price paid for miL to the producer, Hith price equalisation for consumption and for processing milk, plus the official subsidy; reached - in June 1962 - about 60 cents per g llon. At this price of 60 cents a gallon there would still be 400 dollars gross income from milk per acre, on v,hich figure a larger-scale dairy farm could comfortably manage. '.lth less expensive and_ !lJOre modern buildings, free outhouse stalls and a "herringbone'' mi.ki.ng sheal/ instead of a stable nhore each co\/ is tied up, the work uould be greatly decreased ns would building costs. This would enable three persons to handle 150 dairy co\/s, whereas at present 4 persons handle 80 cm1s: this gives a possible reduction of 60Lioin labour costs. Compared with Europe there is the great advantage of requiring less expensive buildings (no cold), of higher yields per acre of grass, and in particular there is no need to build up costly fodder reserves (hay and silage). On tho other hand, the disadvantages include very costly vrator control - but t!Lis is at least as high in the Dutch polders. Health control is also rather more important. Lith better feeding a yield of 1,000 gallons ,Jill one day be reached" this figure is already exceeded in the best Puerto Rican farms, although admittedly the climate is somewhat more favourable.

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7:/ In the USSR e have seen a still l0ss expensive mechanical milking system.

A modern dairy farm such as that very recently set up near Montereau in France for a c cperative of nine big farmers might be envisaged for 480 cows and as many acres1 or a larger area if dry cows and replacement heifers are also to be maintained. There is no reason, if all h3alth precautions are taken (against brucellosis } ticks), for the milk in this case to be considerably dearer than in the United States or in Europe. At 60 cents a gallon, the establishment of processing plants could soon be envisaged.

Costs \L:1ould be already substantially reduced if the calving rate were higher. The present proportion of two calves in three years is insufficient, and too many non-productive cous are supported. This low fertility rate may be the result of protein deficiencies (certain amino-acids) or mineral deficiencies (phosphates?). In any case it seems possible to envisage before long a small milk-processing plant (butter, cheese and powdered milk production) to be situated somewhere on the coast, on condition that there is a threefold development :

- firstly, an incr ase in the improved pastures, which often make it possible to double the milk obtained from the present cows;

- an increase in the herd, forbidding the slaughtering of young females, even of very moderate quality> artificial insemination will quickly improve the follo.-1ing generations

- the bulls needed will be obtained thrwgh the import of a few dozen Holstein heif rs already served by high breed bulls.

The development of the milk-processing industry to replace imported products may soon be envisaged. It will become possible with milk paid at 60 cents a gallon to the producer. Production should be very concentrated, near a processing plant to decrease collection costs. But first of all, it will be ncessary as ne have seen, to improve t'.10capital's milk supply system.

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APPENDIX VIII

A SM.ALL INDIAN DAIRY FARM AT BETERVER7AGTING
- STCOAST D3MERARA)

CONCLUSIONS REGARDING DAIRY S TTLEMENTS

The small farm under study cultivates about one-third of an acre of Para grass, partly under coconut palms. This grass is rono,,ed and is re-planted every five years, approximately. Moreover, the farm brings some 25 lbs. of grass every day from pastures located further a..-ray, for Ylhich 1.50 dGllars por ucok is paid, Each month 5 bags of dairy feed are given at 7 dollars per bag (or 35 dollars per month), plus 6 gallons of molasses per week.

The milk produced from six cross-bred cows (creole x Holstein) is 60 gallons per week in the good period (January - March) but may drop to 40 gallons or lower. This gives a weekly average of some 50 gallons, or 2,600 gallons i.e. 430 gallons per year per milking cow if this cow has a period of lactation lasting a year.

This is not a cattle-raising farm, as the farm keeps only cows in full production which arc sold when they become dry. This system increases depreciation costs. However, oven selling the milk at 64 cents per gallon (recently it was sold at 96 cents), it manages quite well with about 140 dollars gross income and perhaps 90 dollars of net income from agriculture per month.

As a first comment, for the best small producers, t c price of 64 or even 60 cents a gallon is still quite advantageous, even with present production techniques vrhich are rather out-of-date. They can be greatly improved in at least five ways

(a) By closer study given to feeding, especially regarding proteins and mineral salts vlhich could incr.:iase still more tho amount of milk produced. It seems that tho proportion of molasses is too high for good dairy co\7S and tho use of lo.-, quality rice seems less revlarding than that of rice bran.

(b) By reducing feeding costs without impairing the output through improving by cutting it when it is younger - every four to five wee.ks with applications of ammonium sulphate, othen1iso tho plant will soon become exhausted. This expenditure in fort ilisers will be easily recouped, to almost double the figure laid out, by the economy on feed and by the increase in milk production.

(c) By decreasing work. If all the Para grass ,7ere produced near the stable 7 transport for this grass would be reduced and tho manure used ,,ithout transport cost. Such manure is better used for a vegetable garden, the vegetable leaves going to the cows while tho fertilisers would be applied to tho pastures. In the new settlements, it is there-fQre necessary to locate the grass nearer the cows 7 or bettor still put the cows on the cut grass in the case of a reasonably large farm. Boat transport of the grass uould be less costly, especially if draught animals ,Jere in general used to pull these boats, using young cattle (from the age of one year as this work is light); or else donkeys, Hhich are greatly under-employed in British Guiana.

