ABRIDGED ANNUAL REPORT ON SILVICULTURAL RESEARCH IN MADRAS STATE FOR THE YEAR 1954—55.

PART I.

GENERAL.

1. *The Silvicultural Research Programme.*— The Silvicultural Research Programme for the year, as approved by the Chief Conservator of Forests, is given in an Appendix.

2. During the year, two new Research Stations were opened at *Vemburili* and *Markanam*, each under the charge of a Forester. *Benneri* Research Centre was closed and in its place *Rameshwaram* Research Centre was opened under the charge of a Forester. The headquarters of the Research Ranger, Palghat, was shifted to Nilambur.

3. *The climatic factors* of all the Research Centres are furnished in charts and tables.

4. Detailed statements of *experimental plot files* and *experimental garden files* are furnished.

5. During the year, eight new *sample plots* were added bringing the total to 191 sample plots. Detailed statement of these plots is furnished.

6. Detailed statement of all *tree increment plots* and *permanent preservation plots* is furnished.

7. Reference is made to the additions made to the *specific* and *general ledger* files during the year.

PART II.

EXPERIMENTAL SILVICULTURE.

(i) General.

8. Experiments on artificial regeneration of teak continued to occupy a dominant place in the work during the year.

(ii) Natural Regeneration including Coppicing Root Snickers.

(a) *Natural regeneration by seed.*

9. *Artocarpus hirsuta* is very liable to damage by bisons and elephants and hence cannot be grown successfully in localities subject to this damage.

10. *Calophyllum elatum.*—Growth statistics up to age 31 years are furnished.

34. *Teak—Comparison of seeds from plantations and from natural forests.*—There is no significant difference between the two seeds. In Madras State, seed is mostly collected from plantations as natural forests have been mostly cleared and planted with teak.

35. *Teak—Splitting of teak stumps.*—There is no significant difference between entire and halved stumps. In times of scarcity, halved stumps may be used.

36. *Teak—Comparison of good and malformed stumps.*—Malformed stumps are as effective as good stumps.

37. *Teak, manurial experiments in Nilambur.*—Application of 4 oz. of Superphosphate per plant promotes more rapid height growth. Cost of application of manure will come to Rs. 26 per acre. Further investigations are required to show whether weeding costs can be reduced to counter balance the cost of application of manure.

38. *Teak—Plantations with Kumri crop.*—There is no difference of teak raised with any of the common Kumari crops—

(i) Hill paddy.
(ii) Chillies.
(iii) Cotton.
(iv) Ragi.
(v) Tapioca.
(vi) Horsegram.

39. *No deterioration of site quality in second rotation pure teak plantation crops.*—Measurements of sample plots 17A, 18A, 19A, of Nilambur are analysed. Evidence shows that in the second rotation, there is a slight increase in site quality in higher site qualities such as All-India Quality II, All-India Quality III while there may be a slight but not appreciable decrease in site quality in poor site qualities such as All-India Quality IV. Taken on the whole, there is no need for any fear that the quality of pure teak plantations in the second rotation will fall off.

(*b*) *Indigenous hardwood species.*

40. *Dipherocarpus indicus.*—Growth statistics are given.

41. *Hopea parviflora.*—Growth statistics are given.

42. *Hopea parviflora.*—This can be successfully raised after clearfelling and burning secondary re-growth in old shifting cultivation in a natural evergreen forest.

43. *Hopea and Mahogany.*—Can be successfully introduced in a deciduous forest, after clearfelling and burning.

44. *Mesua ferra.*—Growth statistics are furnished.

45. *Terminalia crenulata—Seed from figured trees.*—The experiment is in progress to determine whether 'figure' can be transmitted by seed.

(*c*) *Indigenous soft wood.*

46. *Artificial regeneration of crops in evergreen forest.*—Of the six species tried, *Bombax* and mango have come up best.

47. *Introduction of soft wood in evergreen forests without clearfelling.*—Data furnished on five species which were tried.

48. *Ailanthus excelsa.*—Growth statistics are furnished.

49. *Ailanthus malabarica.*—Growth statistics are furnished.

50. *Bombax malabaricum.*—Best method of raising is through one year old transplants. Manurial experiments with application of Ammonuium Sulphate and Superphosphate have not shown any difference so far.

51. *Evodia roxburghiana.*—Rate of growth is furnished. Thinning of the crop promotes diameter increment and reduces incidence of fungus attack.

52. *Melia dubia.*—Entire transplanting is the best method of raising the species.

53. *Spondias mangifera.*—Stumps and transplants give equally good results. Very liable to damage by deer.

54. *Sterculia alata.*—One year and two year old transplants give good results. Growth statistics are furnished.

55. *Superculia companulata.*—Nine months to one year old transplants give the best results. Nine feet by nine feet espacement is better than 6′ × 6′ espacement.

56. *Vitex peduncularis.*—Growth statistic are furnished up to age of 13 years.

57. *Zanthozylum rhetsa.*—Best method of raising is through nine months to one year old entire transplants. Rate of growth furnished.

(*d*) *Exotics.*

58. *Acacia decurrenns and Acacia mollissima.*—Experiments on espacement manurial treatment and best rotation are given. No conclusions possible at this stage except that the M.A.I. of dry bark of *Acacia mollissima* culminates at age 13 years or later.

59. *Albizzia falcata.*—Experiments have been started.

60. *Alevrtes fordii and Aimontana.*—Observations of plants in existence made.

61. *Bursera delpichina.* (Linaloe).—Vegetative propagation through cuttings have so far failed.

62. *Broussenctia papyrifera.*—Data furnished.

63. *Casurina cunninghamina.*—Data furnished.

64. *Ceratoniasiliqua* (Carol tree).—Seeds obtained from Cypress and tried. Results of germination tests are given.

65. *Cunnamomum camphora.*—Statistics of growth are furnished.

66. *Cinnamomum zeylanicum.*—Both transplants and stumps come up well. Growth statistics are furnished. Underplanting experiments in teak plantations and in evergreen forests show that these are possible ; further observations are necessary.

67. *Copernica cerifera* (Carnuba wax palm).—Growth data are given.

68. *Dalbergia cochinchinensis.*—Growth data are given.

69. *Dalbergia sissoo.*—Transplanting one year old seedlings gives the best result. Transplants two years old and stumps are also successful.

Growth data are given. It comes up well on fire burnt *lantana* infested area in Denkanikota.

70. *Ecualyputs citriodora.*—Inves tigations on the essential. Oil of the leaves have been started. Growth data are given.

71. *Eucalyptus globulus.*—Manurial experiments with N.P.K. fertilizer started.

72. *Grivellea robusta.*—Growth data are furnished.

73. *Hyphaeni thebaica*—(Dam nut).—Growth data are given.

74. *Morus alba.*—Best method of raising is through one year old transplants.

75. *Ochroma lagopus* (Balsa).—Best method of raising is to sow seeds in containers (bamboo tubes) and plant when seedlings are 4″ — 9″ high.

76. *Ocimum camphora* (*Syn. Ocimum Kilimanjaricum*).—This can be successfully raised by broadcast sowing along with planting teak stumps. The yield of leaves obtained from one acre with results of analysis of camphor content, carried out by Forest Research Institute, Dehra Dun, are furnished. Data on cost of cultivation, yield per acre and cost of distillation are furnished to show that commercial cultivation on a cottage industry basis is possible.

77. *Pinus caribaea* (Slash pine).—Nursery trials started.

78. *Pinus taeda* (Loblodly pine).—Nursery trials started.

79. *Pterocarpus dalbergioides.*—Growth data are given.

80. *Salix Babylonica.*—Growth data are furnished.

(*e*) *Bamboos and canes.*

81. *Introduction of canes.*—Experiments started.

(*f*) *Medicinal plants.*

82. *Rauwolfia serpentina.*—Data about growth and annual yield of roots are given. Experiments on underplanting in teak plantations camparison experiments on different methods of raising are discussed. The indications are that the plant can be raised successfully by (i) direct sowing, (ii) shoot cuttings with root attached and (iii) shoot cutting alone.

(vi) Reclamation and Afforestation including Irrigated Plantations.

83. *Hopea in a failed teak area.*—Hopea can be raised successfully in a lateritic area where teak had failed.

