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No. 284. Read the following letter from A. O. HUME, Esq., C.B., Secretary to the Government of India, Department of Revenue, Agriculture, and Commerce, (Forests,) to the Secretary to the Government of Madras, Ootacamund, dated Simla, 31st August 1875, No. 22/967:—

I AM directed to forward, for information and communication to such of the forest officers in the Madras Presidency as take an interest in the subject, the accompanying copies of a Report by Mr. G. Mann, Officiating Deputy Conservator of Forests in Assam, on the Caoutchouc plantations in that province, and the yield of Caoutchouc from *Ficus elastica*, together with a Report by Dr. Schlich, Conservator of Forests in Bengal, on the success which has attended the raising of seedlings of *Ficus elastica* in nursery beds in the Darjeeling Division.

ENCLOSURE No. 1.

REPORT ON THE CAOUTCHOUC PLANTATIONS IN ASSAM AND THE YIELD
OF CAOUTCHOUC FROM *FICUS ELASTICA*.

THE last report submitted on this subject contained the results of the first attempt to plant *Ficus elastica* in Assam up to the end of March 1874, and this report will, therefore, record the results of the planting since that date.

2. The different opinions expressed during the year on the growth and yield of *Ficus elastica* have proved to me that facts regarding the nature of this tree, which I had considered clear and established, because I have had such constant opportunities of watching over and increasing my knowledge of the tree, still remain doubtful to others who have not had the same advantage, which induces me to report in greater detail now than I might have otherwise considered necessary.

3. The planting during 1873-74 was reported in the last report as a failure on account of the lateness of the season when started and drought of that year, whilst the nursery work or the propagation of the plants in Spring 1874 was reported as a success up to that date.

4. This report on *Ficus elastica* may conveniently be arranged under three heads as follows:—

- (1.) The propagation.
- (2.) The growth in plantations.
- (3.) The yield.

5. The necessity for forming plantations of this tree having been recognised, no further remarks are required, except, perhaps, the statement that the protection of the Caoutchouc trees in the forests of Assam has again, during the year, been under the consideration of the Chief Commissioner, and the difficulties of protecting this valuable property prove to be almost insurmountable; scattered as these trees are through the forests situated in the most inaccessible and unhealthy parts of the province, they have been the prey of tribes living near these localities, and may now be said to be almost a thing of the past.

6. Plantations will, of course, not be exposed to these risks, and can be easily managed by a comparatively small staff of Government officers.

I.—THE PROPAGATION OF *Ficus elastica*.

7. Figs are, perhaps, of all the forest trees in India the easiest to propagate; but for all this, the past years' experience has taught us that *Ficus elastica*, both as seedling and cutting, is very susceptible of injury from too much shade or drip from trees causing excessive wet about its roots, which experience cost us a number of young plants, but thus established a fact, which is of the utmost importance, in the propagation of this tree.

8. The seed sown on the Charduar Caoutchouc plantation on the nursery beds, prepared with broken bricks, broken charcoal, and with earth only, as described in paragraph 19 of last year's report, germinated profusely on the 25th of April 1874, having, at first, the appearance of cress, the cotyledons being very small.

Propagation by Seed.

9. The artificial shading over these seed-beds, however, caused drip and excessive moisture, which proved fatal to many of the seedlings before the cause of the mischief was recognised.

10. The number saved amounted, however, to about 1,200, which were, on an average, of the under-mentioned sizes as they grew:—

On the 27th June 1874, $\frac{1}{16}$ th of an inch.

„ 12th Aug. „ $1\frac{1}{16}$ th of an inch.

„ 10th Sept. „ $5\frac{1}{16}$ th of an inch.

„ 21st April 1875, 2 feet 2 inches.

It should here be mentioned that the last of these was a seedling which had been left undisturbed in the seed-bed, and was exceptionally vigorous in growth.

11. The seed sown germinated most freely on the broken bricks, next best on the charcoal, and least on the earth, and as the seedlings grew, those on the broken charcoal succeeded eventually best of all, whilst those on earth perished, which, however, is due partly to the large trees left standing in the nursery and the artificial shade got up, for which there proved to be no necessity.

Germination of Seed.

12. No perceptible difference was noted in the germination of the seed where the whole fruit had been sown and the fruit had been crushed, except that, in the former case, the young seedlings were very much crowded.

13. They are remarkably hardy as long as they are not exposed to too much shade and drip from above, causing excessive moisture about the roots.

14. During the last cold season most of them have formed a thick tuberous root resembling those of *Epiphytcal rhododendron* and *vaccinium*, by which they, no doubt, are enabled to stand drought during the dry season much better than cuttings.

15. During February and March this year a large nursery, measuring 36,000 square feet, has been prepared in the Charduar plantation by raising beds four feet in width and one foot high, and covering them with 160 maunds of broken charcoal.

Seed Nursery of 1874-75.

16. All trees had been cut down in this nursery, and no artificial shade of any description has been given to the seed-beds this Spring.

17. On these beds six maunds of seed were sown, the first of which germinated on the 18th April, and they look remarkably well.

18. A small quantity was also sown on earth alone to give this mode of raising seedlings a further trial, since it is more economical than where charcoal is used.

19. About 400 seedlings were brought in by "Miris" which had evidently germinated on the ground, and these men affirm that the seed of *Ficus elastica* germinates freely on the ground wherever there is sufficient light.

Since these seedlings were fetched from the Akha Hills, immediately north of the Charduar plantations, it is easily understood that the seed will germinate on steep hill-sides where there is light, whilst, for the same reason, in the dense evergreen forests along the foot of the hills this is a very rare occurrence.

Seedlings brought in by Miri villagers.

That the seed of *Ficus elastica* will germinate and grow on the ground is further borne out by the young trees met with in Tea gardens where the ground is kept clear.

20. At the Kulsi plantation in the Kamrup District seedlings have been raised in the same way on a small scale with much the same results.

21. The cuttings made in Spring 1874, and reported on in paragraph 18 of last year's Caoutchouc plantation report, suffered in a similar way from drip from the artificial shade and trees left as a precaution in the nursery, which has taught us the same lesson with regard to cuttings as with the seedling.

Propagation by Cuttings.

22. This experience after all was very cheaply bought, since the cost of the nursery was trifling, and we managed to save 2,000 cuttings which were sufficient for the plantation.

23. The best time for making cuttings in Assam is, no doubt, from the middle of January to the end of May, it depending on the rain-fall during the latter three months which of the cuttings will do best; those made in 1874, after May, failed almost entirely.

Time for making Cuttings.

24. The earlier in the season, before the young shoots to be used have started growth, the better chance they have of success, and at this time young terminal shoots will grow well; whilst after the trees, from which the cuttings are taken, have commenced growth, which happens about the end of January, the lower somewhat harder portion of the young branches succeeds better than the soft terminal shoots.

25. Only young and vigorous branches from topped trees are used, and they are cut 1'—2' in length, and are put three inches in the ground; all scrubby branches from old trees almost invariably fail.

Description of Cuttings.

26. The branches from young trees are still better than those of lopped trees, but these are rarely to be had now.

After our young trees are two or three years old, they will furnish any quantity of shoots best suited for cutting.

27. The making of the cuttings this Spring was begun in the end of January both at the Charduar and Kulsi plantations, and in the former it was continued until the 19th of March.

Nursery for Cuttings of 1874-75.

28. The beds for the cuttings were raised one foot high, all the paths between the beds being so constructed as to prevent water resting, and, as an extra precaution, the earth at the Charduar plantation was mixed with river-sand since it is rather clayey, retaining moisture longer than suits the cuttings.

