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CONSIDERATIONS ON ECONOMY IN THE RUBBER INDUSTRY.

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by

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Introduction.

Whilst at the end of May rubber fetched Gls. 1,08 per half K.G. at Batavia, the price dropped to Gls. 0,94 in June, afterwards falling still further to Gls. 0,90, notwithstanding the restriction of export to 60% of the standard production by the British interests. The cause of this slump must be attributed to the fact that production exceeds consumption, i.e. to over-production or under-consumption, as is obvious from the steady increase of London and New York stocks. The expectation of a considerable increase in consumption in 1926, similar to that in 1925, has not been realised, as shown from the figures of estimated consumption ; 1924 450000 tons, 1925 546000 tons and 1926 548000 tons. This miscalculation was caused chiefly by the fact that the consumption in the U. S. A., the largest consumer of rubber, decreased instead of increasing, being 318000 tons in 1924, 382000 tons in 1925 but only 368000 tons in 1926 [1]).

The decrease in rubber consumption in the United States is a consequence of a campaign to limit the use of plantation rubber as far as possible. Apart from a more economical use of rubber, and the purchase of what was strictly necessary only, this end has been achieved principally by increasing the production of reclaimed rubber. While in 1925 the U. S. A. manufactured 141676 tons of this rubber from waste tires etc., this quantity was increased to 180000 tons in 1926 [2]). Considering that the world's rubber production amounted to 420000 tons in 1924, 500000 tons in 1925 and 608000 tons in 1926 [3]), it is obvious that the large quantities of reclaimed rubber manufactured in the U. S. A. have a marked influence on the sale of the plantation product. From the extension of this industry during the preceding year a considerable increase of the production may be expected for 1927, if the current rubber price is maintained. Is it any wonder that voices are raised to find a means of decreasing the use

1) Korte Berichten van L. N. & H. 1927 p. 67.
2) The India Rubber Journal, 11 June 1927.
3) Korte Berichten van L. N. &. H. 1927 p. 29.

of reclaimed rubber ? And it goes without saying that British planters are the first to do so since their profits are already dwindling on account of the restricted export.

At a meeting a Ceylon planter, Mr. SYDNEY SMITH [1]) pointed out, that the pivotal price of 1/9 per lb. (Gls. 2,32 p. K.G.) at which export of 100 % of standard production is permitted, should be reduced to 1/3 (Gls. 1,66 p. K.G.) to meet successfully the competition from reclaimed rubber. According to inquiries which he had made, the reclaiming of rubber from waste articles, especially tires, is not remunerative at this price. A price of 2/-- with 60 % of the production yields a profit to British planters equal to that from 100 % standard production at 1/3. There is every reason therefore for reducing the price allowing export of 100% of the standard production to 1/3.

The planters association of Ceylon agreed with this view and the association of proprietors of rubber estates in Europe has been informed of this resolution.

Others however think that the danger from the use of reclaimed rubber should not be exaggerated, since in their opinion articles manufactured with this rubber will be less durable and must be renewed sooner, consequently there will be a greater demand for the plantation product and therefore they expect prices to go up in the course of this year. Apparently American manufacturers also look forward to higher prices, since they have organized a pool to prevent by coöperation an unreasonable advance in prices, as stated by the chairman of the U.S.R. Co.

Although it is not easy to predict anything definite as regards fluctuations in the near future, the present slump may be a warning that a further drop of the prices is not precluded. The recent drop in prices has already considerably reduced the profit of the estates and therefore I deem it of sufficient importance to discuss the means by which your profits may be increased. Of course it is not the intention to undertake such measures as might endanger the future of the estate.

Profit.

The annual profit of an estate can roughly be estimated by multiplying the production by the margin between the cost of production and the selling price, therefore obviously an increase in the profit can be attained in two ways, by increasing the production and by widening the margin between cost of production and selling prices.

These two factors are inter-related, in other words increasing the production can diminish the margin between cost of production and selling price, so that increase of production does not always yield a higher profit and may even result in loss.

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1) The Malayan Tin & Rubber Journal XVI (1927) p. 719.

The effect will not always be the same and mainly depends on the selling price. With good prices increase of the production, even if it increases the cost of production, nearly always results in higher profits; on the other hand the cost of production should be reduced by all possible means when prices are low, since in this way the profit can be more readily increased than by higher output.

If for instance the production is increased by 10% and the margin between selling price and cost of production is decreased by 9%, this increased production will not yield any profit, since 100% production × 100% margin is equal to 110% production × 91% margin.

If the margin between selling price and cost of production is wide, it is evident that a measure resulting in higher output usually will not increase the cost of production to such an extent that the profit secured by a higher production will be absorbed. With very low prices this may however easily occur.

If for instance a given measure increases the production by 10%, resulting in an increase of the cost of production of Gls. 0,80 per K.G. by Gls. 0,04, these 4 cents will amount to 4% of the margin if the selling price is Gls. 1,80, and a profit is secured. If however the selling price is Gls. 1,20, 4 cents amount to 10% of the margin and a loss results.

Now let us consider by what means the production can be increased and the cost of production reduced.

Increase of the production.

Apart from an extension of the area in bearing, an increase in production can be attained in four ways ; by planting more trees than are ultimately wanted and thinning out selectively; by replacing the trees by higher yielders; by better and more intensive upkeep of the plantation ; by changes in established procedures of production and manufacture.

The original rubber estates were planted with so-called sapu seed, selection not being considered at the time, consequently the oldest plantations do not consist of the best yielders. It is a well known fact that the yield of these trees varies widely and a few trees produce several times the quantity of latex derived from other trees of equal age.

GRANTHAM [1]), the Director of the Plantation Research Department of the U. S. R. Pl. Inc. determined the daily yield of the trees on an area of 12,5 acres, planted in 1911 ; the results after 9 years are given on tabel, see page hereafter.

The considerable difference in yielding capacity of various trees follows from these data. It is obvious however that these differences should not exclusively be attributed to inherent characters of the trees, but also to accidental factors such as more favourable conditions for some of the trees.

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1) The Planter 1927 p. 347.