84. *Afforesting grass lands in Chandanathode.*—Experiments with several species in 1953–54 are discussed.

(vii) Tending, Thinning, Climber and Weeds.

85. *Pruning in teak plantations.*—Pruning does not appear to be beneficial. Data are given.

86. *Teak plantations—Wynaad—Experiment to ascertain the best time for first thinning.*—First thinning at age five years yields greater diameter in 21 years than first thinning at age seven years or nine years and is therefore definitely superior. Data of measurements are given.

Teak Plantations—Wynaad—Best intensity of thinning.—In sample plots 10 to 25 of Wynaad, experiment was started in 1936 with four intensities of thinning, viz.—

(i) C grade thinning.

(ii) D grade thinning.

(iii) E grade thinning.

(iv) X grade thinning.

(X grade thinning will approximate to an increment felling selections of fine crop at 25 to 30 trees per acre and favouring these at all stages.)

Detailed measurements are given and discussed and the following conclusions are drawn :—

(i) The different intensities of thinning have no effect on height growth.

(ii) Heavier grades of thinning give progressively higher diameter increments.

(iii) At the end of 16 years, the yield of useful basal area *decreases* as the intensity of thinning increases.

(iv) At the end of 16 years, the yield of total volume produced to date, *decreases* as intensity of thinning increases.

87. *Teak Plantations—Nilambur—Best intensity of thinning.*—This is a repetition of the experiment in the paragraph 86 above, in sample plots 69 to 86 of Nilambur.

Detailed measurements are given and discussed. The conclusions are similar to those noted in paragraph 86 above.

88. *Teak Plantations—Heavy and early thinnings to anticipate and not to follow likely suppression.*—In sample plots 120 to 125 of Nilambur, the experiments was started in 1938.

Detailed measurements are given and discussed. The following conclusions are drawn :—

(i) Treatment has no effect on height growth .

(ii) Treatment increases rate of diameter increment.

(iii) At the end of fifteen years, the yield of total basal area and of total volume production are less than for control.

Hence heavy thinning to anticipate and not follow likely suppression (craib's thinning) yields rapid diameter increment; but the volume production is definitely greater with an ordinary 'D' grade thinning as adopted in district practice.

89. *Thinning research plots—Sample plots* 136 *to* 141 *of Nilambur.*—This is a repetition of the thinning experiment noted in paragraph 88 above. Owing to faulty execution of thinnings in the past, it is proposed to abandon these sample plots.

90. *Eradication of Lantana through bamboos.*—Results of experiment in South Coimbatore are furnished.

91. *Eradication of Lantana through clear-felling, burning and planting forest crop with Kumri.*—Details of experiment in Salem North Division are furnished.

92. *Loranthus infestation in teak plantations.*—Experiments on this subject will be undertaken.

93. *Salix babylonica—Pruning of branches.*—There is no difference between pruned and unpruned trees.

(viii) MIXTURES.

94. *Nil.*

(ix) UNDERPLANTING.

95. *Teak plantations in Wynaad.*—Underplanting does not appear to be necessary from the point of view of soil protection.

96. *Teak plantations—Underplanting with bamboo.*—The underplanting reduces the diameter increment of teak but not significantly.

97. *Teak plantations—Underplanting in Nilambur.*—Details of underplanting with several species are furnished.

98. *Teak plantations—Underplanting with Rauwolfia serpentina.*—Details of experiments are furnished.

99. *Lac cultivation in Denkanikota.*—Details of work done are furnished.

100. *Scheme for lac cultivation in the Nilgiris.*—A scheme was prepared by the State Silviculturist.

101. *Manufacture of lac products in the Lac Factory, Denkanikota.*—Details of products manufactured, revenue and expenditure are given.

PART III.

WORKING PLANS AND STATISTICS.

(i) WORKING PLANS.

102. *Working Plans.*—Information is furnished on working plans in progress and those newly taken up.

(ii) YIELD VOLUME AND FORM FACTOR TABLES.

103. *Sample plots, permanent preservation plots and tree increment plots.*—Details of all plots in existence are furnished.

(iii) BARK MEASUREMENTS.

104. *Nil.*

(iv) MISCELLANEOUS FORMULAE.

105. *Nil.*

PART IV.

MISCELLANEOUS.

A. FOREST BOTANY.

106. *Nil.*

B. FOREST ENTOMOLOGY.

107. *Teak defoliator attack—Investigations.*—A report on the above subject prepared at a Conference in which the Forest Entomologist and others participated, is furnished. Investigations on these lines will be started shortly.

108. *Ailanthus excelsa and Ailanthus malabaricum.*—Investigations on the defoliator attack on these plants by *Eligna marcissus* (Noctuidae) will be started.

C. FOREST ZOOLOGY.

109. *Nil.*

D. UTILIZATION.

110. *Forest utilization.*—Information is furnished on the activities of the Forest Utilization Officer, Madras.

TABLE OF CONTENTS.

PART I.

GENERAL.

PART II.

EXPERIMENTAL SILVICULTURE.

(i) GENERAL.

(ii) NATURAL REGENERATION INCLUDING COPPICING ROOT SUCKERS, ETC.

(a) *Natural Regeneration by seed.*

(*b*) *Natural regeneration by coppice.*

(iii) SEEDS (COLLECTION, WEIGHT, GERMINATION PER CENT, PLANT PER CENT, ETC.)

(iv) NURSERY WORK.

(v) ARTIFICIAL REGENERATION.

(*a*) *Experiments on Teak.*

(*b*) *Indigenous Hardwood Species.*

(v) ARTIFICIAL REGENERATION—*cont.*

(*c*) *Indigenous soft wood.*

(*d*) *Exotics.*

INDEX TO SPECIES.

INDEX TO SAMPLE PLOTS.

INDEX TO EXPERIMENTAL PLOTS.

LIST OF TABLES.

LIST OF APPENDICES.

LIST OF CHARTS.

ANNUAL REPORT ON SILVICULTURAL RESEARCH IN MADRAS STATE FOR THE YEAR 1954-55.

PART I.

GENERAL.

1. *Silvicultural Research programme.*—The Silvicultural Research programme for the year 1953–54 was prepared by the State Silviculturist in consultation with District Forest Officers and Conservators and submitted to the Chief Conservator of Forests for approval. A copy of the programme as embodied in the Revised Plan of Operations for 1954–55 is given in Appendix 'A'.

2. *Research Gardens and Stations.*—At the commencement of the year the following Research Centres were in existence. During the year, as per G.O. Ms. No. 1130, Agriculture, dated 21st April 1955, two new Research Centres were opened, one at Markanum with a view to initiate research into artificial regeneration problems of casuarina and one at Vemburili in Madurai district to initiate research into problems of afforestation of dry fuel forests. A staff of one Forester and one Mali was sanctioned for each of these two centres.

Also, the Research Centre at Bonnari was closed as per Chief Conservator's orders No. 2473/54-D3, dated 26th November 1954, and in place of Bonnari, with the same staff consisting of one Forester and one Reserve Watcher, a new Research Centre was opened at Rameshwaram with a view to conduct research into the question of fixation of shifting sand, which is a serious menace in the island.

Hence the following statement shows the centres at the beginning and at the end of the year :—

TABLE I.