29. The nursery for cuttings in the Charduar plantation in the Darrang District prepared in this way measures 25,200 square feet, and at the Kulsi plantation in the Kamrup District a small nursery, sufficient to grow the cuttings for an extension of 30 acres, was prepared and planted.

30. The same artificial shading of grass was employed as last year, but was removed every afternoon and not replaced until about 9 o'clock in the morning, by which more light was ensured to the cuttings during part of the day, and they had the benefit of the night dew.

31. On the 7th of March the first rain fell at the Charduar plantation and continued for some time, which opportunity was taken advantage of to harden off the cuttings and to remove the artificial shading entirely; until rain fell all were watered twice a-day.

32. The success of the harder cuttings has been general, whilst amongst the soft young shoots there have been many losses.

33. On the whole, the propagation from cuttings has this Spring been most successful, there being at the Charduar plantation 16,401 cuttings alive out of 21,213.

Number of Cuttings.

34. This is 22 per cent. of failures which is insignificant, considering that many of the cuttings were necessarily still inferior young trees which are the best for cuttings, being extremely scarce.

35. At the Kulsi plantation there are 1,790 cuttings alive and doing well, which is also much more than we require for this year's extension.

36. A small nursery has also been prepared with equal success at the Baruni Hill plantation in the neighbourhood of Tezpur for an extension of 10 acres this year.

II.—THE GROWTH IN PLANTATIONS OF *Ficus elastica*.

37. The first plantation of *Ficus elastica* in Assam extended over 1¹/₂ acres, and was started on the right bank of the Kulsi river, about 33 miles west of Gauhati in the Kamrup District, adjoining the experimental Teak and Sissoo plantations, which are the headquarters of the officer in charge of the Gauhati forest division.

38. The experiment became a failure from reasons explained in last year's report on Caoutchouc plantations, but the old lines have been replanted and 17 acres added, which makes the total area under plant in the Gauhati division 35 acres.

The Kulsi Caoutchouc Plantation.

39. The method of planting adopted in the Kulsi Caoutchouc plantation is the following:—

Lines 20 feet in width and 50 feet apart are opened out in mixed plain and savannah forest, and the trees are planted out on these lines at distances of 25 feet.

40. The plants in this plantation were examined by me on the 26th of April, and the countings showed 2 per cent. of failures, which were filled up the same day. Nothing could surpass the healthiness and vigour of the young trees, whose only enemies are the deer, which has made fencing necessary, but the plants will soon have grown beyond the reach of them.

41. Besides this, 30 acres have been prepared for planting during last cold season, but, as the weather up to the end of April was very dry, the planting is only being done now, and these 30 acres have, therefore, not been brought on the register of area of Caoutchouc plantations before the end of the financial year 1874-75.

42. This locality was not chosen for the first plantation, because it was well suited, but on account of the season being far advanced, and there was a forest officer on the spot to look after it.

43. Kamrup is, compared with other districts in Assam, dry, and it is not intended to have Caoutchouc plantations on a large scale in this district on this account, since the yield will be proportionately small.

44. All land in the Kulsi plantation reserve not suited for timber plantations will thus be made use of for Caoutchouc plantations, which will make the total area about 100 acres. This will furnish a field for experiments in tapping, and enable us hereafter to draw comparisons between the yield of Caoutchouc from trees in this district and that from the more favorably situated Charduar plantation at the foot of the Himalayas in the Darrang District, 18 miles north of Tezpur.

The Charduar Caoutchouc Plantation.

45. The latter plantation extended over an area of 180 acres in the year 1873-74. The plants in this plantation were examined by me on the 21st of April 1875, and the countings made all through the plantation showed 3¹/₂ per cent. of failures.

In addition to this 140 acres more have been got ready, and another 60 acres are in course of clearing for plants.

None of this area has, however, been planted, since the rains will be more suited for this work, and no additional area has, for the above reason, been brought on the register of area of Caoutchouc plantations before the end of 1874-75.

46. The method of planting adopted in the Charduar plantation was the following:—
Lines 20 feet in width and 100 feet apart were opened out through lower hill forest, and trees were planted out on these lines at distances of 50 feet.

47. The width of the lines proved insufficient as soon as the rains set in, and the excessive shade and drip from the trees on either side of the line proved injurious and in many cases fatal to the plants.

48. The plantings on split stumps of trees and in earthenware rings, placed with the widest opening on stumps, was suggested by the Chief Commissioner, and proved very successful in low situations, counteracting the excessive wetness of the ground, but vigorous growth was not insured, and more light was admitted.

49. All the lines of last year's plantation were, therefore, opened to forty feet in width, and the effect on the young trees has already been most beneficial, so that, although it is only the commencement of the growing season, nothing could surpass the vigour and healthy appearance of the trees, and so far as the planting on lines opened out through the forest goes it certainly is a perfect success.

50. The ground on these lines is not cleared except just around the plants, but the opening out of bridle-paths has become necessary to save time in going over the plants, since frequent inspection is the only way to prevent any vacancies remaining in the plantation.

51. The growth of low jungle or scrub on these lines has neither been such as to necessitate subsequent clearing.

52. The opening out of these lines to double the width has, however, doubled the cost of this, the chief work in the plantation, and since the daily increasing demand for labor on the Tea gardens has induced the planters to pay abnormally high wages, thus making local labor, which only is suited for the Caoutchouc plantation work, scarcer every day.

53. For this reason experiments have been started to plant the young trees in strongly-made cane baskets and to place these in the forks of trees.

Planting in the forks of Trees.

54. Only seedlings are used for this mode of planting, since they soon form thick tuberous roots, and thus become more fit to combat with the comparative dryness to which they are exposed in the tops of trees in the dry season.

55. The first of these were planted on the 25th of January in trees near the nursery, and on the 21st of April they looked everything that could be desired.

56. This mode of planting would only necessitate a small bridle-path being opened through the forest instead of lines forty feet in width, and is estimated to reduce the cost of the creation of Caoutchouc plantations on a large scale, including survey, formation, conservation, roads, buildings, and salaries, from Rs. 19 to Rs. 5 per acre.

57. The only objection to this plan is the difficulty of inspection, and without constant examination of the plants no satisfactory results can be reckoned on.

This I hope to overcome by having every line numbered, and every tree on which a Caoutchouc plant has been placed, marked.

These lines will then be regularly gone over at least once in two months, and the result placed on record in the plantation journal.

After a year or two the plants will be sufficiently large to render the climbing of trees unnecessary, which latter will be the only difficult task in the examination of the plants, but it is considered of such importance during the first year or two, as to justify high pay to the men who have to do this work.

58. It is hoped to bring during these rains 50 acres under cultivation in this way, and thus to obtain results on as early a date as practicable.

59. This mode of growing *Ficus elastica* it is intended to introduce only on the ground of economy and the growing scarcity of labor, and not because it is believed that this tree grows naturally as an epiphyte only, for trees which germinated on the ground are said to be not at all rare in the Akha Hills north of the Charduar plantation, and the Caoutchouc collectors, who go beyond the British boundary into these hills, will have it that such trees, although few in number, grow larger than those which commenced life as epiphytes between the branches of other trees.

60. I myself have never seen but one tree which had undoubtedly germinated on the ground, but then the want of light in the dense forests along the foot of the hills renders it impossible for trees to grow in this way as proved by our seed experiments.

Ficus elastica grown in the Soil.

61. The only one specimen above mentioned which ever I saw had a true stem, cylindrical in shape, and measured 16 feet in girth 30 feet above the ground; but this had not prevented the tree from throwing out great numbers of aerial roots descending from branches 50 feet above the ground.

Some of these aerial roots measured 6 to 8 feet in girth at distances of 20 feet from the stem, and had established themselves firmly in the ground like the tree itself.