Yield in K.G. over 9 years period	Number of trees in class	Average actual yield per tree in lb. per year
below 10	42	2,1
10—20	351	3,7
20—30	313	6,1
30—40	127	8,6
40—50	52	10,8
50—60	22	13,6
60—70	7	15,8
70—80	3	18,0
above 80	1	21,7
Total	918	5,9

Selective thinning out.

One method of obtaining a plantation of trees yielding more rubber than the original material consists of planting more trees than the eventual stand and thinning out the bad yielders. This system was first introduced by the well known HAMAKER on Kiara Pajong Estate in Java and at present has been widely used.

GRANTHAM has also experimented along this line and investigated how many trees [1]) should be planted to secure the best results. He ascertained that thinning out can wait until the 3rd year even with as many as 416 trees per acre, since the trees do not get crowded before that time. He thinned out the poorly grown trees and started test tapping at $3^1/_2$ years old over half the circumference for a 14 days period, subsequently thinning out more trees. This test tapping was repeated after one year.

When the trees were $4^1/_2$ years old they were tapped alternate months with one cut over half the circumference.

Number of trees planted per acre in 1920	Thinned in. . . . . to			Yield lb. per acre, 1st latex only	
	1923	1924	1925	First year	Second year, 6 months
417	256	200	126	453	273
349	213	175	119	437	269
253	209	150	125	440	267
199	194	125	123	429	269
126	121	117	116	345	238

[1]) The experiment here quoted was planted with *selected* seed, which possibly explains why the results of planting 400 were not superior to planting 200.

It appears from this table that the production of a plantation with 126 trees originally planted to the acre is lower than that from an original stand of 200 trees. The advantage of planting a larger number of trees is insignificant, therefore when using selected seed 200 trees should be planted to the acre and thinned selectively.

The results of selective thinning however depend on the planting material used ; the better this is, the higher the rubber production of the eventual plantation.

Superior planting material.

Ordinary seed is the worst planting material, since selection has not been taken into consideration. In an ordinary plantation the majority of trees are bad yielders, therefore the greater part of the trees grown from this seed will become inferior producers.

When the intension is to plant an estate which will produce more rubber than a thinned plantation from ordinary seed, superior materal should be used.

Choosing the best mothertrees — i.e. the trees with the highest yields in the plantation — for seed trees, gives improvement, but this method will be long in yielding results, since it is not known to what extent the high yield is a consequence of environmental factors or to what extent to inherent characters. Moreover the fathertree will exert an influence on the latex yield of the offspring. Dr. HEUSSER [1]) has ascertained that the yields of the illegitimate offspring of 7 mothertrees varied widely, so that not only did the average yield of the offspring of one mothertree differ considerably from that of another, but also the yields of the offspring of one mothertree showed considerable variation among themselves.

This uncertainty as regards the quality of the planting material only ceased when VAN HELTEN, the Manager of the „Cultuurtuin" at Buitenzorg, succeeded in vegetatively propagating Hevea. Independent of him BODDE, the Manager of Pasir Waringin Estate, also succeeded in grafting Hevea. This budgrafting has proved a means of testing mothertrees, to ascertain whether the high yield is an inherent character of the tree or a consequence of favourable environmental factors.

Also the trees with an inherent high rubber yield can be propagated on a large scale by this method, with no chance of the favourable characters being lost.

Several research workers, amongst others GRANTHAM on the H. A. P. M. estates, Dr. CRAMER and VAN HELTEN at Buitenzorg and Dr. HEUSSER of our experiment station, have tested mothertrees in this way, by tapping buddings, and thanks to Dr. HEUSSER's work we have at present several approved clones, bidded offspring, which have proved to be high yielders. The high yield of these approved clones is a hereditary character, therefore in all probability seeds from these buddings will also possess this desirable character and it is not pre-

[1]) Communications Rubber Series No. 40.

Rejuvenation in other cultivations.

In Europe the harvest of crops yielding timber or bark, when the trees are unrooted, is the moment to plant a new stand. Usually owners choose a given period in which to rejuvenate their forests[1]), a corresponding proportion being felled annually and re-planted. Apart from this, rejuvenation is limited to the planting of gaps made by wind or disease, so long as the plants supplied have a chance of growing.

In the „Plenterbetrieb" [1]), consisting of trees of widely differing ages, the plantation is rejuvenated according to another system. The oldest trees are felled and younger ones grow up in the gaps thus formed, a new undergrowth growing up from the seeds of the old trees.

Generally speaking the teak and mixed forests [2]) in the Dutch East Indies are rejuvenated in a similar manner to the ordinary forests in Europe.

In coffee cultivation stumping is practised, after which the trees are allowed to shoot again. Recently the stumps are sometimes grafted with wood from high yielders.

Usually tea is rejuvenated by supplying the plants killed by disease.

In Cinchona cultivation originally part of the plantation was annually felled and re-planted, but of late rejuvenation by supplying has been introduced by VAN LEERSUM on the Government's Cinchona Estate. On this Subject he has published the following comment [3]) : „It goes without saying that gaps in „these plantations should not be left unplanted, since otherwise they will „become large, as round these gaps several diseased trees are found. Besides „the cost of upkeep of these gaps is considerable since they are centres of harm-„ful weeds and pests.

„There are two ways of restoring these plantations, by felling and re-„planting the stand, or by supplying the gaps with well developed Cinchona „Ledgeriana grafts of high alkaloid content on hybrid robusta or C. succirubra „stocks, according to the condition of the topsoil ; the latter system is used „on the Government's Cinchona Estate for several years and has proved a „success".

Rejuvenation of rubber.

Rubber can also be rejuvenated according to the abovementioned two systems, viz. re-planting or selective rejuvenation, removing the poorest yielders first and supplying with superior material, till ultimately all trees have been replaced.

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[1]) A. Buhler. Der Waldbau II p. 499.
„ „ „ II p. 572.
[2]) H. J. A. M. BECKMAN. Tectona XII p. 1.
[3]) Teysmannia XXII p. 217.

cluded, that amongst the seedlings trees will be found even better than the original clones. Therefore seed from our isolated seed gardens and generally speaking from plantations budded with approved clones will be superior to so-called selected seed from ordinary plantations, since we know for certain that it originates from mothertrees with the inherent character of a high rubber yield.