	Research centres with staff at beginning of year on 1st April 1954.	*Research centres and staff at end of year on 31st March 1955.*	*Reasons for change.*
I	Research Station, Wynaad, with sub-centres at Begur, Chandanathode and Kannoth. Staff—	Research Station, Wynaad, with sub-centres at Begur, Chandanathode and Kannoth. Staff—	No change.
	Ranger 1	Ranger .. 1	
	Foresters .. 3	Foresters .. 3	
	Forest Guard .. 1	Forest Guard 1	
II	Research Station, Palghat, with sub-centres at Topslip and Dhoni. Staff—	Research Centre at Nilambur with sub-centres at Topslip and Dhoni. Staff—	No change except that the headquarters of the Research Ranger was shifted from Palghat to Nilambur as the importance of work at Nilambur was undoubtedly greater than that of Palghat.
	Ranger 1	Ranger .. 1	
	Foresters .. 3	Foresters .. 3	

TABLE I.—*cont.*

Research centre with staff at beginning of year on 1st April 1954.	*Research centres and staff at end of year on 31st March 1955.*	*Reasons for change.*
III Reserach Station, Nilambur. Staff—	Research Station, Nilambur. Staff—	The Ranger is now working under the Research.
Forester .. 1	Forester .. 1	Ranger, Nilambur. No other change.
IV Research Station Ootacamund. Staff—	Research Station, Ootacamund. Staff—	No change.
Foresters .. 2	Foresters .. 2	
V Reserach Station, Denkanikota. Staff—	Research Station, Denkanikota. Staff—	No change.
Ranger 1	Ranger .. 1	
Forester .. 1	Forester .. 1	
Forest Guards .. 3	Forest Guards 3	
VI Research Station, Bennari Staff—	Resrach Station, Rameswaram. Staff—	Ermanur Station closed and New Rameswaram Station opened.
Forester .. 1	Forester .. 1	
Reserve Watcher 1	Reserve Watcher 1	
VII	Research Station, Markanum. Staff—	Markanum Station newly opened in 1953–54 as per G.O. Ms. No. 1130, Agriculture, dated 21st April 1955.
	Forester .. 1	
	Mali .. 1	
VIII	Research Station, Vemburili Staff—	Vemburili Station newly opened in 1953–54 as per G.O. Ms. No. 1130, Agriculture, dated 21st April 1955.
	Forester 1	
	Mali .. 1	

3. *Climate and rainfall.*—The climatic factors of each of the Research Centres are given in the form of charts which gives the monthly averages of rainfall, maximum and minimum temperatures in addition to the number of rainy days in each month and in the year. For each of the experiments detailed in the body of the report the name of the Research Centre is given prominently at the top so as to enable any one reading the report to understand the climatic factors of the locality under which the experiment was conducted.

The rainfall statements for all the Research Centres are also given in Appendix B for the year 1954–55. In respect of the new Research Stations at Markanum, Vemburili and Rameshwaram, as rainfall figures for these stations are not available, the rainfall figures for the nearest stations, viz., Cuddalore, Madurai and Pamban are furnished.

4. *Records.*—The records for the experimental plot files were chiefly maintained in the office of the State Silviculturist, Ootacamund. The Research Range Officers and Research Foresters did not have complete copies of these experimental plot files. This places the Research Range Officers and the Research Foresters at a disadvantage. Hence arrangements were made for the local

Research Range Officers and Research Foresters to have copies of all experimental plot files. This process is still incomplete and it is hoped that in the coming year all local officers will have copies of all experimental plot files.

All experimental garden files were maintained by the Research Rangers and Research Foresters and subsequently sent to the State Silviculturist for analysis of the measurements.

The following statement summarises the information on the open experimental plot files and experimental garden files at the close of the year :—

TABLE II.

Description.	*At the beginning of the year.*	*Added during the year.*	*Closed during the year.*	*At the close of the year.*
Experimental plot files. ..	219	54 + 3 *	3	273
Experimental garden files ..	162	+117 +46 *	117	30

* Errors in closing balance of last year's annual report rectified.

Experimental plot files proposed for closure during the year. Orders of competent authority are awaited. The closure of these files will appear in the next year's report.

5. *Computations and analysis of annual measurements.*—In the office of the State Silviculturist, at the beginning of the year there were as many as 219 experimental plot files and 162 experimental garden files or a total of 381 files in all. Owing to pressure of work in other directions and shortage of office staff it was found that the original measurements on these 381 files as recorded by the field staff of Research Range Officers and Research Foresters had not been computed or statistically analysed in a large number of cases from the year 1950 onwards. The computation of the figures involves considerable work as several hundreds of figures in each plot file have to be put through an adding machine to get at the averages and further statistical analysis involves considerable mathematical calculations.

An attempt was made by the present writer to bring the computations up to date. He was assisted in this matter by the Chief Conservator of Forests who in his Order No. 2473/54-D-3, dated 26th November 1954, placed the services of a Forester at the disposal of the State Silviculturist for use in office for doing computations of the field measurements. This work of bringing the analysis of the measurements up to date is in progress and will be completed by the close of the next year.

6. *Sample plots.*—There were 183 sample plots under the control of the State Silviculturist during the beginning of the year.

During the year eight new sample plots were opened in the Wynaad as shown below :—

Sample plot No.	On
48	*Vitex penduncularis.*
49	*Lagerstroemia flosreginae.*
50	*Hopea parviflora.*
51	*Pterocarpusa dalbergiodes.*
52	*Chlorophora excelsa.*
53	*Hopea parviflora.*
54	*Ailanthes malabaricum.*
55	*Sterculia companulata.*

At the end of the year there were 191 sample plots as shown below (Please see Appendix C for detailed list) :—

TABLE III.

Serial number and division.	*Species.*	*Number of sample plots.*
1 Palghat	*Pterocarpus marsupium*	1
2 Do.	*Swietenia macrophyla*	2
3 Do.	*Tecona grandis*	1
4 Do.	*Terminal a crenulata*	1
5 Nilgiris	*Acacia decurrens*	1
6 Do	*Acacia mollissima*	1
7 Do.	*Eucalyptus acmenoides*	2
8 Do.	*Eucalyptus euginoides*	1
9 Do.	*Eucalyptus paniculata*	1
10 Do.	*Eucalyptus pillularis*	1
11 Do.	*Eucalyptus propinqua*	1
12 Coimbatore South ..	*Tectona grandis*	1
13 Nilambur	*Lagerstroemia flos-reginae*	24
14 Do.	*Lagerstroemia lanceolata*	1
15 Do.	*Pericopsis mooniana*	1
16 Do.	*Swietenia macrophylla*	1
17 Do.	*Tectona grandis*	4
18 Do.	*Xylia xylocarpa*	86
19 Wynaad	*Ailanthes malabaricum*	2
20 Do.	*Chlorophora excelsa*	1
21 Do.	*Hopea parviflora*	1
22 Do.	*Lagerstroemia flos-reginae*	2
23 Do.	*Pterocarpus dalbergiodes*	1
24 Do.	*Pterocarpus marsupium*	1
25 Do.	*Stercul.a companulata*	1
26 Do.	*Swieten a macrophylla*	1
27 Do.	*Tectona grandis*	1
28 Do.	*Terminalia crenulata*	42
29 Do.	*Vitex peduncularis*	1
30 South Kanara ..	*Hpea pa.viflora*	1
31 Coimbatore North ..	*Tectona grandis*	3
	Total ..	**191**

6A. ***Sample plots, tree increment plots and permanent preservation plots.***—Appendix C furnishes a list of all sample plots, tree increment plots and permanent preservation plots in the Madras State.

7. *Library.*—The Library in the office of the State Silviculturist, Ootacamund, was maintained. During the year 50 books were added to the Library. These were only publications of the Forest Research Institute and the Madras Government, many of them dealing purely with—

Administration Reports.

Silvicultural Research Codes.

Monographs on Species, etc.

No new books of Forestry or Research importance were added to the Library.

8. *Documentation.*—The ledger files of the Office of State Silviculturist, Ootacamund, on Silviculture and allied subjects were maintained. Ledger filing of world literature in Forestry on subjects of interest to the Madras State was done as usual. During the year seven additions to the general ledger files and eleven additions to the specific ledger files were made.

At the VIII Silvicultural Conference held at Dehra Dun in December 1951, it was recommended that "the Oxford System of Decimal Classification for Forestry" should be adopted in future. However this system has not yet been introduced in this office and the ledger files continue to be classified under the old system "Classification of Silvicultural Ledger Files" which is a revision of the original Hoard's 'A System of Filing Information of Forestry".

At the end of the year there were 548 general ledger files and 839 specific ledger files as shown below :—

TABLE IV.

	At the beginning of the year.	*Added during the year.*	*At the close of the year.*
Specific Ledger Files	828	11	839
General Ledger Files	541	7	548

In addition 64 entries were made in existing specific ledger files and 26 entries were made in existing general ledger files, making a total of 90 additional entries during the year.

9. *Photographic collection.*—The office of the State Silviculturist is equipped with a good camera ; but it did not have proper accessories.

During the year, as there was a change in the incumbent of the office of State Silviculturist and also due to other unavoidable circumstances no photographs were added to the photographic collection. The number of specific photographs and general photographs continued to be 943 and 857 respectively.