62. Neither does *Ficus elastica* in Assam, if planted in the ground, remain smaller or more destitute of large aerial roots than trees which grew first as epiphytes, as has been stated.

63. The measurements given below will show that the epiphytic growth of a *Ficus elastica* is not by any means essential, for, after all is done and said, this tree is only epiphytical in early life for a comparatively small number of years after which it has its roots in the ground like any other tree.

64. Natives will have it that the aerial roots of young *Ficus elastica* in the Charduar reach the ground in the third year.

65. To corroborate the above and to ascertain the distances at which the young Caoutchouc trees should be planted, inquiry was instituted regarding the age of the largest tree planted in Tezpur, and measurements made of this tree, which were as follow:—

Age of tree	32 years.
Height of tree	110 feet.
Diameter of crown	140 "
Circumference of the centre mass of aerial roots surrounding the stem	70 "
Distance of outermost aerial roots from stem	30 "

There were over a hundred aerial roots, the five largest of which measured each respectively 6 feet, 4 feet, 4 feet, 3½ feet, and 3 feet in girth, 5 feet above the ground.

66. These measurements show the size and rapid growth of *Ficus elastica* planted in the ground in Assam, which, in the forests at the foot of the hills, must be even much greater than in the station of Tezpur, and is not less than that of epiphytic trees.

67. As the roots spread out in the soil very near the surface to a distance of 150 feet and more, and form a thick network, it is considered close planting will seriously interfere with the free development of the roots and growth of the young Caoutchouc trees, and unless vigorous growth is ensured no yield of caoutchouc can be expected.

68. It is, however, intended to have the trees on all the area at present under cultivation planted at 25 feet distances in the lines instead of 50 feet, so as to have a number of young trees available for experiments in tapping to ascertain the yield from young *Ficus elastica*. It is thus intended to have every alternate tree killed by tapping at the time they begin to interfere with the growth of those it is intended to let grow to maturity.

69. The tree measured in Tezpur is exceptionally large and to all appearance not only healthy but luxuriant; but for all this it yielded next to no Caoutchouc when permission was given by the proprietor to one of the traders in the bazaar to tap it.

70. This latter fact I do not attribute, as Dr. Schlich, the Conservator of Forests, Bengal, and Dr. King, the Superintendent of the Calcutta Botanical Garden, do to the fact of the tree having originally been planted in the ground, but to the locality in which it grows, which will be further remarked on under the head of yield of *Ficus elastica*.

71. The above fact of this luxuriant tree in Tezpur not yielding any Caoutchouc, and similar results of experiments in tapping trees in Gauhati made by me, point to the great

Selection of Localities for Plantation.

necessity for a most careful selection of the localities for Caoutchouc plantations, and no greater mistake could possibly be made than to start plantations of *Ficus elastica* in any part of Bengal with the view of producing Caoutchouc, as suggested by Dr. Henderson, or to draw any conclusions regarding the way it should be cultivated from the appearance of trees planted in Bengal, for, although the trees will grow in any part of Bengal, Caoutchouc there would be next to none.

72. To insure a sufficiently large area of land being maintained as forest for Caoutchouc plantations, proposals for the reserving of an area of about 140 square miles in the Charduar, north of Tezpur, were submitted in Spring 1873 and are now under the consideration of the Chief Commissioner.

73. Experiments of planting *Ficus elastica* on a small scale in grass land are carried on by order of the Chief Commissioner in the neighbourhood of Tezpur, to obtain results hereafter regarding the yield of Caoutchouc from trees in this locality, as compared with the yield from trees at the foot of the Himalayas.

74. Ten acres were thus brought under cultivation by planting at distances 25 × 25, no vacancies exist, and the plants, though small as yet, look very healthy.

75. Nahor (*Mesua ferrea*) has been planted between the young Caoutchouc trees.

76. Close planting in this case is resorted to, to bring about on as early a date as possible a perfect cover on the land, and thus extirpate the grass, insure the formation of vegetable mould, the moisture of the soil, and the surface sufficiently open to atmospheric influences, which conditions are insured in the Charduar plantation by leaving part of the forest standing.

77. The general conditions for the healthy and rapid growth of the young trees of *Ficus elastica* as detailed above are these:—

- (1st.) Perfect drainage about its roots and looseness of soil so as to admit the air readily, the geological composition of the soil not affecting the trees as long as the above conditions are fulfilled, but it should not be gravel or sand, since all Caoutchouc collectors state that it produces much smaller quantities even in the best localities.
- (2nd.) Plenty of light without decreasing the moisture of the air by the admission of it.
- (3rd.) Heat and moisture combined, or what is commonly termed a close and steamy atmosphere.

78. The districts in Assam suited for Caoutchouc plantations are—

1. The Darrang District.
2. The Naga Hill District.
3. The Lakhimpur District.

79. The south of the Cachar District would be suited, but the comparatively unsettled state of the Looshai boundary would not render such a measure for the present at least advisable.

80. None but the moist evergreen forests along the foot of the mountains should ever be chosen for Caoutchouc plantations.

81. In the Kulsi plantation no separate establishment has been entertained for this particular work, but the Caoutchouc plantation is debited with one-fourth of the cost of the whole plantation establishment.

82. The area of the Caoutchouc plantation at the Kulsi at the end of 1873-74 was 35 acres, on which an expenditure of Rs. 377-13-0, or Rs. 10-12-8 per acre, had been incurred up to that date.

83. The area got ready for planting last year at the Kulsi is 30 acres, which, together with improvement and conservation of the plantation of 1873-74, cost during the financial year 1874-75 Rs. 605-14-0, or Rs. 15-2-1 per acre for two years, which has become so high on account of the nursery, the greater part of which, and especially the seed nursery, was destroyed by floods last year, and the great difficulty in procuring suitable branches for cuttings in this locality.

Establishment, Area, and Cost of the Charduar Caoutchouc plantation.

84. The establishment entertained at the Charduar Caoutchouc plantation, including the small experiment near Tezpur, was the following:—

- 1 Mohurir on Rs. 14 per mensem, for 9 months.
1 " " 20 " " " "
1 Watcher on " 7 " " " "

85. The area of the Caoutchouc plantation at the end of 1873-74 was 180 acres, on which an expenditure of Rs. 415-3-6, or Rs. 2-4-10 per acre, had been incurred up to that date.

86. The area planted in 1874-75 was ten acres near Tezpur, and 140 acres have been got ready for planting at the Charduar plantation.

87. In addition to this, all the lines of last year's plantation have been opened out to double the width, bridle-paths been opened out along each line, the plants been fenced in, and large nurseries for cuttings and seedlings been prepared, the cost of which, during the financial year 1874-75, was in the abstract as follows:—

	RS.	A.	P.
Demarcation ...	43	11	0
Formation ...	2,084	3	0
Protection from fire ...	24	12	0
Improvement and conservation ...	505	6	3
Fencing and enclosing ...	193	9	6
Roads and bridges ...	205	10	0
Buildings and offices ...	607	2	0
Salaries ...	232	10	0
Total...	3,896	15	9

or Rs. 13-1-0 per acre for two years, which is also above the average cost on account of buildings, roads, and bridges, as well as the large nurseries which had to be prepared at starting.

88. For all this the cost of the Caoutchouc plantations, even at Rs. 10 per acre as now estimated, is very small compared with other plantations.

89. The cost per acre if planted in baskets to be placed in trees is estimated at Rs. 5, but as the experience gained in the latter mode of planting is as yet small, this estimate must be considered subject to correction hereafter.

90. The headquarters of the divisional forest officer in the Gauhati division are on the Kulsi plantations, and that of the officer in charge of the Tezpur division, at the Barolighat, a distance of 5 miles from the Charduar plantation, so that in either case competent supervision throughout the year is given to this work.