By thinning out the poorest yielders in a plantation of these buddings and their seeds an appreciable improvement of the rubber production can be attained. For this reason, when using superior material, again more trees are planted per unit of surface than are ultimately retained, about 150 to the acre, e.g. 12 × 24 feet.

At present the supply of seed from budded areas of approved clones is still inadequate, and therefore until larger quantities are available it is almost essential to plant buddings exclusively, or buddings mixed with seedlings from so-called selected seed from the plantation. In the latter case it should be borne in mind that ultimately a greater percentage of the seedlings must be thinned out than of the buddings.

Menace to old plantations.

The new plantations laid out with superior material, on coming into bearing, will form a menace to the older estates planted with ordinary seed, since the former will yield more rubber per unit of area than the latter, and consequently the cost of production will be reduced.

As long as the selling price remains high the older plantations will yield a profit, but if as a consequence of increased production, especially when the plantations of buddings and selected seed come into bearing, the supply of rubber increases and the selling price falls, it will no longer be possible to work the oldest plantations remuneratively, whilst the younger estates with superior material still yield a profit. This process will be accelerated by the decrease in production of the oldest plantations, not only on account of their age, but also as a consequence of the less efficient systems of exploitation in former years. As soon as this occurs or better still at an earlier date the old plantations should be replanted with superior material, i. e. rejuvenated.

Rejuvenation.

This problem, the rejuvenation, will be of utmost importance for the future of the rubber planting industry, since as soon as selection makes progress and improved material is available, the present new plantations must also be rejuvenated.

The best system of rejuvenation has not yet been ascertained and this will for the greater part depend on the condition of the plantation. Therefore a discussion of the present state of the problem of rejuvenating plantations in general and rubber in particular will be of interest and also experiments which should be laid out to improve our knowledge in this respect.

Re-planting.

If the trees have suffered too much from too severe tapping and inadequate upkeep, the plantation must be re-planted, since no advantage worth mentioning can be secured by saving the high yielders for a given period. Plantations suffering severely from root diseases can only be improved by re-planting, since this is the only method of removing all wood thoroughly. If for some reason the uprooting is delayed, the trees can be tapped on a more severe system in order to turn them to good account. Probably the wintering period is the best time for urrooting. All trees are removed and it stands to reason that the new clearing should be re-planted according to the latest scientific progress to secure the best chance of success. The soil on older estates has often suffered much from inefficient upkeep and nothing should be left undone to improve its condition. In the majority of cases manurial experiments are to be recommended, to ascertain whether the growth of the plantation is improved by application of manures. Bunds and stilt pits, and where required drains, green manures and ample planting holes, in which the earth is mixed with stable or artificial manure, will stimulate the growth. Several successfully re-planted areas are known already.

Selective rejuvenation.

Old plantations which have not yet deteriorated too far can be rejuvenated according to both abovementioned systems and the question now arises which of the two will entail the least expense.

HAMAKER has experimented with the second. method, the selective rejuvenation. He mentions [1]) that plantations with extensive soil wash or otherwise spil can be rejuvenated by uprooting the trees in such a way that 60 per bouw (85 per H.A.) at the utmost, but preferably less (the best of course), are left and re-planting with the best material available. Experience with ordinary old estates, planted previous to 1915, has taught him that in areas of 10 years and older, with more than 100 trees to the bouw, removal of the poorest down to 100 per bouw causes no loss in yield.

If in an area with 100 trees to the bouw the poorest up to 20% are removed a loss will occur during the first year. The extent of this decrease in yield will depend on circumstances, whether the poor trees were scattered more or less favourably amongst the high yielders. It is possible however that the decrease will not exceed 10% and the previous yield is equalled after one year.

If the stand numbers between 70 and 100 trees per bouw, then the smaller the number of trees before thinning and the larger the percentage removed, the larger will be the percentage decrease in yield. If the poorest trees are removed and their number does not exceed 50% of the total it is possible that the decrease in yield during the first year will not be more than half of the percentage which the removed trees contributed to the production.

1) Algemeen Landbouwweekblad 1926 p. 857.

This is what HAMAKER has published on the subject ; I may add here that in a large re-planting experiment on the Eastcoast only 8—12 trees were left per acre and yielded 40 — 60% of the previous production.

Large plantations.

Usually large plantations will not be renewed at one time, but over a period of several years, since the costs are then more equally divided and the temporary decrease in yield less perceptible. Moreover the labour force will often be inadequate to re-plant such extensive areas in the course of one year.

In this instance rejuvenation can be carried out in two ways ; either a given part can be cleared annually and re-planted, or an equal number of the poorest trees can be chosen from the total area. With both systems the trees which are next to be removed can be tapped more severely in order to secure a maximum yield. Dr. DE VRIES [1]) gives the following description of an experiment on Tjiseroe Estate. The 14 years old trees were tapped daily with two cuts up to the wood over half the circumference, starting at 80 and 160 c.m. height. In a period of 3 years the yield of these trees was three times that of the control plot which was tapped daily with one cut over $^1/_4$ circumference and on the last (8th) panel over $^1/_3$. The production amounted to 1065 and 326 K.G. per H.A. per year respectively. It is very desirable to start experiments along this line to investigate which tapping system is the most satisfactory and to ascertain the correct period for tapping with the severer system. It stands to reason that period will not be the same in all cases and will partly depend on the available bark reserve.

Whilst individual yield records are not essential for re-planting a given part of the estate, they form the base for selective rejuvenation. Estates which want to rejuvenate according to the latter system and have not yet recorded individual yields will do well to start these measurements at once.

When the individual yield of all trees has been recorded with sufficient accuracy, selective rejuvenation, if carried out in the course of a few years, will probably be less expensive than annual clearing and re-planting of part of the plantation over an equal period. In the former case the best trees are kept on for a few years and are tapped severely, giving a considerable yield, whilst in the latter case each year high yielders are removed and poor trees remain.

It is however still doubtful whether re-planting the gaps made by selective thinning may not present difficulties, whether the young plants will be handicapped too much by the surrounding trees. This will largely depend on the number of trees removed in the first year and experiments must ascertain the correct percentage to be removed. Further re-planting gives a uniform stand, whilst selective rejuvenation results in a plantation with trees differing up to 4—5 years in age.