10. *Administration.*—The post of State Silviculturist was held by Sri K. N. Raghavan Nair, till 5th August 1954, when he was relieved by S i P. Venkataramany, I F.S., who continued as State Silviculturist till the end of the year.

11. *Staff under the State Silviculturist.*—The staff under the State Silviculturist at the beginning of the year and at the end of the year is furnished below :—

TABLE V.—*Statement of staff.*

Serial number.	*Staff at the beginning of the year.*		*Staff at the end of the year.*		*Reasons for change.*
1	Assistant Silviculturist	1	Assistant Silviculturist ..	1	
2	Research Rangers ..	3	Research Rangers.	3	
3	Reserve Foresters ..	11	Reserve Foresters.	13	Due to opening of two new Research Centres at Vemburili and Markanum.
4	Forest Guards ..	3	Forest Guards ..	3	
5	Reserve Watchers ..	2	Reserve Watchers.	2	
6	Malis	..	Malis	2	Remarks same as for item (3) above.
7	Upper Division Clerks	2	Upper Division Clerks	2	1 Head Clerk. 1 Accountant.
8	Lower Division Clerks	4	Lower Division Clerks	4	
9	Typist	1	Typist	1	
10	Stenotypist ..	1	Stenotypist ..	1	
11	Peons	8	Peons	8	

12. *Tours.*—The State Silviculturist toured for a total of 189 days during the year under report.

13. *Office inspections.*—The following Research Range Offices, Research Foresters' Accounts and the Denkanikota Lac Depot were inspected by the State Silviculturist during the year on the dates as noted below :—

1 Research Range Office, Denkanikota.	1st and 2nd March 1955.
2 Research Range Office, Palghat ..	22nd to 24th February 1955.
3 Research Range Office, Wynaad.	19th May 1954.
4 Research Foresters Accounts, Bennari	7th May 1954.
5 Research Foresters Accounts, Nilambur.	23rd and 24th February 1955.
6 Research Foresters Accounts, Ootacamund.	26th July 1955.
7 Lac Depot at Denkanikota ..	7th March 1955.

The condition of the several offices and accounts was generally satisfactory.

The office of the State Silviculturist was inspected by the Conservator of Forests, Ootacamund Circle, on 1st May 1954 and the general condition of the office was found to be satisfactory.

14. *Discipline.*—The discipline of the staff was satisfactory.

15. *Vanamahotsava.*—Seeds and seedlings were supplied to the members of the public from the various nurseries free of charge during Vanamahotsava.

16. *Technical advice, contribution and publications.*—During the year, the State Silviculturist gave technical advice on several points referred to him by several officers in the State, with reference to the ledger files in his office.

The following technical contributions were compiled during the year :—

(1) A note on "Role of Forests in Flood Control" prepared in connexion with a Seminar of Engineers interested in the subject ;

(2) A note on "The Role of Forests in Water and Soil Conservation" ;

(3) A note on "the Production of Rauwolfia serpentina in Madras" for the use of the Officer-in-charge of "Rauwolfia Survey" of Forest Research Institute, Dehra Dun ; and

(4) A scheme for Lac cultivation in the Nilgiris district was prepared and submitted to the Chief Conservator of Forests, Madras, for approval.

17. *Acknowledgments.*—The writer of this report places on record his deep debt of gratitude to all officers for their valuable advice, suggestions and help at all times.

PART II.

EXPERIMENTAL SILVICULTURE.

(i) GENERAL.

18. New experimental works were undertaken as per approved plan of operations for the year, besides maintaining all open experiments of previous years. Experiments on the artificial regeneration of teak, such as teak seed origin methods of artificial regeneration and thinning continued to occupy a dominant place in the work of the State Silviculturist.

(ii) Natural Regeneration including coppicing, root suckers, etc.

(a) *Natural Regeneration by seed.*

19. *Natural regeneration by seed—Acacia mollissima.*—When a mature wattle plantation is clearfelled, profuse natural regeneration comes up from the dormant seeds lying in the forest floor for the past several years as the seed does not lose its viability for a considerable number of years. To find out the best method of obtaining uniform natural regeneration in a second rotation wattle area, experimental plot 22/54 was started. There are three treatments with three replications—

A—Control.

B—Leaving 2 feet wide strips untouched at intervals of 11 feet while the intervening space is forked.

C—Passing a light uniform fire over the area.

Results are awaited.

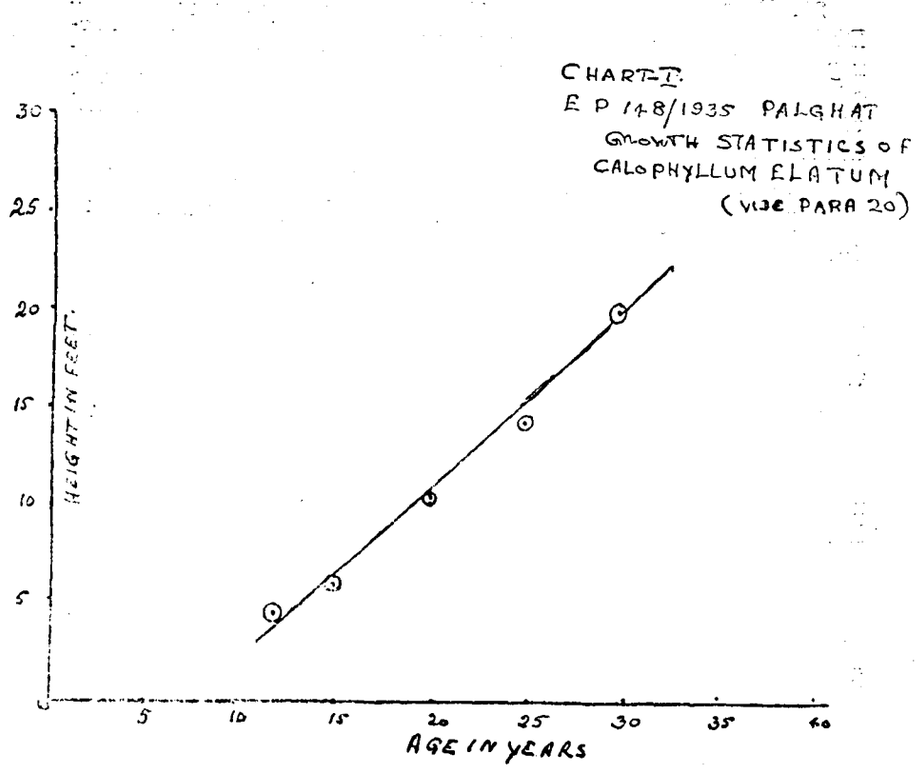
19-A. *Artocarpus hirsuta—Experimental plots 43 and 46 of Wynaad - Growth and Development—Experimental plots 43/37 and 46/37 of Chandanathode.*—These experimental plots were formed in 1937 out of old garden experiments started in 1937 and 1938 respectively to observe the growth and development of the species from seedlings of known age to the sapling and pole stages—

(i) under complete evergreen cover ; and

(ii) under evergreen top canopy cover only cutting out the middle storey of trees up to 3 feet girth.

Due to damage by wild elephants and bisons no valid conclusions can be drawn and so the two plots are proposed for closure. There are only fourteen survivals out of which 11 are top dead or top-broken in experimental plot 43/37. In experimental plot 46/37 there are only 11 out of 100 survivals. The object of the experiment has been vitiated by the high percentage of casualities due to damage by bisons, elephants and due to wind-falls. The conclusion can be drawn that the species, owing to its susceptibility to damage by bisons and wild elephants, cannot be successfully grown in any area where there is this menace of wild elephants, as in Chandanathode and Topslip. In Nilambur damage by wild elephants is not appreciable ; but browsing by spotted deer and Sambhar is appreciably great.

20. *Calophyllum elatum.*—Experimental plot 148/35 of Palghat was started to study the growth and development of Calophyllum elatum of known age from the sapling to the pole stage. It was eleven years old at the time of formation in 1935.



The statement below gives the increase in height growth :—

TABLE VI.

Year.	Age in years.	Survival.	Mean height in feet.	Increase during the previous period.
		PER CENT.		FEET.
1936	12	100	4·20	..
1941	17	100	7·90	3·07
1946	22	99	11·90	4·00
1951	27	99	16·	4·92
1955	31	95	19·90	30·8

The plot was lightly thinned in 1951. A graph showing the increase in height with age is attached. The present stocking is 104 in an area of 0·09 acre. A thinning will be carried out during the coming year and the desirability of converting this into a sample plot will be considered.