III.—YIELD OF *Ficus elastica*.

91. Amongst the different conditions on which the yield of the *Ficus elastica* depends stands foremost the locality in which it is grown.

Yield in different Localities.

92. When first inquiring in 1869 from the Caoutchouc collectors into the yield of the tree in different localities, I was informed that it would yield most in the hills, next best immediately at the foot of the mountains, and that this yield diminished according to the distance from the hills the Caoutchouc tree was growing in the open country or even on the banks of the Brahmaputra, when, I was informed, it would yield little or none.

93. I was in accordance with this information that the Charduar plantation was started, as being in one of the most favorable localities in Assam.

94. Subsequent and frequent inquiry has been made on this subject, and the collectors now say they get more at the foot of the mountains than in the hills.

95. Whichever is the correct statement, the difference in quantity yielded by trees growing in the plains along the foot of the mountains and those growing on the lower hills is but trifling, if not entirely imaginary, whilst, as the forests along the foot of the mountains are left and the open country is entered, the quantity diminishes very rapidly until on the banks of the Brahmaputra, in the stations of Tezpur and Gauhati, as mentioned above, trees which had not been tapped before were tapped without yielding any Caoutchouc worth speaking of, thus substantially proving the above information to be correct.

96. The next question raised during the last year is, will *Ficus elastica* yield equally if tapped from the stem or aerial roots? On this point, in Assam at least, no doubt ever existed.

The collectors state that there is no difference whatsoever, but that if they dig up the ground and thus get at the roots in the ground, that the latter will give more.

97. My own observations are that Caoutchouc collectors will go to the utmost extremity of the branches at the risk of their lives to procure Caoutchouc, and that the quantity will only vary according to the place first attacked; if this is commenced at the upper branches, the greater quantity will be obtained from there; if at the roots in the ground, as, I regret to say, is done in the most cases, the largest quantity will be obtained from these.

98. I have always looked on the formation of aerial roots as one of the greatest advantages in favor of the cultivation of *Ficus elastica*, since the facility with which these are thrown out enables this tree to recover itself much faster than other Caoutchouc trees with only a single stem.

99. I do not wish to affirm by the above remark that I do believe in surplus milk, or that a vigorous tree receives through one stem less sap than through many stems; on the contrary, a tree in health will always produce as much sap as it requires, no matter if through one or many stems or roots, but if by tapping the actions of roots or stem are interfered with or rendered impossible, *Ficus elastica* will, by making new roots, adjust this quicker than a Caoutchouc tree with a single stem only.

100. On the other hand, the great number of aerial roots enable the collector to overlap a *Ficus elastica* more than any other Caoutchouc tree, as the surface exposed is greater, but this can be easily controlled in the plantations when the trees are ready for tapping.

101. If the *Ficus elastica* is planted in the ground, or germinates in the fork of a tree, it makes but little difference to the size or number of aerial roots formed after, especially if grown, as is done in the Charduar plantation, where part of the forest is left standing between the lines of Caoutchouc trees, by which an excessively steamy atmosphere is ensured; in such localities the aerial roots will always correspond in size and number to the size of the tree.

102. A single-stemmed *Ficus elastica* without any aerial roots of large size has never been seen by me in Assam, except in stations where every boy takes a pleasure in hacking about the tree wherever he can get at it.

103. The size which *Ficus elastica* will reach if planted in the ground (in Assam) has been exhibited in the measurements given above of the oldest planted tree in Tezpur.

104. After a year or two when the natural trees in or about the Charduar plantation have recovered, we shall be able to collect accurate information as to the yield per tree.

Yield per Tree of *Ficus elastica*.

105. The information we have about the yield of trees and climbers producing Caoutchouc in other parts of the world is so vague that even after we have ascertained the yield of *Ficus elastica* we shall not be able to draw comparisons.

106. It has been stated that a tree of *Castilloa*, 18 inches in diameter, will give 20 gallons of milk; this certainly *Ficus elastica* will not give, but I must admit that my knowledge of vegetable physiology does not permit me to believe this of *Castilloa* either at least not oftener than once.

Proceedings of the Madras Government, Revenue Department,
30th September 1875.

107. As to the *Urceola elastica* yielding Caoutchouc in the third year, *Ficus elastica* will do this also, but for all that I consider it would be very imprudent to tap trees before the age of 20 years.

108. The most favorable time for tapping certainly is January, February, and March, when the milk runs abundantly, and is superior to that collected in the rains.

Time for Tapping.

109. There are two varieties of *Ficus elastica*, the "Bogi-Bur," and the "Shika-Bur," and the former of which is said to be slightly superior, but the difference is not such as to

Varieties of *Ficus elastica*.

render it advisable to confine planting to this variety only.

110. There is no doubt room for improvement in the manufacture and collection of Caoutchouc, and experiments have been started with a view to insure this.

Manufacture and Collection of Caoutchouc.

111. The task which forest officers in Assam have set themselves to perform, however, is, in the first instance, to propagate and grow *Ficus elastica*, which has been done most successfully so far, considering the past year was only the second year of these experiments, and the manufacture of superior Caoutchouc will be tried during the coming season as far as the exhausted state of the trees permits.

112. The climber in Cachar giving Caoutchouc was searched for and examined; good botanical specimens could not be got at the time, but it is hoped will be procured during the coming year.

The Cachar Climber yielding Caoutchouc.

The quality of the Caoutchouc is extremely inferior, there being no elasticity at all in the substance.

(Signed) GUSTAV MANN,
Offg. Deputy Conservator of Forests, Assam.

APPENDIX.

From Dr. W. SCHLICH, Conservator of Forests, Bengal, to the Secretary to the Government of Bengal, dated Darjeeling, 26th May 1875, No. 87C.

In reply to your endorsement, No. 2,012, dated 17th July 1874, forwarding letter, No. 736, dated 7th July 1874, from the Government of India, Department of Revenue, Agriculture, and Commerce, I have the honor to submit, for His Honor the Lieutenant-Governor's information, the following remarks regarding the raising of seedlings of *Ficus elastica* in nursery beds, as carried out by Mr. Gamble, Assistant Conservator of Forests, in charge Darjeeling Division.

2. At Bamunpokri nine nursery beds were prepared, three with common garden soil, three with broken bricks, and three with charcoal, and all intersected by irrigation trenches, thus keeping the soil thoroughly moist by percolation. The seed was collected in September 1874, and sown in that month and in October, partly in whole figs, and partly crumbled up by the hand. The beds were then shaded by thatch, raised two feet above the ground on the south, and three feet on the north, and the sides were closed in with mats which could be removed at will.

3. From four to six weeks after sowing the seeds germinated profusely, best of all in the garden soil, next best on the broken bricks, and last, though still pretty well, on the charcoal; they have thriven well, and are now up to five inches high, with leaves up to two inches long. On the whole, therefore, it may be said that little or no difficulty has been experienced in raising seedlings of the *Ficus elastica*. When of a sufficient size they will be planted out, some in the ground, and some on useless forest trees, and I hope to report further on the result of the experiment after another year.

Proceedings of the Madras Government, Revenue Department,
30th September 1875.

Endorsed by the Government of Bengal, dated 10th June 1875, No. 1,937.
Copy submitted to the Secretary to the Government of India, Department of Revenue, Agriculture, and Commerce, for information, with reference to his No. 736, dated 7th July 1874.

No. 285.

ORDER THEREON, 30th September 1875, No. 1,443.

Forests, No. 26.

COMMUNICATED to the Board of Revenue and to the Inspector of Forests for information.

(True Extract.)

(Signed) L. A. CAMPBELL,
Under-Secretary to Government.