(d) By direct grazing of a grass such as Pangola \1hich Lwould cl0arly bo the best solution. This .1ould greatly r:,ducc rnrk but Ln:,uld requiro larger areas located near the farm,

In future dairy settlements; it Hill thcrefcre be necessary to envisage at least ten acres of Pangola, plus rCJaybe three acres of cut fe,dder, to feed 16 cows per dairy farm; these c0;rn r10uld graze in the r.iorning and \/ould be stabled in the afternoon,in a peasant farm system thus, on the basis of 500 gallons per cow, a gross annual production of 8,000 gallons of milk would be obtained. At that time, even paying 50 cents a gallon for this milk - which ,,culd greatly facilit1.to the running of a processing plant - there would still be 4,000 doll2rs grcss receipts per family, or far more than the income from rice on a similar area. Later on, \/hon tecnnical stand,:,rds arc higher, production per acre would be increased even further (but also expenditure) by overhead irrigaticn, which vrnuld very greatly economise v,ator.

(e) By better veterinary care and especially tho complete elimination of cattle ticks ,,hich should be achieved in future dairy belts in any caseL Such farms should not be dispersed, as otherLJise thGy uould be locked upon as s1 b'3idiary prc.,duction of a rice farm. Such subsidiary farms should cater only for the food needs of a local market. To supply touns and factories it is necessary to collect the dairy farms in specialised belts to reduce the cost of collecting the milk to ab0ut 2 cents per gallon. Milk collection in Jamaica costs 16 cents or 0ne quarter the price paid the producer, as milk is produced all ever the island. The cost of artificial insemination and of veterinary control would likovise be reduced considerably.

A earicus effort at dairy settlement .10uld make it p0ssible to envisage the setting up of a small processing plant; but only if the peasants arc backed up by a strong oxtensic.,n service and have alrondy established Pangola fields with largo fertiliser applications. It ill aloo bo necessary to envisage lerge-scale p:roduction of young heifers. In s,1vrt, in place of the present inefficient nd uneconomic micrv-dairy farms, where the largely low-quality millc is toe costly to produce and colloct, it \lould be interesting to devolop t 0 typos of dairy farm :

- the "settlement" tyne, tho family farm L,:ith 15 to 20 co;1s, hand-milked or with milking-shod and vne milking machine shared by threG, four or five noighb0uring farms,
- the "estate" typo, the large dairy farm, L,1ith 100 to 500 head and ith sp3cialisod milking shed; a st to farm could have from 500 to 1,000 cous.

Quality fresh milk for town c0nsumption could be pr0ducod at 60 cents a gallon, milk for processing in the plants could even be produced at 50 cents. At that time, tho problems of disposal of excess production and the setting up CJf processing plants could be solved. Milk nt present costs too much and tho price is not adjusted to quality. It is necessary to lo or ho base price, allov it to vary seasonally to regularise supply; and pay handsomely for quality, especially as rognrds tho fnt cvntent and bacteriological purity.

APFfilrnrx IX

GARD:illf OF DEW LAND SbTTLlJUENT

Locatod in the outskirts of Georgotc.,.m to the s0uth this sottlomont is divided into threo sections, accc.,rding to tho duminant soil typo. On the clay alluvial scils to the uost along tho Demorara River, plots measuring 7.5 acres have ba3n allocated, ith vieu to setting up permanent plantations, especially of citrus fruit (oranges) and of caca0. Further aL.-,ayfrom the river, 0n shallm1 pegasse oc..il 25 acres have been allocated fer the setting up vf mixed farms, citrus fruit un a smaller p rt and milk on the larger part. Finally, there is the deep pogasse soil tu the extromo cast, where dairy production only .,as envisaged at tho outset. Irrigation and drainage arc 1.1ti1 assured fc,r tho main canals.

In actual fact, there is scarcoly any difference bct-.-1e0n these throe sectors. Proximity to tho tmm has onablod tho farmers to undertake profitable cultivation of b nanas, Qlantains, vcgcta lcs and ground provisions (ed,loes? tanias, yarns). On tho Jhole, those crvps are planted too closely, tho remains of an Indian habit of an over-populated cuuntry. Internal drainage canals h.vc not always boon built and, if they have, they are usually badly maintained. Some of those to \7hom tho l1.nd has been allocated do not live on the spot, but they arc not very many. In the citrus sector two acres had in principle been set asido for pastures, but no such area 'i7as over in fact allocated to them. Certain small pastures have in fact been enclosed, but these are natural, not improved, pastures. Some very tiny plots of fodder fur cutting are the chief improvement in this sphere, but this is highly insufficient.

The demonstration plot of the Department of Agriculture is an excellent idea, one to be generalised on conditi n that fodder crops are cut more frequently (there arc often 6-woek intervals) and thnt they are no longer carried on the overseer's head. Tho practical possibility of reduuing this very heavy ,rnrk should be i7idoly demonstrated oithor b r driving the cous to the spot to food er by bringing the grass to them by bvat or cart. This ;iculd be a step towards improved internal transp0rt on the farm v1hich would (at last) enable the manure to be used rationally.

Tho citrus fields arc not all properly drained and there is tuc much cutting Spanish-style. Tho troes should rather be shaped American style, like a half-balloon resting on the ground. The Cudzu-type cover plants could be grazed by cattle ,waring a disc to prevent them from feeding higher up, as in Jamaica.

In the dairy section, there is in fact the same system, only with a little more emphasie on cows. But cattle-raising is still poor, ,1hile tho disposal o'f'crops at a govd price due to the proximity of the toi7n makes these crcps far more profitable. This results in a dofinito discredit to stock-raising, stomming especially from techniques \lhich are often back.7ard. Nevorthelt?ss, tho presence of the neighbouring tovm rJakos it equally advantagoous to prutluco fresh milk.