21. *Dysoxylum malabaricum.*—Experimental plot 23 of Wynaad Division was started in 1934 to find out the best method of inducing natural regeneration of the species in the evergreen forests of Chandanathode. The ground space equal to the area of the crown under each tree was divided into three sectors and treated as follows :—

A—Clearing undergrowth and three weedings a year;

B—Clearing undergrowth and soil working up to a depth of 5–6 inches;

C—Control—no weeding or soil working.

In paragraph 9 of last year's report the conclusion has already been drawn that treatment 'B' gives the best results and that the experiment will be closed.

Last measurements recorded in December 1954, confirm the conclusion drawn last year that clearing the weed growth and raking the soil just before the seed fall is the best treatment to induce natural regeneration of the species. This experiment has been kept open for a sufficiently long time and it may be closed.

Mesua ferrea—Experiment plot 23/34, *Chandanathode.*—In the same experiment, there are now eleven trees of *Mesua ferrea* also which were subjected to the same treatment as shown above. Latest measurements in May 1955 show the following seedlings for the above three treatments :—

A—343.

B—342.

C—115.

It is seen that—

(i) clearing undergrowth and three weedings; and

(ii) clearing undergrowth and soil working up to a depth of 5–6 inches.

both induce significantly natural regeneration more than control where nothing was done.

22. *Gluta travancorica.*—Experimental plots 44 and 48 of Wynaad were formed in Chandanathode in 1937 to observe the growth and development of the species from seedling stage of known age—

(i) under complete evergreen canopy;

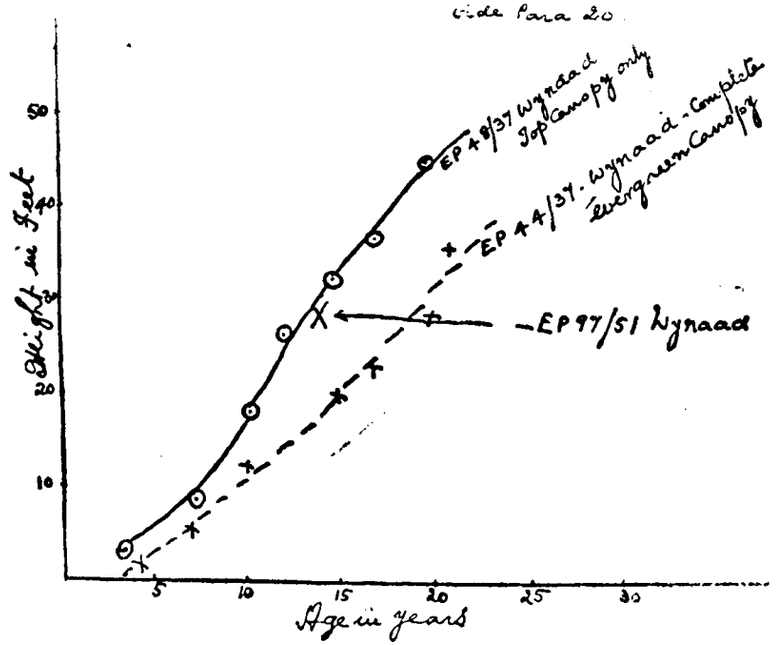
(ii) under top canopy.

respectively. The species was raised as garden experiments in 1933 and 1934 and subsequently converted into experimental plots.

Chart - II

Gluta travancoxaa

vide Para 20



The following are the results :—

TABLE VII.

Experimental plot number.		Survival.	Average height in 1954.	Average diameter.	Remarks.
		PER CENT.		INCHES.	
44	Complete evergreen canopy.	21	34·8	5	Survival per cent has no significance as thinnings were done in 1950.
48	Top canopy ..	37	46·0	6	

The results were largely vitiated by the havoc caused by wild elephants though experimental plot 48 suffered in a lesser degree. However the good height and diameter growths attained by the trees show that the species can be successfully raised in the locality where damage by wild elephants can be minimised or prevented.

23. *Gluta travancorica—Growths and development—Experimental plot* 97/51 *of Chandanathode.*—This was formed in 1951 out of plants raised in experimental ground 199/40 in Chandanathode to observe the growth and development of the species in the evergreen forests under cover of top canopy only. This is a repetition of experimental plot 48/37 noted above. Out of 26 trees selected

5 exist and have reached a height up to 40 feet 9 feet 2 inches) and diameter of 4 inches may be noted here that the rate of growth in this e as in experimental plot 48/37.

...ght growth curve for the three experimental plots is attached.

24. *Natural regeneration by seed.*—Experimental plots 54, 55, 56 of South Coimbatore Division was started to study the effect of clearing undergrowth and raking the soil on the incidence and survival of natural regeneration under selected mother trees of *Hopea parviflora Mesua ferrea and Calophyllum elatum.* Treatments were applied under each tree as follows:—

One-third sector left as control C

One-third sector weeds cut .. .. A

And the balance one-third sector undergrowths cut and removed and soil working done by forks .. .. B

All the old seedlings in the plot under each tree were pulled out before application of the above treatments.

Experimental plot 54/33-Hopea parviflora.—Treatment A (weeding) gives significantly the largest number of seedlings above 9 inches in height.

Experimental plot 55/33 Mesua ferrea.—It is found that there is no significant difference between treatment and control in respect of seedlings both above 9 inches and below 9 inches though the earlier years treated plots had better stocking than control plots. From 1951 onwards there was no new recruitment of seedlings below inch in the three sectors. Monkeys appear to eat away the tender fruits before maturity. Most of the trees bear flowers and fruits regularly every year although recruitment is absent or negligible.

Experimental plot 56/1933—Calophyllum elatum.—There are only two seedlings below 9 inches in height in the forked area. There are no plants in the control or weeded sectors. All the trees are over-mature and no seedfall is reported from 1943 onwards. Out of fifteen trees under observation eight were dead in 1954-55. The surviving trees had not flowered in 1954-55. This experiment has failed to give any useful indications. This will be closed.

25. *Hopea parviflora canopy manipulation over established natural regeneration—Experimental plots 72, 73, 74 of 1938 of South Coimbatore.*—These were opened in 1938, to determine the effect of opening of the canopy over established and unestablished natural regeneration of the species with three treatments, leaving mother trees in all the treatments—

A—Clearfelling evergreen forest;

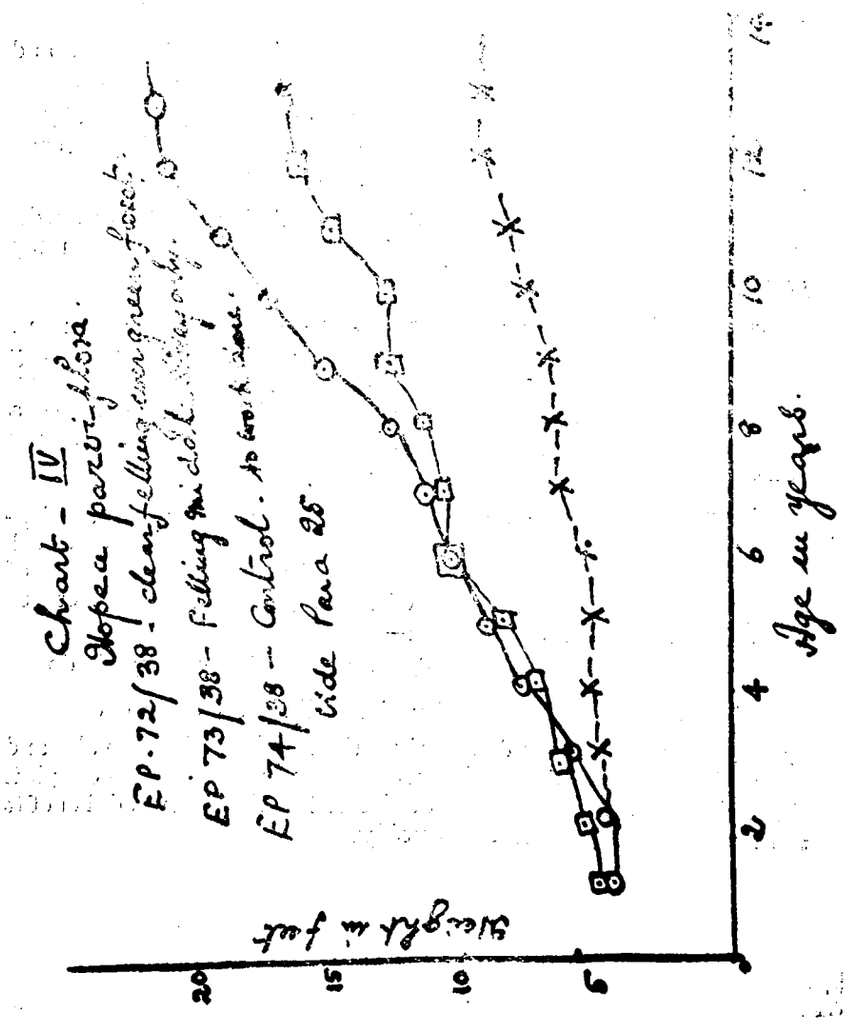
B—Felling and removing the middle storey only, that is, all trees not in the top canopy;

C—Control—no work done.