To the Board of Revenue.
" the Officiating Inspector of Forests.

Exd. F. R. Bantleman.

REPORT ON THE CAOUTCHOUC PLANTATIONS IN ASSAM AND THE YIELD OF CAOUTCHOUC FROM "FICUS ELASTICA."

The last report submitted on this subject contained the results of the first attempt to plant *Ficus elastica* in Assam up to the end of March 1874, and this report will therefore record the results of the planting since that date.

2. The different opinions expressed during the year on the growth and yield of *Ficus elastica* have proved to me that facts regarding the nature of this tree which I had considered clear and established, because I have had such constant opportunities of watching over and increasing my knowledge of the tree, still remain doubtful to others who have not had the same advantage, which induces me to report in greater detail now than I might have otherwise considered necessary.

3. The planting during 1873-74 was reported in the last report as a failure on account of the lateness of the season when started and drought of that year, whilst the nursery work or the propagation of the plants in spring 1874 was reported as a success up to that date.

4. This report on *Ficus elastica* may conveniently be arranged under three heads as follows:—

- (1.)—The propagation.
- (2.)—The growth in plantations.
- (3.)—The yield.

5. The necessity for forming plantations of this tree having been recognised, no further remarks are required, except perhaps the statement that the protection of the caoutchouc trees in the forests of Assam has again during the year been under the consideration of the Chief Commissioner, and the difficulties of protecting this valuable property prove to be almost insurmountable; scattered as these trees are through the forests situated in the most inaccessible and unhealthy parts of the province, they have been the prey of tribes living near these localities, and may now be said to be almost a thing of the past.

6. Plantations will of course not be exposed to these risks, and can be easily managed by a comparatively small staff of Government officers.

I.—THE PROPAGATION OF *Ficus elastica*.

7. Figs are perhaps of all the forest trees in India the easiest to propagate, but for all this the past years' experience has taught us that *Ficus elastica*, both as seedling and cutting, is very susceptible of injury from too much shade or drip from trees causing excessive wet about its roots, which experience cost us a number of young plants, but thus established a fact which is of the utmost importance in the propagation of this tree.

8. The seed sown on the Charduar caoutchouc plantation on the nursery beds prepared with broken bricks, broken charcoal and with earth only, as described in paragraph 19 of last year's report, germinated profusely on the 25th of April 1874, having at first the appearance of cress, the cotyledons being very small.

9. The artificial shading over these seed-beds, however, caused drip and excessive moisture, which proved fatal to many of the seedlings before the cause of the mischief was recognised.

10. The number saved amounted however to about 1,200, which were on an average of the undermentioned sizes as they grew:—

- | | |
|------------------------|--------------------------------|
| On the 27th June 1874, | $\frac{2}{10}$ ths of an inch. |
| " 12th August 1874, | $1\frac{2}{10}$ ths inch. |
| " 10th September 1874, | $5\frac{7}{10}$ ths inches. |
| " 21st April 1875, | 2 feet 10 inches. |

It should here be mentioned that the last of these was a seedling which had been left undisturbed in the seed-bed, and was exceptionally vigorous in growth.

11. The seed sown germinated most freely on the broken bricks; next best on the charcoal, and least on the earth, and as the seedlings grew, those on the broken charcoal succeeded eventually best of all, whilst those on earth perished, which however is due partly to the large trees left standing in the nursery and the artificial shade got up, for which there proved to be no necessity.

12. No perceptible difference was noted in the germination of the seed where the whole fruit had been sown and the fruit had been crushed, except that in the former case the young seedlings were very much crowded.

13. They are remarkably hardy as long as they are not exposed to too much shade and drip from above, causing excessive moisture about the roots.

14. During the last cold season most of them have formed a thick tuberous root resembling those of *Epiphytocal rhododendron* and *vaccinium*, by which they no doubt are enabled to stand drought during the dry season much better than cuttings.

15. During February and March this year a large nursery, measuring 36,000 square feet, has been prepared in the Charduar plantation by raising beds four feet in width and one foot high, and covering them with 160 maunds of broken charcoal.

Caoutchouc Plantations in Assam and Bengal.—
Communicating to the Board of Revenue and to
the Inspector of Forests for information letter
from the Government of India forwarding Mr.
Mann's and Dr. Schlich's reports on—

SEPTEMBER.
Nos. 284-285.

G. O., 30th September 1875, No. 1,443.

Recd.
Dated September, 30th.

THE BOARD OF REVENUE,

REVENUE.

Obdt. of 1875

16. All trees had been cut down in this nursery and no artificial shade of any description has been given to the seed-beds this spring.

17. On these beds six maunds of seed were sown, the first of which germinated on the 18th April, and they look remarkably well.

18. A small quantity was also sown on earth alone to give this mode of raising seedlings a further trial, since it is more economical than where charcoal is used.

19. About 400 seedlings were brought in by "Miris" which had evidently germinated on the ground, and these men affirm that the seed of *Ficus elastica* germinates freely on the ground wherever there is sufficient light.

Since these seedlings were fetched from the Akha hills immediately north of the Charduar plantations, it is easily understood that the seed will germinate on steep hill-sides where there is light, whilst for the same reason in the dense evergreen forests along the foot of the hills, this is a very rare occurrence.

That the seed of *Ficus elastica* will germinate and grow on the ground is further borne out by the young trees met with in tea gardens where the ground is kept clear.

20. At the Kulsi plantation in the Kamrup district seedlings have been raised in the same way on a small scale with much the same results.

21. The cuttings made in spring 1874, and reported on in paragraph 18 of last year's caoutchouc plantation report, suffered in a similar way from drip from the artificial shade and trees left as a precaution in the nursery, which has taught us the same lesson with regard to cuttings as with the seedlings.

22. This experience after all was very cheaply bought, since the cost of the nursery was trifling, and we managed to save 2,000 cuttings which were sufficient for the plantation.

23. The best time for making cuttings in Assam is no doubt from the middle of January to the end of May, it depending on the rainfall during the latter three months which of the cuttings will do best; those made in 1874, after May, failed almost entirely.

24. The earlier in the season, before the young shoots to be used have started growth, the better chance they have of success, and at this time young terminal shoots will grow well; whilst after the trees from which the cuttings are taken have commenced growth, which happens about the end of January, the lower somewhat harder portion of the young branches succeeds better than the soft terminal shoots.

25. Only young and vigorous branches from lopped trees are used, and they are cut 1'—2' in length, and are put three inches in the ground; all scrubby branches from old trees almost invariably fail.

26. The branches from young trees are still better than those of lopped trees, but these are rarely to be had now.

After our young trees are two or three years old, they will furnish any quantity of shoots best suited for cutting.

27. The making of the cuttings this spring was begun in the end of January both at the Charduar and Kulsi plantations, and in the former it was continued until the 19th of March.

28. The beds for the cuttings were raised one foot high, all the paths between the beds being so constructed as to prevent water resting, and as an extra precaution the earth at the Charduar plantation was mixed with river sand since it is rather clayey, retaining moisture longer than suits the cuttings.

29. The nursery for cuttings in the Charduar plantation in the Darrang district, prepared in this way, measures 25,200 square feet, and at the Kulsi plantation in the Kamrup district a small nursery sufficient to grow the cuttings for an extension of 30 acres was prepared and planted.

30. The same artificial shading of grass was employed as last year, but was removed every afternoon and not replaced until about 9 o'clock in the morning, by which more light was ensured to the cuttings during part of the day, and they had the benefit of the night dew.

31. On the 7th of March the first rain fell at the Charduar plantation and continued for some time, which opportunity was taken advantage of to harden off the cuttings and to remove the artificial shading entirely; until rain fell all were watered twice a day.