1) Annual Report 1926 p. 23.

But these drawbacks will be readily accepted if selective rejuvenation proves the cheaper system. Our station will be pleased to give advice in laying out experiments.

Small plantation.

Considering both systems of rejuvenation for small plantations, which can be cleared and re-planted in one year, another factor plays a part, viz. that when re-planting the young stand will be bearing in the shortest possible time, whilst several years will elapse before all young trees are yielding when the estate is selectively rejuvenated. The question arises as to whether the severe tapping of the trees which are saved annually in the old plantation will compensate the loss caused by the fact that part of the young stand comes into bearing at a later date. It seems however certain that there is a fair chance that selective rejuvenation will proved the most satisfactory method ; and investigation on the percentage of trees to be removed annually and on the tapping system which yields the best results is desirable.

Intensive upkeep.

More intensive upkeep can also contribute to an increased production, since like other cultivated plants Hevea is responsive to careful treatment.

Nutrition of the Hevea tree.

To judge the best way of taking care of Hevea one must know first its requirements and from where it takes up the different foodstuffs.

Investigation has proved, that all plants containing chlorophyll require carbondioxide and oxygen, two gases which the plants take up from the air, and also water and certain salts, which they take up from the soil. These salts must contain the elements nitrogen, potassium, calcium, magnesia, iron, phosphorus and sulphur. Therefore the first requirement of all our plants is, that the soil contains sufficient quantities of these elements in such a form, that they can be taken up by the plants or at least that they become assimilable during the period of growth of the plants. And it goes without saying, that roots must be able to reach the foodstuffs, in other words, the structure of the soil must admit of a sufficiently deep penetration of the roots. Further the plants must be able to take up a sufficient quantity of water, and, since all parts of plants, roots included, breathe, a fourth requirement is, that the soil must contain a sufficient quantity of oxygen.

These requirements may be more briefly formulated thus, that the plants require a soil with a good structure, so that the regular absorption of water and oxygen is ensured, and also oppertunity is afforded for the absorption of a sufficient quantity of foodstuffs.

Retention of the topsoil.

The endeavour to secure an increased yield from the plants by an improved treatment involves in the first place precautions to prevent the rain water carrying away part of the topsoil, since the upper layers of the soil are the richest in foodstuffs, and soil wash therefore means a decline in the fertility. On steep inclines horizontal terraces are made, sloping slightly inward, to retain the water, or they are induced to form naturally by planting hedges of shrubby green manures such as Tephrosia and Crotalaria, and depositing the trimmings behind the hedges. On slightly undulating and also on so-called level areas bunds are made in such a way that the flow of the water over the surface is prevented. The terrain is divided therefore into reservoirs resembling sawah's. At the lower side of the bunds catch drains are made (length 2 M., breadth 0,5 M., depth 0,5 M.) so that the water overflowing the bunds is caught and the soil which is carried along is deposited in the drain. The number of bunds and rows of catch drains depends of course on the lay of the land. In this way the flow of water over the surface, carrying along soil particles, can be prevented. On the bunds as well as on the rest of the area green manures are planted to prevent the soil being clogged up. It stands to reason that soils with insufficient permeability should be drained, but in this case small berms are made alongside the ditches, so that the water cannot flow direct from the surface into the drains, but is forced to enter the soil. The absorption of water has the advantage that the air is renewed, carbondioxide is removed and oxygen enters the soil.

Forcing the entrance of water into the soil has given a considerable improvement on several estates, especially in plantations on which the yield fell off quickly when a period of drought set in. Growth of lalang and other grasses in the cover of green manures must of course be checked by weeding.

Shortage of food materials.

Further a shortage of food materials required by the plants can occur. This can best be investigated by starting manuring experiments. More and more areas are found on the Eastcoast which show a shortage of these substances. It has been found that the production of estates on whitish clay soils can be considerably improved by nitrogen. The H. A. P. M., the first company to start manuring, has calculated that a profit of 13 million guilders has been secured in 6 years as a consequence of application of nitrogen.

The yield on these whitish soils has now equalled that on the unmanured red soils, which is an increase of more than 100%.

Improvement of the yield by nitrogen has also been found on red and yellow soils. Besides it has been found, that the growth of green manures can often be stimulated by an application of phosphates, and that this manure can have a favourable effect on young rubber.

Therefore I advise you to start manurial experiments as soon as you observe that the growth is unsatisfactory, or that the production leaves much

to be desired. We shall be pleased to render you assistance with such experiments.

Combating diseases.

As regards the trees a well organized combating of diseases will have an appreciable influence on the production. Especially the efficient treatment of brown bast disease and root fungi has given satisfactory results on many estates. It should be borne in mind that the value of a 10 years old rubbertree amounts to Gls. 16.— - Gls. 20.— and of high yielders of course much more.

Spaces.

It is a well known fact that it is not feasible to renew a single tree, but large spaces, as a consequence of damage by wind or other causes, should be supplied. This should not be carried out too sparingly, since the costs of supplying are insignificant and already compensated if a few trees succeed.

Earthing.

If the roots of a tree have been laid bare by soil wash they should be covered again with earth, since this will improve the yield.

Tapping.

Many estates assign a large number of trees to the tapper (500 for instance), with a view to reducing the tapping costs. It has been found however that if a smaller number of trees is assigned, for instance 350, the yield of a tapping task is considerably increased, so that the higher tapping costs are counteracted. The reason is to be sought for in better tapping.

Loss of latex as a consequence of cups being upset etc. should be prevented and washings of cups and pails should also be worked up into the off-grades.

Manufacture.

Then attention may be drawn to the higher output in sheet manufacture as compared with crepe ; in the former case a larger proportion of the serum constituents remains in the rubber which also absorbs smoke constituents. The difference amounts to 1%. In addition the capital cost of a crepe battery is considerably higher than for a sheet plant. Another advantage is secured in packing, a case containing 100 K.G. of sheet and only 75 K.G. of crepe, giving an appreciable saving on freight.

Reducing the cost of production.

Having discussed the increase of production, the first factor which determines the profit of the estate, now let us consider the second factor, the margin between cost of production and selling price.