On the whole clearfelling has given the best results as compared with the other two treatments, as regards both height growth, and mean diameter increment. The mean height of the plants after 16 years in the clearfelled plot is 27 feet while in the control plot it was only 11 feet three inches.

It may therefore be concluded that clearfelling after obtaining natural regeneration significantly promotes height increment. As all plants have reached the sapling stage future measurements will be taken only once in five years in future.

A similar conclusion has been drawn in experimental plots 163, 164, 165 of 1938 of Palghat in respect of *Pallaquium ellipticum.* Hence this conclusion may be taken as confirmed.



26. *Hopea parviflora—Frequency of weeding.—Experimental plot 90/1942 of South Coimbatore Division* was started to determine the frequency of weeding in the second and following years (only one weeding being done for the weeded plots in the first year) for a crop of *Hopea parviflora* artificially raised under the shade of evergreen forests. Results obtained till 1952 are published in Statement 3 of Part II of Report 1951-52.

In this experiment there were four treatments noted below :—

A—Plots were kept as unweeded—control.

B—Plots weeded once in September in the first year and once in a year in July in the subsequent years.

C—Plots weeded once in September in the first year and twice a year in July and September in subsequent years.

D—Plots weeded once in September in the first year and thrice a year in May, July and September in subsequent years.

Treatment D has given the best height growth. It may be stated that regular weedings three times a year till the seedlings reach the sapling stage encourages rapid height increment.

Annual measurements were discontinued from 1953 onwards. This experimental plot is proposed to be thinned in the coming year.

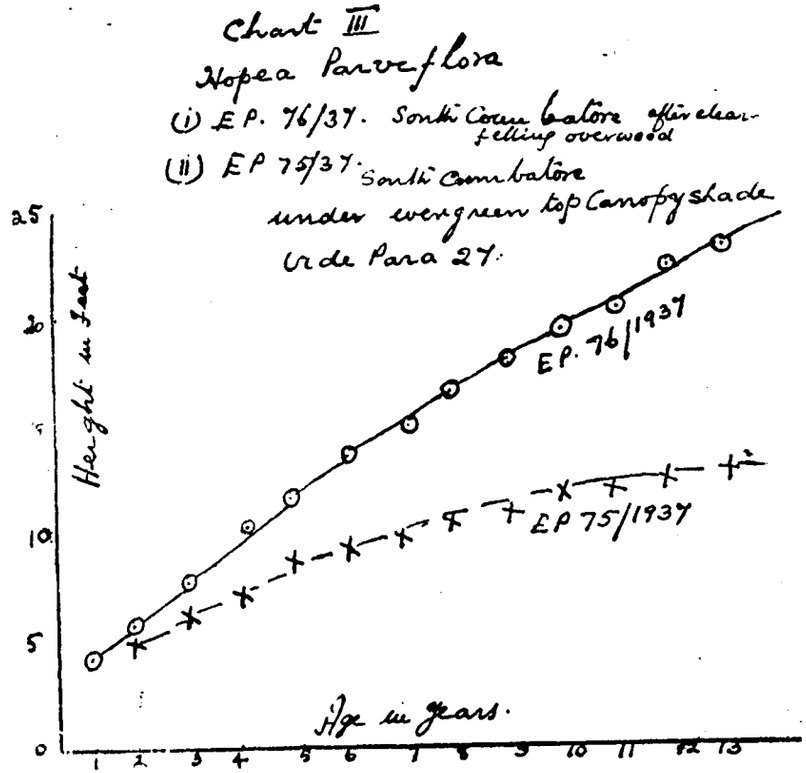
Experimental plot 89/1942 of Wyraad was a similar experiment started in 1942 to determine the frequency of weeding necessary for establishing an artificially raised crop of *Hopea parviflora* in an evergreen forest. The results so far show that weeding thrice a year gives significantly best mean height and highest survival per cent.

27. *Hopea parviflora—canopy manupulation to regulate development of established seedlings.*—Experimental plots 75, 76 of South Coimbatore were started in 1937 to observe development of established natural regeneration of *Hopea parviflora* three feet to eight feet in height as follows :—

Experimental plot 75—under evergreen top canopy shade

Experimental plot 76—after clear felling the overwood.

Latest measurements indicate that the number of survivals and mean height are distinctly greater in the clearfelled plot. The indications are therefore that clearfelling the overwood benefits the natural regeneration appreciably.



28. *Mesua ferrea effect of tending natural regeneration.*—Experimental plots 3, 4, 5, 6 of 1932—Chandanathode were started in 1932 to study the effect of tending natural regeneration of *Mesua ferrea* in seedling and sapling stages by reducing competition by other species in the underwood. The latest measurements which were recorded in 1953 show that the mean annual increment in height diameter and in number of trees below and over five feet in height is greater in the tended plot than in the control plot. Effects of tending are more prominent in the earlier years. Tending natural regeneration of *Mesua ferrea* in seedling and sapling stages by reducing competition from other species is therefore distinctly beneficial for the establishment of natural regeneration. These will be closed.

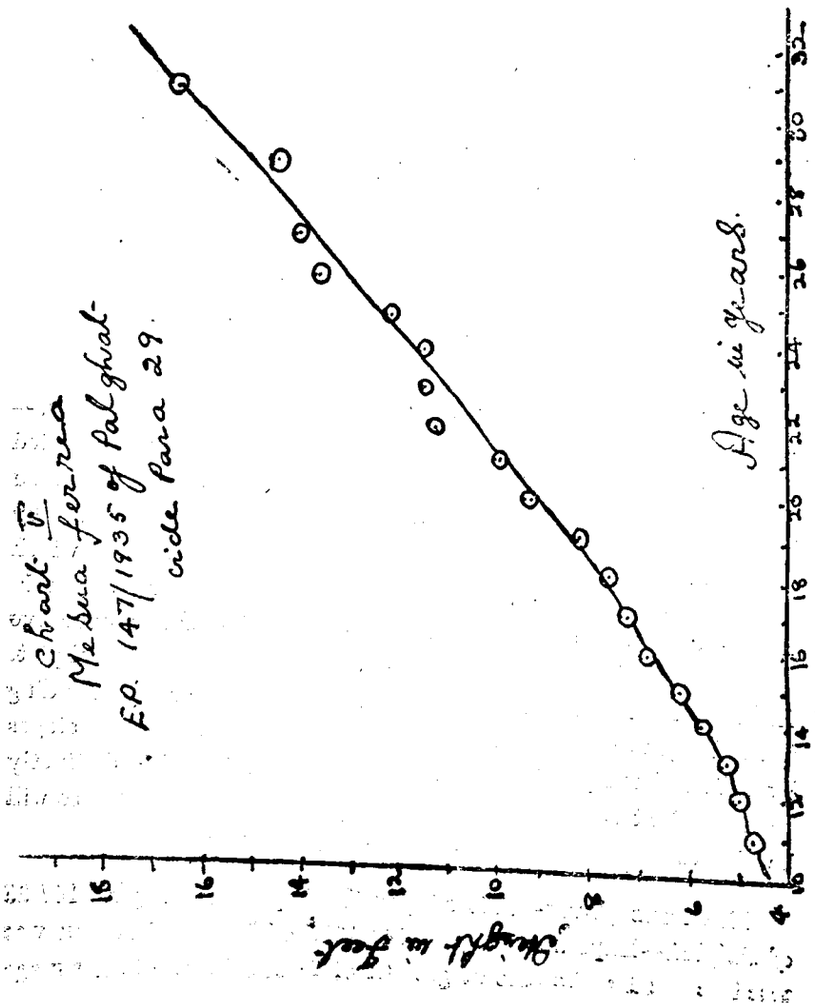
29. *Mesua ferrea—Rate of growth—Experimental plot 147/35 of Palghat.*—Experimental plot 147/1935 of Palghat Division was started to study the rate of growth of *Mesua ferrea* of known age

from the sapling to the pole stage. The statement given below gives the increment in height since 1935:—

TABLE VIII.