32. The success of the harder cuttings has been general, whilst amongst the soft young shoots there have been many losses.

33. On the whole the propagation from cuttings has this spring been most successful, there being at the Charduar plantation 16,401 cuttings alive out of 21,213.

34. This is 22 per cent. of failures, which is insignificant considering that many of the cuttings were necessarily still inferior, young trees, which are the best for cuttings, being extremely scarce.

35. At the Kulsi plantation there are 1,790 cuttings alive and doing well, which is also much more than we require for this year's extension.

36. A small nursery has also been prepared with equal success at the Bamuni hill plantation in the neighbourhood of Tezpur for an extension of 10 acres this year.

II.—THE GROWTH IN PLANTATIONS OF *Ficus elastica*.

37. The first plantation of *Ficus elastica* in Assam extended over 18 acres, and was started on the right bank of the Kulsi river, about 30 miles west of Gauhati in the Kamrup district,

adjoining the experimental teak and sissoo plantations, which are the head-quarters of the officer in charge of the Gauhati forest division.

38. The experiment became a failure from reasons explained in last year's report on caoutchouc plantations, but the old lines have been replanted and 17 acres added, which makes the total area under plant in the Gauhati division 35 acres.

39. The method of planting adopted in the Kulsi caoutchouc plantation is the following:—

Lines 20 feet in width and 50 feet apart are opened out in mixed plain and savannah forest, and the trees are planted out on these lines at distances of 25 feet.

40. The plants in this plantation were examined by me on the 26th of April, and the countings showed 2 per cent. of failures, which were filled up the same day. Nothing could surpass the healthiness and vigour of the young trees, whose only enemies are the deer, which has made fencing necessary, but the plants will soon have grown beyond the reach of them.

41. Besides this, 30 acres have been prepared for planting during last cold season, but as the weather up to the end of April was very dry, the planting is only being done now, and these 30 acres have therefore not been brought on the register of area of caoutchouc plantations before the end of the financial year 1874-75.

42. This locality was not chosen for the first plantation because it was well suited, but on account of the season being far advanced, and there was a forest officer on the spot to look after it.

43. Kamrup is, compared with other districts in Assam, dry, and it is not intended to have caoutchouc plantations on a large scale in this district on this account, since the yield will be proportionately small.

44. All land in the Kulsi plantation reserve not suited for timber plantations will thus be made use of for caoutchouc plantations, which will make the total area about 100 acres. This will furnish a field for experiments in tapping and enable us hereafter to draw comparisons between the yield of caoutchouc from trees in this district and that from the more favourably situated Charduar plantation at the foot of the Himalayas in the Darrang district, 18 miles north of Tezpur.

The Charduar caoutchouc plantation. 45. The latter plantation extended over an area of 180 acres in the year 1873-74.

The plants in this plantation were examined by me on the 21st of April 1875, and the countings made all through the plantation showed 3½ per cent. of failures.

In addition to this 140 acres more have been got ready, and another 60 acres are in course of clearing for plants.

None of this area has, however, been planted, since the rains will be more suited for this work, and no additional area has for the above reason been brought on the register of area of caoutchouc plantations before the end of 1874-75.

46. The method of planting adopted in the Charduar plantation was the following:—

Lines 20 feet in width and 100 feet apart were opened out through lower hill forest, and trees were planted out on these lines at distances of 50 feet.

47. The width of the lines proved insufficient as soon as the rains set in, and the excessive shade and drip from the trees on either side of the line proved injurious and in many cases fatal to the plants.

48. The plantings on split stumps of trees and in earthenware rings, placed with the widest opening on stumps, was suggested by the Chief Commissioner and proved very successful in low situations, counteracting the excessive wet on the ground, but vigorous growth was not insured until more light was admitted.

49. All the lines of last year's plantation were therefore opened to 40 feet in width, and the effect on the young trees has already been most beneficial, so that, although it is only the commencement of the growing season, nothing could surpass the vigour and healthy appearance of the trees, and so far as the planting on lines opened out through the forest goes it certainly is a perfect success.

50. The ground on these lines is not cleared except just around the plants, but the opening out of bridle paths has become necessary to save time in going over the plants, since frequent inspection is the only way to prevent any vacancies remaining in the plantation.

51. The growth of low jungle or scrub in these lines has neither been such as to necessitate subsequent clearing.

52. The opening out of these lines to double the width has however doubled the cost of this, the chief work in the plantation, and since the daily increasing demand for labour on the tea gardens has induced the planters to pay absurdly high wages, thus making local labour, which only is suited for the caoutchouc plantation work, scarcer every day.

53. For this reason experiments have been started to plant the young trees in strongly-made cane baskets and to place these in the forks of trees.

Planting in the forks of trees. 54. Only seedlings are used for this mode of planting, since they soon form thick tuberous roots and thus become more fit to combat with the comparative dryness to which they are exposed in the tops of trees in the dry season.

55. The first of these were planted on the 25th of January in trees near the nursery, and on the 21st of April they looked everything that could be desired.

56. This mode of planting would only necessitate a small bridle path being opened through the forest instead of lines 40 feet in width, and is estimated to reduce the cost of the creation of caoutchouc plantations on a large scale, including survey, formation, conservation, roads, buildings and salaries, from Rs. 10 to Rs. 5 per acre.

57. The only objection to this plan is the difficulty of inspection, and without constant examination of the plants no satisfactory results can be reckoned on.

This I hope to overcome by having every line numbered, and every tree on which a caoutchouc plant has been placed, marked.

These lines will then be regularly gone over at least once in two months, and the result placed on record in the plantation journal.

After a year or two the plants will be sufficiently large to render the climbing of trees unnecessary, which latter will be the only difficult task in the examination of the plants, but it is considered of such importance during the first year or two, as to justify high pay to the men who have to do this work.

58. It is hoped to bring during these rains 50 acres under cultivation in this way, and thus to obtain results on as early a date as practicable.

59. This mode of growing *Ficus elastica* it is intended to introduce only on the ground of economy and the growing scarcity of labour, and not because it is believed that this tree grows naturally as an epiphyte only, for trees which germinated on the ground are said to be not at all rare in the Akha hills north of the Charduar plantation, and the caoutchouc collectors who go beyond the British boundary into these hills, will have it that such trees, although few in number, grow larger than those which commenced life as epiphytes between the branches of other trees.

60. I myself have never seen but one tree, which had undoubtedly germinated on the ground, but then the want of light in the dense forests along the foot of the hills renders it impossible for trees to grow in this way as proved by our seed experiments.

61. The only one specimen above mentioned which ever I saw had a true stem, cylindrical in shape and measured 16 feet in girth 30 feet above the ground, but this had not prevented the tree from throwing out great numbers of aerial roots descending from branches 50 feet above the ground.

Some of these aerial roots measured 6 to 8 feet in girth at distances of 20 feet from the stem, and had established themselves firmly in the ground like the tree itself.

62. Neither does *Ficus elastica* in Assam, if planted in the ground, remain smaller or more destitute of large aerial roots than trees which grew first as epiphytes, as has been stated.

63. The measurements given below will show that the epiphytic growth of a *Ficus elastica* is not by any means essential, for after all is done and said this tree is only epiphytical in early life for a comparatively small number of years, after which it has its roots in the ground like any other tree.

64. Natives will have it that the aerial roots of young *Ficus elastica* in the Charduar reach the ground in the third year.