Advance of the selling price may be left out of discussions, since this is out of the control of the planters, and only coöperation of the various Managing Boards might perhaps achieve results in this respect. Usually the prices of products from cultivations, which yield high profits, will be reduced in the long run, since so long as the prices are high the plantations will be extended, resulting in an increased supply with consequent lower prices, and even overproduction. Also high prices induce manufacturers to look for substitutes so as to be able to sell their products more cheaply, as is apparently successfully carried out at present with reclaimed rubber.

Therefore we will confine ourselves to the cost of production, which should be reduced as far possible to secure the highest profit for the estate, without decreasing the production, the other factor, too much.

With good prices a high cost of production yields less profit than that secured by more efficiently managed estates, whilst in times of depression one will be amongst the first to work at a loss, and therefore will be obliged to shut down.

It follows that one should always aim at reducing the cost of production to be able to compete with other producers. This should not be put off till low prices compel retrenchment, but attention should be given to this point always, thus also in times of high prices. In times of high prices there is less objection to the introduction of improvements, which involve expense at first, but subsequently reduce the cost of production.

I am convinced that you are much better informed as regards the means of reducing the cost of production than I, to whom this problem is not of daily occurrence, and my remarks should not be considered as settled methods, which must be put into practice without delay, but more as hints which in my opinion are worthy of consideration. I will not discuss all factors composing the cost of production, but restrict myself to the factors directly connected with the cultivation, the collection and the manufacture of the product

The following table, giving the calculation of the cost of production of Hevea rubber on the Government's Rubber Estates in 1926, clearly demonstrates the headings of the cost of production.

Two kinds of factors composing the cost of production can be discerned, viz. the capital outlay, depreciation of which is used in the calculation, and expenses which are entirely taken up in the cost price. It appears from the table that the depreciation amounts to a considerable proportion of the cost price. Under depreciation is included that of the concession, the plantation, and equipment and machinery; only the two former will be discussed.

Depreciation of the concession.

Concessions are granted for 75 years and the possibility exists that on expiry the term of the concession is not extended. Usually the cost of the concession is equally distributed over the period during which the concessionary can work the land with profit.

Calculation of the cost of production per K.G. in cents.

Salaries	8,1
Travelling expenses	1,3
Upkeep of plantations in production	5,5
Tapping, collection and transport to the factory	12,5
Manufacture and packing	7,6
Upkeep other than plantations	3,7
Disease control	1,2
Various expenses	1,1
Sundries	2.—
	43.—
Interest	12,3
Depreciation	15,8
Cost of production on estate	71,1
Quota cost of Administration	3.—
Quota depreciation of Administration	0,1
Total cost of production	74,2
Transport to port of loading	1,6
Cost price in port of loading	75,8

On Sumatra s Eastcoast and also in Tapanoeli there is not much good soil ieft open to lease, since the greater pa t, if not all, has already been granted. Therefore one must either buy concessions, or be contented with less fertile soils, or go in search of other regions.

Managing Boards rightly aim at a low cost of the concession, but as a consequence of these efforts it may easily occur, that on application for a lease or on purchase of a concession only the amount of the capital outlay is considered, and insufficient attention is paid to the subsequent influence of the difference in fertility on the cost price of the product.

With the marked advance of the rubber price in 1910 estates were choosen in a hurry and it is quite comprehersible, that errors were made, especially since experience in this respect was lacking. When at present a choice is made, intending purchasers should make use of the progress of soil science.

Suppose that a choice can be made between a cheap whitish clay soil near the coast and a expensive red or yellow soil ; we know that during the first 5 years the growth of Hevea on the white soil w'll be qu'te sat'sfactory, but ultimately will become inferior to that on red soil. The production on these white soils is also considerably lower than that on red soils. However experiments have shown that by application of a nitrogen manure these trees can be improved in a few years to such an extent, that the yield equals that from trees on red soils. The lower cost of purchase will therefore cause increased expenses for manures, and it remains to be seen whether this concession wil be more remunerative than one on red soil.

If a concession on white soil costs Gls. 50.— per H.A. and one on red soil Gls. 250.—, the depreciation, in 50 years, amounts to Gls. 1.— for the former and for the latter to Gls. 5.—, a difference of Gls. 4.— per H.A. If the stand numbers 200 trees per H.A. when manuring is started, 200 K.G. of ammonium sulphate must be applied annually, the cost amounting to ± Gls. 40.—, and since these applications should be regularly repeated, the cost under this heading will always increase the cost of production ; with a yield of 500 K.G. per H.A. this increase amounts to 8 cents per K.G. This increase exceeds that caused by the higher writing off for depreciation of a concession on red soil, which in this instance amounts to not quite 1 cent per K.G.

Other questions should also be considered, such as the higher cost of draining white soils, cost of weeding, which usually is higher on white soil, and cost of transport, which is often lower, but which should be considered for each individual case.

However there is still a ray of hope for white soils, viz. that superior material can be planted, and an advantage over old plantations is secured thereby. When these old plantations are rejuvenated or re-planted, this advantage is however lost.

Generally speaking the best policy is not to purchase whitish clay soils, even taking into account the possibility that in after years plantations on red soils must also be manured, and that the improved white soils can be kept in condition by smaller applications.

Moreover attention may be drawn to the fact that as a rule small estates have higher general expenses than large ones, and therefore large aggregate areas are aimed at, which can be exploited with higher efficiency.

It stands to reason that the present extensions in regions, where no estates have yet been opened, involve greater risk as regards the quality of the soil. Analysis of soil samples can give valuable indications, but too much importance should not be attached to the results, and therefore a complete examination of the terrain can never be dispensed with.

Depreciation of the plantation.

The cost of the plantation in the years it is not producing, apart from the expenses for bungalows, cooly lines, roads, bridges, etc., consist of those for planting and upkeep of the area during that period.

The cost of planting consists of the expenses for clearing, purchase of planting material and planting.