Year.	Age in years.	Survival per cent.	Mean height in feet.	Increase during the period in feet.
1936	12	100	4·70	
1 41	17	100	6·88	2·18
1943	22	98	9·90	3·02
19 1	27	96	13·70	3·80
1955	31	95	16·80	3·10

Rate of growth is shown in the form of a graph.



30. *Pallaquium ellipticum—Canopy manipulation over established natural regeneration—Experimental plots* 163, 164, 165 *of* 1938 *of Palghat.*—These experimental plots were formed in 1938 to determine the effect of opening of canopy over established and unestablished natural regeneration of *Pallaquium ellipticum* by—

A—Clearfelling evergreen forest.

B—Removal of middle canopy.

C—Control (no treatment).

Measurements recorded in 1955 after 17 years show that treatment 'A' (clearfelling) gives the best mean height growth (31 feet 6 inches) while the mean height for treatment 'B' is only 12·3 feet and for 'C' 6 7 feet.

The indications are that clearfelling an area with established natural regeneration of *Pallaquium ellipticum* is significantly beneficial to the establishment of the species and promotes rapid height growth. A similar conclusion has already been drawn in experimental plots 72, 73, 74 of South Coimbatore in respect of *Hopea parviflora*.

Plots 163, 164, 165 of Palghat are proposed for closure as useful results have been obtained and these have been kept open for a sufficiently long time.

31. *Teak—Natural regeneration by seed—Experimental grounds* 447, 448 *of Wynaad.*—Experimental grounds 447 and 448 were formed during 1954 in 1892 and 1899 regeneration areas respectively in Begur Range, to find out if it is possible to induce natural regeneration in a pure plantation of teak after the last thinning. There were four treatments—

A—Clearing undergrowth just before seed fall.

B—Clearing undergrowth and running a light ground fire after the seed fall.

C—Sowing seeds in prepared patches.

D—Sowing seeds in worked patches and then running a light ground fire.

Unfortunately the experiments were vitiated by the forest fire which swept over the regeneration areas in March 1955 and all the seedlings died. However the position in March 1955 was that 'A' and 'C' failed completely while there were a large number of seedlings in 'B' and 'D' thus showing that burning induces and accelerates natural regeneration.

(c) Natural regeneration by coppice.

32. *Teak coppice—Mortality of stools.—Experimental plot* 162/1937 *of Palghat Division* has been maintained. The object is to study the effect of coppicing different heights with and

without trimming on the mortality of stools, number of stools produced and their subsequent development.

There were four treatments—

A—Low cutting (as near the ground as possible) with trimming.

B—Low cutting without trimming.

C—High cutting (stumps 9 inches to 12 inches) with trimming.

D—High cutting without trimming.

During the year a part of the plot was clearfelled for laying the diversion of the Highway between Coimbatore and Palghat and on account of this the area of the plot has been reduced from 30 acres to 18 acres.

Analysis of the latest measurements taken in 1952 show that there is no difference so far between high cutting and low cutting or between trimming stools and not trimming stools.

This is indeed a happy result particularly as forest extraction work is done mainly with illiterate mazdoors through the agency of a contractor and it is practically impossible to make the mazdoors cut the stumps low or to trim the stools.

33. *Coppice—Teak—Reduction of coppice shoots to* 4, 2, 1 *per stool.*—Experimental plot 142 was started in 1935 with a view to determine whether it is advisable to thin out the teak coppice shoots when grown for the purpose of producing poles. There are four treatments as below :—

A—Reduction of coppice shoots to one shoot.

B—Reduction of coppice shoots to two shoots.

C—Reduction of coppice shoots to four shoots.

D—Control.

Analysis of results shows that best height and diameter growth are exhibited by the treatments in the following order. Reduction to one shoot : two shoots : four shoots and Control. But we are interested in total volume production per acre and not the size of the individual coppice shoots. We will have to wait till the rotation to ascertain which treatment gives the maximum volume production.

(iii) Seeds (collection, weight, germination per cent, plant per cent, etc.).

34. *Supplies of seeds, seedlings and stumps.*—As usual, the State Silviculturist was in charge of supplies of seeds, seedlings and stumps for the various officers of the Madras State and also to various officers outside Madras in India and also outside India.

During the year, arrangements were made for the supply of 213 indents comprising 35 species and an aggregate quantity of 20,485 lb. of seeds. A large proportion of this stock was collected by the Research staff in addition to their duties. Seeds of Madras origin are particularly popular with various officers of other States in India. The gross revenue realised by seed supplied during the year was Rs. 7,324-11-5.

The enormous volume and variety of seeds collected and supplied, either directly by the State Silviculturist or under his auspices can be gauged from the tabular statement in Appendix D which furnishes the details of various seeds collected and supplied to various indentors.

During the year 9,935 lb. of teak seeds and 102,950 teak stumps were supplied to indentors in and outside Madras State. This is particularly brought to notice as teak seeds of Madras origin are deservedly held in high regard by everyone in India and abroad.

35. *Germination tests and seed weighments.*—All seeds received in the research centres were tested to ascertain the weight of seed, the germinative capacity and the plant per cent. The results of these tests are embodied in Appendix E-1.

36. *Aids to germination—Pre-treatment of seed*—36-A. *Pre-treatment.*—Routine seed pre-treatment tests were done with a large number of species, the treatments used being, cold, hot and boiling water, with an untreated control in each case. The results are progressively combined with the previous year's results, and results up to date, are indicated in the following paragraphs.

36-B. The germinative capacity of seed of the following species was not apparently improved by any of the treatment used :—

Acacia auriculiformis, Acacia cyclopis, Acacia ferruginea, Acacia leucophoea, Acacia melanoxylon, Acacia planiforns, Acacia saligna, Acacia sundra, Acrocarpus fraxinifolius, Albizzia amara, Albizzia lebbek, Bauhinia racemosa, Bischofia javanica, Commiphora caudata, Eugenia arnottiana, Givotia rottleriformis, Grewia tiliaefolia, Holoptelia integrifolia, Leucaena glauca, Markhamia platycalyx, Poinciana elata, Premna tomentosa, Prosopis juliflora, Prosopis spicigera, Zizyphus glabrata, Zizyphus incurva, Zizyphus jujuba and *Zizyphus xylopyrus.*

36-C. The germinative capacity of seed of the following species has apparently been best when sown without any treatment :—

Anacardium occidentale, Azadirachta indica, Berberis tinctoria, Cassia siamea, Chorisia speciosa, Cupressus torulosa, Dendrocalamus strictus, Elæocarpus oblongus, Glochidion neilgherrense, Hakea saligna, Ligustrum neilgherrense, Litsea zeylanica, Mahonia leschenaultii, Meliosma wightii, Michelia nilagirica, Quercus inicana, Sapindus emarginatus and *Tamarindus indica.*

36-D. The germinative capacity of seed of the following species has apprently been best when they were soaked in cold water for 24 hours prior to sowing :—

Alangium lamarckii, Ailanthes excelsa, Bombax malabaricum, Cassia marginata, Chickrassia tabularis, Harrisonia benetti, Mangifera indica, Ochroma lagopus Pinus longifolia, Pinus insignis, Pongamia glabra, Soymida febrifuga, Thyrostachys oliveri and *Pterocarpus santalinus* when sown without removing the seed coat.