65. To corroborate the above and to ascertain the distances at which the young caoutchouc trees should be planted, enquiry was instituted regarding the age of the largest tree planted in Tezpur, and measurements made of this tree, which were as follow—

Age of tree	...	...	32 years.
Height of tree	...	...	110 feet.
Diameter of crown	...	...	140 "
Circumference of the centre mass of aerial roots surrounding the stem	...	...	70 "
Distance of outermost aerial roots from stem	...	...	30 "

There were over a hundred aerial roots, the five largest of which measured each respectively 6 feet, 4 feet, 4 feet, 3½ feet and 3 feet in girth, 5 feet above the ground.

66. These measurements show the size and rapid growth of *Ficus elastica* planted in the ground in Assam, which in the forests at the foot of the hills must be even much greater than in the station of Tezpur, and is not less than that of epiphytic trees.

67. As the roots spread out in the soil very near the surface to a distance of 150 feet and more, and form a thick network, it is considered close planting will seriously interfere with the free development of the roots

and growth of the young caoutchouc trees, and unless vigorous growth is ensured no yield of caoutchouc can be expected.

68. It is however intended to have the trees on all the area at present under cultivation planted at 25 feet distances in the lines instead of 50 feet, so as to have a number of young trees available for experiments in tapping to ascertain the yield from young *Ficus elastica*. It is thus intended to have every alternate tree killed by tapping at the time they begin to interfere with the growth of those it is intended to let grow to maturity.

69. The tree measured in Tezpur is exceptionally large and to all appearance not only healthy but luxuriant, but for all this it yielded next to no caoutchouc when permission was given by the proprietor to one of the traders in the bazar to tap it.

70. This latter fact I do not attribute, as Dr. Schlich, the Conservator of Forests, Bengal, and Dr. King, the Superintendent of the Calcutta Botanical Garden, do, to the fact of the tree having originally been planted in the ground, but to the locality in which it grows, which will be further remarked on under the head of yield of *Ficus elastica*.

71. The above fact of this luxuriant tree in Tezpur not yielding any caoutchouc, and similar results of experiments in tapping trees in Gaubati made by me, point to the great necessity for a most careful selection of the localities for caoutchouc plantations, and no greater mistake could possibly be made than to start plantations of *Ficus elastica* in any part of Bengal with the view of producing caoutchouc, as suggested by Dr. Henderson, or to draw any conclusions regarding the way it should be cultivated from the appearance of trees planted in Bengal, for although the trees will grow in any part of Bengal, caoutchouc there would be next to none.

72. To insure a sufficiently large area of land being maintained as forest for caoutchouc plantations, proposals for the reserving of an area of about 140 square miles in the Charduar, north of Tezpur, were submitted in spring 1873, and are now under the consideration of the Chief Commissioner.

73. Experiments of planting *Ficus elastica* on a small scale in grass land are carried on by order of the Chief Commissioner in the neighbourhood of Tezpur, to obtain results hereafter regarding the yield of caoutchouc from trees in this locality, as compared with the yield from trees at the foot of the Himalayas.

74. Ten acres were thus brought under cultivation by planting at distances 25'x25', no vacancies exist, and the plants, though small as yet, look very healthy.

75. Nabor (*Mesua ferrea*) has been planted between the young caoutchouc trees.

76. Close planting in this case is resorted to, to bring about on as early a date as possible a perfect cover on the land and thus extirpate the grass, insure the formation of vegetable mould, the moisture of the soil, and the surface sufficiently open to atmospheric influences, which conditions are insured in the Charduar plantation by leaving part of the forest standing.

77. The general conditions for the healthy and rapid growth of the young trees of *Ficus elastica* as detailed above are these:—

Conditions required for the growth of *Ficus elastica*.

(1st).—Perfect drainage about its roots and looseness of soil so as to admit the air readily, the geological composition of the soil not affecting the trees as long as the above conditions are fulfilled, but it should not be gravel or sand, since all caoutchouc collectors state that it produces much smaller quantities even in the best localities.

(2nd).—Plenty of light without decreasing the moisture of the air by the admission of it.

(3rd).—Heat and moisture combined, or what is commonly termed a close and steamy atmosphere.

78. The districts in Assam suited for caoutchouc plantations are—

1. The Darrang district.
2. The Naga Hill district.
3. The Lakhimpur district.

79. The south of the Cachar district would be suited, but the comparatively unsettled state of the Looshai boundary would not render such a measure for the present at least advisable.

80. None but the moist evergreen forests along the foot of the mountains should ever be chosen for caoutchouc plantations.

81. In the Kulsi plantation no separate establishment has been entertained for this particular work, but the caoutchouc plantation is debited with one-fourth of the cost of the whole plantation establishment.

82. The area of the caoutchouc plantation at the Kulsi at the end of 1873-74 was 35 acres, on which an expenditure of Rs. 377.13, or Rs. 10.12-8 per acre, had been incurred up to that date.

The area got ready for planting last year at the Kulsi is 30 acres, which together with improvement and conservation of the plantation of 1873-74, cost during the financial year 1874-75 Rs. 605.14, or Rs. 15-2-1 per acre for two years, which has become so high on account of the nursery, the greater part of which, and especially the seed nursery, was destroyed by floods last year, and the great difficulty in procuring suitable branches for cuttings in this locality.

84. The establishment entertained at the Charduar caoutchouc plantation, including the small experiment near Tezpur, was the following:—

1 Mohurir on Rs. 14 per mensem, for 9 months.
1 " " 20 " " 2 "
1 Watcher on " 7 " " 9½ "

85. The area of the caoutchouc plantation at the end of 1873-74 was 180 acres, on which an expenditure of Rs. 415-3-6, or Rs. 2-4-10 per acre, had been incurred up to that date.

86. The area planted in 1874-75 was 10 acres near Tezpur, and 140 acres have been got ready for planting at the Charduar plantation.

87. In addition to this, all the lines of last year's plantation have been opened out to double the width, bridle paths been opened out along each line, the plants been fenced in, and large nurseries for cuttings and seedlings been prepared, the cost of which, during the financial year 1874-75, was in the abstract as follows:—

	Rs.	A.	P.
Demarcation	...	43	11 0
Formation	...	2,084	3 0
Protection from fire	...	24	12 0
Improvement and conservation	...	505	6 3
Fencing and enclosing	...	193	9 6
Roads and bridges	...	205	10 0
Buildings and offices	...	607	2 0
Salaries...	...	232	10 0
Total	...	3,896	15 9

or Rs. 13-1 per acre for two years, which is also above the average cost on account of buildings, roads and bridges, as well as the large nurseries which had to be prepared at starting.

88. For all this the cost of the caoutchouc plantations, even at Rs. 10 per acre as now estimated, is very small compared with other plantations.

89. The cost per acre if planted in baskets to be placed in trees is estimated at Rs. 5, but as the experience gained in the latter mode of planting is as yet small this estimate must be considered subject to correction hereafter.

90. The head-quarters of the divisional forest officer in the Gauhati division are on the Kulsi plantation and that of the officer in charge of the supervision of the caoutchouc plantations, Tezpur division, at the Barolighat, a distance of 5 miles from the Charduar plantation, so that in either case competent supervision throughout the year is given to this work.

III.—YIELD OF *Ficus elastica*.

91. Amongst the different conditions on which the yield of the *Ficus elastica* depends stands foremost the locality in which it is grown.

92. When first enquiring in 1869 from the caoutchouc collectors into the yield of the tree in different localities, I was informed that it would yield most in the hills, next best immediately at the foot of the mountains, and that this yield diminished according to the distance from the hills the caoutchouc tree was growing in the open country or even on the banks of the Brahmaputra, where, I was informed, it would yield little or none.

93. It was in accordance with this information that the Charduar plantation was started as being in one of the most favourable localities in Assam.

94. Subsequent and frequent enquiry has been made on this subject, and the collectors now say they get more at the foot of the mountains than in the hills.