As regards clearing, it has been established beyond doubt that cheap clearing means subsequent higher expenses for upkeep, and in several regions the danger from root diseases is far from imaginary. Moreover these plantations will come into bearing at a later date, especially if lalang has not thoroughly been changkolled out. However Hevea is an exceptional cultivated plant in so far as it will grow also with extensive clearing and upkeep. It is not precluded

however, that selected Hevea will be more responsive to careful treatment, so that it will be necessary to bestow more care on the upkeep to secure the higher yields.

I need not dwell at length on planting material, planting and upkeep, but subjoin the remark, that selective thinning also reduces the cost of production.

Cost of tapping.

As regards the other headings a few remarks may be made on the cost of tapping, which amounts to a considerable percentage of the cost of production.

Formerly several cuts, one above the other, was the usual system, but this has now been abandoned, and one cut only is used, to the left of the spout, since experiments have shown that a left cut with 30° incline yields ± 8% more rubber than a right cut of equal length. Daily tapping is more and more superseded by tapping alternate months or alternate days. These periodical systems reduce the tapping cost appreciably, and it is an established fact that one cut ino $^1{}_3$ circumference tapped daily yields an equal quantity of rubber as one cut on $^1/_2$ circumference tapped alternate months or days. When tapping alternate months the bark consumption should be increased to 45 m.m. per tapping month, since according to GRANTHAM'S investigations the highest yield is secured in this way.

However with this way of tapping the most economical system has not yet been attained. Plantations which are tapped alternate months with 1 cut on $^1/_2$ circumference often have a considerable percentage of brown bast disease, which means a decreased production since only part of the cut yields latex. Although the progress of the disease can be prevented by the method of KEUCHENIUS, part of the bark is eliminated. Since according to our present ideas the cause of the disease should for the greater part be set down to the withdrawal of too much latex from the bark, a decrease of this bleeding by shortening the cut will decrease the percentage of cases of brown bast disease, which may in the end result in an increase instead of a decrease in production.

For several estates it remains to be seen therefore which is the more efficent system, $^1/_2$ circumference tapped alternate months with a high percentage of brown bast, or $^1/_3$ circumference tapped alternate months with less cases. Several large concerns already shorten the cut to $^1/_3$ on trees attacked by brown bast when changing the tapping panel. If a tree is attacked a second time on the same panel the cut is immediately shortened to $^1/_3$. In this way the more susceptible trees, which usually are the highest yielders, are given a shorter cut, whilst the less susceptible trees are tapped more severely. A few estates, tapping alternate months, have already shortened the cut to $^1/_3$ on all trees.

Obviously the opinion is gaining ground that tapping on half the circumference alternate months is still too severe on the trees and that tapping on $^1/_3$ will prove the better system. It is quite possible that older trees should be tapped with a still shorter cut or should be given longer intervals of rest.

The best tapping system for buddings has not yet been ascertained and experiments along this line are very desirable.

Manufacture and packing.

Lastly a few remarks may be made on the heading manufacture and packing.

Till quite recently acetic acid was generally used, but at present the cheaper formic acid has superseded it for the greater part. The import of acetic acid on Sumatra's Eastcoast has considerably dcreased, as may be seen from the following table.

Import of	Acetic acid	Formic acid.
1923	270.295 K.G.	—
1924	497.331 „	—
1925	181.987 „	96.160 K.G.
1926	74,825 „	184 345 „

Nevertheless attention should once more be drawn to the fact,, that formic acid presents no difficulties in estates practice, and that by using this chemical nearly 50 % of the cost of coagulation can be saved.

Recently the experiment station has started experiments with sodium-silicofluoride, a coagulant even cheaper than formic acid. An objection to the use of this coagulant was, that latex of 20% rubber content can be coagulated only by using a hot solution of adequate concentration. It appeared in the experiments, that this difficulty can be met by adding a small quantity of formic acid to the cold solution of this coagulant. It is an excellent coagulant, especially on estates manufacturing sheet and where the latex is frequently spoiled by rain, since the percentage of off-sheet is appreciably decreased, when the coagulum is worked up next morning.

In sheet manufacture a further decrease of the cost of production is attained by tank coagulation which economises on manual labour.

It remains to be seen whether the present marketable grades of rubber, crepe, smoked sheet, sprayed rubber and sole crepe, are the most desirable and whether they will not be superseded by other grades. It is evident that the practical possibilities of rubber in these grades are not equal to those of the product from which they are manufactured, the latex. Latex can be used directly for impregnation ; latex can be sprayed with fillers to prepare a mixture for the manufacture of vulcanized articles ; latex can be vapour cured etc. Considerable quantities of latex are already exported from the F. M. S. and Sumatra, viz. :

	1925	1926
F. M. S.	10.524 tons	9.490 tons
Ceylon	17 „	59 „
Sumatra	6.512 „	128 „
Total	17.053 tons	9.677 tons

Latex already gives more possibilities for practical use, but concentrated latex wears an even more favourable aspect. At present it is prepared according to two systems, viz. the manufacture of Revertex, which is made in a rotating cylinder by vaporization of latex to which a soap solution has been added, the Hauser-process, and the concentrated latex according to the Utermark patent. Centrifugalization yields a product with only an insignificant quantity of serum constituents, the colouring matter being practically removed; besides being concentrated the latex is also purified.

Adding water to these products yield ordinary latex, whilst mixing the concentrated latex with suphur and fillers is easily carried out. Masticating on heavy and expensive rollers, which has a detrimental influence on the quality of the rubber, can be dispensed with.

Comparison of the factors of the cost price.

Finally attention may be drawn to the fact that comparison of the proportion of the factors of the cost price on various estates is another means of attaining a decrease. Large concerns automatically compare these factors for their estates and by investigating the cause of the deviations from the average, the cost price can be reduced, if such is possible. I recommend for small estates which cannot make comparisons with others a mutual control, to utilize each others experience.

The experiment station will have pleasure in rendering services in this espect.

RUBBERPATENTEN.

Het concentreeren van latex.

Het concentreeren van Hevea-latex door middel van centrifuges had tot nu toe in Nederlandsch-Indië bijna uitsluitend plaats met de melkcentrifuges van het bekende Alfa-de Laval model.