95. Whichever is the correct statement, the difference in quantity yielded by trees growing in the plains along the foot of the mountains and those growing on the lower hills is but trifling, if not entirely imaginary, whilst as the forests along the foot of the mountains are left and the open country is entered, the quantity diminishes very rapidly until on the banks of the Brahmaputra, in the stations of Tezpur and Gauhati, as mentioned above, trees which had not been tapped before were tapped without yielding any caoutchouc worth speaking of, thus substantially proving the above information to be correct.

96. The next question raised during the last year is, will *Ficus elastica* yield equally if tapped from the stem or aerial roots? On this point, in Assam at least, no doubt ever existed.

The collectors state that there is no difference whatsoever, but that if they dig up the ground and thus get at the roots in the ground, that the latter will give more.

97. My own observations are that caoutchouc collectors will go to the utmost extremity of the branches at the risk of their lives to procure caoutchouc, and that the quantity will only vary according to the place first attacked; if this is commenced at the upper branches the greater quantity will be obtained from there; if at the roots in the ground, as, I regret to say, is done in the most cases, the largest quantity will be obtained from these.

98. I have always looked on the formation of aerial roots as one of the greatest advantages in favour of the cultivation of *Ficus elastica*, since the facility with which these are thrown out enables this tree to recover itself much faster than other caoutchouc trees with only a single stem.

99. I do not wish to affirm by the above remark that I do believe in surplus milk, or that a vigorous tree receives through one stem less sap than through many stems; on the contrary, a tree in health will always produce as much sap as it requires, no matter if through one or many stems or roots, but if by tapping the actions of roots or stem are interfered with or rendered impossible, *Ficus elastica* will, by making new roots, adjust this quicker than a caoutchouc tree with a single stem only.

100. On the other hand the great number of aerial roots enable the collector to overtap a *Ficus elastica* more than any other caoutchouc tree, as the surface exposed is greater, but this can be easily controlled in the plantations when the trees are ready for tapping.

101. If the *Ficus elastica* is planted in the ground, or germinates in the fork of a tree, it makes but little difference to the size or number of aerial roots formed after, especially if grown, as is done in the Charduar plantation, where part of the forest is left standing between the lines of caoutchouc trees, by which an excessively steamy atmosphere is ensured; in such localities the aerial roots will always correspond in size and number to the size of the tree.

102. A single stemmed *Ficus elastica* without any aerial roots of large size has never been seen by me in Assam, except in stations where every boy takes a pleasure in hacking about the tree wherever he can get at it.

103. The size which *Ficus elastica* will reach if planted in the ground (in Assam) has been exhibited in the measurements given above of the oldest planted tree in Tezpur.

104. After a year or two when the natural trees in or about the Charduar plantation have recovered, we shall be able to collect accurate information as to the yield per tree.

105. The information we have about the yield of trees and climbers producing caoutchouc in other parts of the world is so vague, that even after we have ascertained the yield of *Ficus elastica* we shall not be able to draw comparisons.

106. It has been stated that a tree of *Castilloa*, 18 inches in diameter, will give 20 gallons of milk; this certainly *Ficus elastica* will not give, but I must admit that my knowledge of vegetable physiology does not permit me to believe this of *Castilloa* either, at least not oftener than once.

107. As to the *Urceola elastica* yielding caoutchouc in the third year, *Ficus elastica* will do this also, but for all that I consider it would be very imprudent to tap trees before the age of 20 years.

108. The most favourable time for tapping certainly is January, February, and March, when the milk runs abundantly, and is superior to that collected in the rains.

109. There are two varieties of *Ficus elastica*, the "Bogi-Bur," and the "Shika-Bur," and the former of which is said to be slightly superior, but the difference is not such as to render it advisable to confine planting to this variety only.

110. There is no doubt room for improvement in the manufacture and collection of caoutchouc, and experiments have been started with a view to ensure this.

111. The task which forest officers in Assam have set themselves to perform, however, is in the first instance to propagate and grow *Ficus elastica*, which has been done most successfully so far, considering the past year was only the second year of these experiments, and the manufacture of superior caoutchouc will be tried during the coming season as far as the exhausted state of the trees permits.

112. The climber in Cachar giving caoutchouc was searched for and examined; good botanical specimens could not be got at the time, but it is hoped will be procured during the coming year.

The quality of the caoutchouc is extremely inferior, there being no elasticity at all in the substance.

GUSTAV MANN,

Offg. Deputy Conservator of Forests, Assam.

APPENDIX.

No. 87C, dated Darjeeling, the 26th May 1875.

From—DR. W. SCHLICH, Conservator of Forests, Bengal,

To—The Secretary to the Government of Bengal.

IN reply to your endorsement No. 2013, dated 17th July 1874, forwarding letter No. 736, dated 7th July 1874, from the Government of India, Department of Revenue, Agriculture and Commerce, I have the honour to submit, for His Honour the Lieutenant-Governor's information, the following remarks regarding the raising of seedlings of *Ficus elastica* in nursery beds, as carried out by Mr. Gamble, Assistant Conservator of Forests, in charge Darjeeling Division.

2. At Bamunpokri nine nursery beds were prepared, three with common garden soil, three with broken bricks, and three with charcoal, and all intersected by irrigation trenches, thus keeping the soil thoroughly moist by percolation. The seed was collected in September 1874, and sown in that month and in October, partly in whole figs, and partly crumbled up by the hand. The beds were then shaded by thatch, raised two feet above the ground on the south, and three feet on the north, and the sides were closed in with mats which could be removed at will.

3. From four to six weeks after sowing the seeds germinated profusely, best of all in the garden soil, next best on the broken bricks, and last, though still pretty well, on the charcoal; they have thriven well, and are now up to five inches high, with leaves up to two inches long. On the whole, therefore, it may be said that little or no difficulty has been experienced in raising seedlings of the *Ficus elastica*. When of a sufficient size they will be planted out, some in the ground, and some on useless forest trees, and I hope to report further on the result of the experiment after another year.

No. 1937, dated the 10th June 1875.

Endorsed by the Government of Bengal.

COPY submitted to the Secretary to the Government of India, Department of Revenue, Agriculture and Commerce, for information, with reference to his No. 736, dated 7th July 1874.

No. ²² 967

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FROM

A. O. HUME, Esq., C.B.,

Secretary to the Government of India,

TO

The Secretary to the Government
of Madras
Pottacamund

Department of Revenue,
Agriculture, and Commerce.
Forests.

SIMLA, the 31st August 1875.

SIR,

I AM directed to forward, for information and communication to such of the Forest Officers in the Madras Presidency as take an interest in the subject, the accompanying copies of a Report by Mr. G. Mann, Officiating Deputy Conservator of Forests in Assam, on the Caoutchouc Plantations in that Province, and the yield of caoutchouc from *Ficus Elastica*, together with a Report by Dr. Schlich, Conservator of Forests in Bengal, on the success which has attended the raising of seedlings of *Ficus Elastica* in nursery beds in the Darjeeling Division.

I have the honour to be,

SIR,

Your most obedient Servant,

A. O. Hume

Secretary to the Government of India.

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N. 36.5

1875.

GOVERNMENT OF INDIA.
DEPARTMENT OF REVENUE,
AGRICULTURE, AND COMMERCE.

FORESTS.

To

No. ²² 56-

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Dated Simla, the 31st August 1875.

Recd. 20th Sep

21 to Mr. Mann
3 - 9 copies of the same } June 2/10

SUBJECT.

FORWARDING Mr. Mann's and Dr. Schlich's
Reports on Caoutchouc Plantations in Assam
and Bengal.

No. 1443
Copies to the Secy
of the Dept of
Forests for information

20th Sep 1875