W. B. WESCOTT heeft een octrooi-aanvrage ingediend voor een werkwijze en inrichting voor het concentreeren van, een vaste samenstelling geven aan, en het zuiveren van latex, waarbij het gebruikte apparaat veel overeenkomst heeft met de Sharples Super centrifuge

Het is hier niet de plaats de verschillende argumenten voor het gebruik van gecentrifugeerde latex, en de toepassingen ervan in de practijk nogmaals uitvoerig te reproduceeren In de Nederlandsche Octrooiaanvrage is ook de invloed van alkalische waschvloeistoffen op de bovenlatex uiteengezet, belangstellenden kunnen in de beschrijving van het octrooi de bijzonderheden vinden.

Bij den bouw van de centrifuge is alles er op berekend het proces van het concentreeren der latex geleidelijk te doen geschieden. Plotselinge bewegingsveranderingen of stooten worden zoo veel mogelijk vermeden, om ontijdige samenballing der rubberdeeltjes te voorkomen.

Gedurende het centrifugeeren kan de latex met alkalisch gemaakt water, bij voorkeur een verdunde ammoniak-oplossing wordén gewasschen.

Door een holle aandrijvingsas wordt de te concentreeren latex van boven ingevoerd en van onder afgevoerd in tegenstelling met de normale gang van zaken bij een supercentrifuge, waar men van onder voedt en de gesepareerde vloeistoffen aan de bovenzijde in trommels worden opgevangen en afgevoerd.

De continu werkende centrifuge heeft radiaal geplaatste vleugels voor het aandrijven van de te centrifugeeren vloeistof, welke vleugels zich van den omtrek naar binnen door het vloeistoflichaam naar het afvoereinde van de centrifuge uitstrekken. De breedte van deze vleugels neemt van een zeker punt der as naar het invoereinde toe, geleidelijk tot nul af, terwijl de vleugels beneden dit punt hun volle breedte bezitten, zoodat de binnentredende latex geleidelijk zonder schokken in beweging komt. De ontvangtrommel aan het ondereinde der holle as is er ook op gemaakt, de beweging van de afgevoerde latex langzamerhand te verminderen en plotselinge bewegingsveranderingen te vermijden.

Aanvrage No. 26816 Ned. Klasse 39. b. l.

Openbaar gemaakt 15 October 1927.

U. S. Patent No. 1.639.411.

In het Archief voor de Rubbercultuur 9e Jg. 1925, blz. 663, werd in een overzicht betreffende het concentreeren van latex reeds gewezen op een werk-

wijze van Dr. TRAUBE om latex op te roomen door bepaalde plantenextracten toe te voegen.

Iets nieuws ligt er in het patent van de *Naugatuck Chemical Co.* in dit opzicht niet. Aan de latex wordt een waterige oplossing van pectine, Iersch mos of Karayagom toegevoegd en na 30 tot 50 uur staan heeft men een room gekregen welke 50 — 55% vaste stof bevat. De hooge viscositeit van de opgeroomde latex wordt door verhitten gedurende twee uur bij een temperatuur van ± 80° C. en onder toevoegen van Saponine of zeep gereduceerd.

Een Engelsch en een Canadeesch patentschrift behandelen nagenoeg dezelfde materie onder een anderen naam.

Engelsch Patent No. 268.299. Naug. Chem. Co.
Canadeesch Patent No. 271.205. Dominion Rubber Comp., Ltd.

Behalve het concentreeren van de latex met het doel een product te krijgen dat een hooger rubbergehalte heeft en zuiverder is dan de oorspronkelijke latex, kan men ook een concentraat maken, dat reeds gedeeltelijk gevulcaniseerd is of reeds een vulcanisator, versneller en vulstoffen bevat.

PHILIP SCHIDROWITZ heeft zijn bekende werkwijze neergelegd in het Engelsche Patent 193.451, waarbij latex door toevoegen van colloidale zwavel of polysulfiden gevulcaniseerd kan worden, uitgebreid tot de geconcentreerde vormen van latex.

Engelsch Patent 266,418.

Het dispergeeren van rubber in water.

Heeft men door het concentreeren van latex een middel om een rubberdispersie van hoog rubbergehalte te krijgen, W. BEACH PRATT neemt als uitgangspunt voor dergelijke dispersies de gewone sheet- of indamprubber. Hij gaat uit van de stelling dat het coaguleeren van rubber een omkeerbaar proces zou zijn. Wanneer men namelijk de mechanische adhaesie van de bolletjes door hun beschermende huidjes weer zou kunnen opheffen door die huidjes water te laten absorbeeren dan zou men een dispersie krijgen waarin de bolletjes in de zelfde mate gedispergeerd zouden zijn als in de oorspronkelijke latex.

De houder van het patent heeft waargenomen, dat ruwe of gecoaguleerde rubber, ook balata of guttapercha in een waterig medium te dispergeeren zijn.

De werkwijze vervalt in twee stadia, ten eerste het inbrengen van water in de rubbermassa, wat gebeurt met behulp van gommen, eiwitten, of andere colloidale stoffen en vervolgens het dispergeeren van de massa in water zoodat ten slotte een pasta ontstaat waarin de rubber de disperse phase vormt. Zwavel en vulstoffen kunnen voor of gedurende de behandeling van de rubbermassa daarin worden gemengd.

Aanvrage No. 25582 Ned. Klasse 39. b, 1.
Openbaar gemaakt 15 Juli 1927.
U. S. Patent No. 1.621.468.

Toepassingen van geconcentreerde latex.

Indien men vulstoffen aan een latex pasta wilde toevoegen werd tot nu toe de vulstof met water bevochtigd en vervolgens in de pasta geroerd.

Voegde men de vulstoffen droog toe, dan was meestal het resultaat dat plaatselijk coagulatie van de latex optrad en geen homogeen mengsel te krijgen was. De *Metallbank und Metall Ges.* heeft een patent gevraagd voor een werkwijze welke hieruit bestaat, dat men de latex pasta met een oplosmiddel voor caoutchouc omroert en eenigen tijd laat staan. Aan deze massa kunnen de droge vulstoffen zonder gevaar voor coagulatie toegevoegd worden.

Duitsch Patent No. 441383. Klasse 39 b. groep 5.

Behalve het maken van rubbermassa's uit latexpasta, waarbij vulcanisator en vulstoffen aan de geconcentreerde latex toegevoegd zijn, waarna het water uit het mengsel verdampt wordt en de massa geplasticeerd en gevulcaniseerd kan worden, is het ook mogelijk uit geconcentreerde latex onmiddellijk voorwerpen te vormen. Het patent van JOHN MC GAVACK is hiervan een voorbeeld. Aan de latex wordt een coagulant toegevoegd, in dit geval organische stoffen als hoogere aromatische koolwaterstoffen met een hydroxyl groep. Het mengsel van deze stoffen met de latex wordt in een vorm gegoten en coaguleert na enkele uren. Het gevormde product wordt dan al of niet in den vorm gedroogd, eerst bij lage, dan bij hoogere temperatuur. Zwavel, versneller en vulstoffen zijn als gewoonlijk van te voren bij gemengd.

In de aangehaalde proeven van den houder van het patent wordt als coagulant dennenhoutteer gebruikt, welke teer voldoende aromatische koolwaterstoffen als bovenbedoeld bevat.

U. S. Patent 1.629.924.

Na lezing van de eerste conclusie van de octrooiaanvrage van D. F. WILHELMI luidende : „Werkwijze voor het verstuiven van het melksap van rubber, balata, gutta-percha of djeloetoeng, enz. met het kenmerk dat tegelijk met genoemde vloeistoffen de voor fabricatie van voorwerpen noodige vulcanisatie-, kleur- en vulstoffen mede verstoven worden, na tot op het oogenblik van verstuiving gescheiden gehouden te zijn, terwijl na de verstuiving en menging — met behulp van een mengverstuifstroom — het wolkvormige mengsel opgevangen wordt op het oppervlak van de modellen, waarop nu het rubbervoorwerp in min of meer sneeuwachtingen toestand aangroeit tot het gewenschte profiel van baan, snoer, draad, buis, plaat, blok enz. waarna een eventueele nadroging plaats vindt, het neerslag op de modellen gecomprimeerd wordt zonder zijdelingsche verpersingen en dan gereed is voor vulcanisatie" behoeft het procédé geen verdere toelichting meer.

Aanvrage No. 27914 Ned. Klasse 39. b. 1a.

Openbaar gemaakt 15 Juli 1927.

Kleefstoffen voor technische en chirurgische doeleinden kunnen onmiddellijk uit latex, maar waarschijnlijk nog beter uit gezuiverde geconcentreerde

latex gemaakt worden. De Nederlandsche aanvrage van de *American Rubber Comp.* moet bescherming geven voor een werkwijze voor het maken van een rubberkleefstof, door rubberlatex te mengen met een ammonium-harsverbinding, daardoor gekenmerkt dat men latex of geconcentreerde latex mengt met een oplossing van ammoniumresinaat in water en met loodglit en zwavel. Tevens kan onder krachtig roeren solphent naphta aan het mengsel toegevoegd worden.

In het Amerikaansche patentschrift steriliseert men met ammoniak of andere anticoagulant geconserveerde latex door verhitting tot 100° C. gedurende een uur op drie achtereenvolgende dagen. Medicinale stoffen kunnen aan de latex toegevoegd worden.

Het eerstgenoemde octrooischrift past de latex-kleefstof toe in de schoenindustrie, het laatste is in het bijzonder voor medische doeleinden geschikt.

Aanvrage No. 30428 Ned. Klasse 22. i. groep 2.
Openbaar gemaakt 15 Sept. '27.
U. S. Patent No. 1.626.493.

R. B. Russell en H. Broomfield maken een combinatie van latex en vilt door gedurende het vilten latex bij de vezelmassa te laten loopen, de rubber bij hooge temperatuur op de vezels te coaguleeren en het gevormde materiaal te persen, te drogen en te vormen.

U. S. Patent No. 1.579.890.

Ongevulcaniseerde rubbercompositie.

Uit ongevulcaniseerde rubberlatex bereidt H. Wilkinson rubbercomposities met grooten weerstand tegen slijtage, welke zonder vulcanisatie gereed zijn voor gebruik.

Van het in de latex aanwezige gewicht droge rubber wordt ongeveer 3 — 5 % oxyde of sulfide van lood, antimoon, zink of magnesium aan de latex toegevoegd, of een mengsel van oxyden en sulfiden van deze metalen, met een kleine hoeveelheid zwavel, welke 0,5 — 1,6 % van het droge rubbergewicht bedraagt. Zonder toevoegen van een coagulant laat men het mengsel staan tot het vanzelf door roeren tot coagulatie te brengen is.

Het coagulum dat in 24 — 72 uur gevormd is, kan gemangeld worden en dient dan bijvoorbeeld voor de bereiding van zoolcrepe. Een interessante toepassing van de op deze wijze bereide rubber zagen wij in de fabriek van den Heer Wilkinson te Batu Caves in de F. M. S. Daar werd onder den naam Linatex een product gemaakt uit zoolcrepe lagen waartusschen gegalvaniseerd ijzergaas gewalst was; het geheel dienende tot het inwendig bekleeden van pijpleidingen in gebruik bij de tinmijnen. De slijtage van de rubber door het schuren van erts en zand is belangrijk minder dan die van ijzeren pijpen zonder bekleeding.

Aanvrage No. 27133 Ned. Klasse 39. b. l.
Openbaar gemaakt 15 Augustus 1927.

Walswerkaandrijving.

FRIED. KRUPP GRUSON-WERKE heeft een aandrijving voor walswerken voor het wasschen van ruwe rubber gemaakt, waarbij de aandrijving geschiedt door een achter het walswerk in een asblok rustende as met tandrad, welke samenwerkt met een tandrad dat met een der assen van het walswerk is verbonden. Het asblok rust nu op een steunblok zoodanig, dat het 180 graden met zijn oorspronkelijken stand gedraaid kan worden. De hartlijn van het asblok kan dus evenwijdig met de hartlijn der walsen verplaatst worden en geeft gelegenheid zoowel kleine als groote tandraderen aan te brengen om kleine of groote snelheden van de aandrijvende as over te kunnen brengen op de walsen.

Aanvrage No. 33315 Ned. Klasse 39. a. 8.

Openbaar gemaakt 15 September 1927.

N. H. v. H.