36-E. Treatment with boiling water (water 20 times the volume of the seed used is brought to the boil, is taken off the fire, the seed immediately put in and left till cold), appears to increase the germination of :—

Acacia baileyana, Acacia cyanophylla, Acacia dealbata, Acacia decurrens, Acacia mollissima and *Myrsine wightiana.*

36-F. Treatment with boiling water as described in the previous paragraph appears to decrease appreciably the germination of—

Adenanthera pavoniana, Alangium lamarckii, Azadirchta indica, Balanocarpus utilis, Bauhinia purpurea, Bombax malabaricum, Calophyllum elatum, Canthium didymum, Cassia auriculata, Cassia fistula, Cassia marginata, Cassia siamea, Chickrassia tabularis, Chlorophora excelsa, Chlorxylon swietenia, Dalbergia latifolia, Dalbergia sissoides, Dendrocalamus strictus, Dolichandrone crispa, Dolichandrone falcata, Erythroxylon monogynum, Evodia roxburghiana, Feronia elephantum, Gluta travancorica, Gmelina arborea, Juniperus procera, Lagerstœmia flos reginae, Largerstoemia lanceolata, Ligustrum neilgherrense, Litsea zeylanica, Mahonia leschenaultii, Mangifera indica, Neolitsea zeylanica, Palaquium, ellipticum, Pinus insignis, Pithecolobium dulce, Pterocarpus dalbergiodes, Pterocarpus marsupium, Schleichera trijuga, Sterculia urens, Strychnos nux vomica, Strychnos potatorum, Tectona grandis, Terminalia chebula, Terminalia crenulata, Terminalia paniculata, Thyrostachys oliveri, Vateria indica, Vitex altissima, Vitex littoradis and *Vitex peduncularis.*

36-G. The results of pre-treatment tests are summarised in Appendix E-2. Generally 100 seeds were used for each treatment in each test. The results of the tests in previous years are also included.

36-H. *Seed pre-treatment—Obdudate species.*—The following species which usually give a very low or variable germination per cent were experimented on with special tests to try and increase their germination. The treatments were (*a*) control, (*b*) soaking in lime water for 24 hours, (*c*) soaking in cold water for 48 hours and then keeping moist in straw out of free circulation of air (fermenting), (*d*) scrorching over a fire, (*e*) soaking in concentrated sulphuric acid, nd (*f*) exposting to sun and watering on alternate days.

36-I. Results including those of previous years are seen in the table below :—

Species.	Number of tests.	Percentage germination of seeds treated with: Control.	Lime water.	Fermenting.	Scorching.	Sulphuric acid.	Weathering.
Acacia arabica ..	1	12·6	..	13·4	..	21·5	—
Acacia auriculiformis.	21	9	..	9	..	6	9
Acacia leucophloea.	43	13	..	13	..	14	8
Alangium lamarckii.	1	2	—	3	—	2	6
Acrocarpus fraxinifolius.	80	9	6	13	4	..	6½
Calophyllum elatum.	8	9	..	..	—	2	—
Canthium didymum.	2	0.3	..	0·4	..	1·2	0·8
Casia auriculata ..	10	7	—	8		25	7
Cassia fistula ..	43	12	9	10	..	28	8
Cassia marginata ..	12	20	13	9	—	35	3
Erthoxylon monogynum.	13	6	—	9	—	7	9
Givotia rottleriformis.	9	3	..	8	..	0·2	0·8
Pterocarpus santalinus.	43	24	..	21	2	10	13
Terminalia chebula.	43	19	9	29	16	9	16
Trema orientalis ..	24	13	..	..	6	..	—

Other remarks.—Seed passed through goats gave 21·9 per cent.

36-J. Concentrated sulphuric acid treatment appears to have appreciably improved the germination per cent of *Acacia arabica* (almost equal to seed passed through goats), *Cassia auriculata, Cassia fistula* and *Cassia marginata* while fermenting has greatly improved the germination per cent of *Terminalia chebula,* and slightly that of *Acrocarpus fraxinifolius.*

36-K. *Special pre-treatment for certain seeds.*—Certain species respond to special pre-treatment and give increased germination per cent with such treatment. These are described below in alphabetical order:—

(i) *Acacia arabica.*—The pods are fed to goats and the seeds which pass through the body of the goats, give better germination owing to softening of the hard seed coat.

(ii) *Acacia mollissima.*—The testa is very hard and without pre-treatment the seeds give a low germination per cent (5 per cent). The usual method of pre-treatment is to boil water (about five times the volume of seed to be treated) in a drum ; just when the water has started to boil, the fire is removed from underneath, and the seeds are put into the water and well stirred. The water with the seeds is then allowed to cool for 12 hours. Finally the seeds are washed 4 or 5 times in clean cold water to remove the gummy

mucilage and dried in the shade. Seed, pre-treated in the above manner give a germination per cent of 53 to 60 and a plant per cent of 14 to 20.

(iii) *Acrocarpus fraxinifolius.*—Pre-treatment is not an important factor in the case of this seed. However in one instance seeds mixed with chopped straw and watered for one week till germination resulted in a high germination per cent of 49·8 against a normal germination per cent of 10.

(iv) *Ailanthes excelsa.*—Untreated seed gives a germination per cent of 10–12 and a plant per cent of 5–7. Seeds soaked in cold water for 24 hours give a germination per cent of 30 to 40 and plant per cent of 28 to 39.

(v) *Azadirachta indica* (Neem).—Seeds are collected from underneath trees which are frequented by birds that eat the fruits. Whether the seed actually passes through the birds or whether they just eat the pulp and spit out the seed is not clear. Probably both processes occur in nature. Germination tests show that such seed is superior to seeds collected direct from the mother trees. In the alternative the seeds collected from the trees should be depulped so that the seed is white when dry.

(vi) *Casia fistula.*—Soaking in concentrated Sulphuric acid increases germinative capacity.

(vii) *Chrysanthemum cinerariaefolium* (pyrethrum).—Seeds are soaked in clod water for 12 hours before sowing.

(viii) *Eucalyptus citriodora.*—No pre-treatment of the seeds is necessary if fresh seeds are sown. Seeds which have been stored for more than three months, should however be pre-treated in cold water for about three to four hours. This is done by tying up the seed in a small cloth bundle and immersing it in cold water. The seeds are then dried in the *shade* and sown in the nursery bed.

(ix) *Eucalyptus rostrata.*—Same as for *Eucalyptus citriodora.*

(x) *Melia dubia.*—This is a difficult seed to germinate in normal nursery conditions. Several methods usually applied to refractory seeds have so far failed. The method described below has so far given the best results. The seeds, soon after collection are pounded in a wooden morter to remove the pulp. They are then spread in the seed bed and covered with a 3 inches layer of leaf litter and burnt. Immediately after the burn, the seeds should be covered with a 3"-4" layer of earth and watered liberally.

(xi) *Terminalia chebula* (myrabolams).—This gives difficulty in germination. By soaking in water for 48 hours and fermenting the seed later by keeping it stratified in moist straw under pressure, for about three weeks until the seed starts to crack, a high percentage of germination is obtained in direct sowings in the open or in nursery beds.

(iv) Nursery work.

37. Nurseries were maintained at all the Research centres, Begur, Chandanathode, Kannoth, Nilambur, Dhoni, Topslip, Denkanikota, Benneri for raising stock for experimental purposes. New nurseries were also started in the new centres opened during the year namely Markanam, Vemburuli and Rameswaram.

(v) Artificial regeneration.

38. As teak (*tectona grandis*) is the most important species on which considerable research is being done in this State, experiments on teak will be described in the first place. Thereafter the results of experiments on indigenous hardwood species will follow in alphabetical order.

Softwoods.—Softwood species particularly, those suitable for the match and plywood industries have continued to receive attention and more data have been collected on *evodia roxburghiana, melia dubia, spondias mangifera, sterculia alata, sterculia companulata, vateria indica, ailanthes malabaricum, zanthoxylum rhetsa* and *bombax malabaricum.* These will be given in alphabetical order.

Exotics.—Finally experiments on exotics will be given in the alphabetical order of the species.

(a) *Experiments on teak.*

39. *Teak—All-India teak seed origin experiments*—Sample plots 96 *to* 119 *of Nilambur and sample plots* 2 *to* 17 *of South Coimbatore.*—Experiments started in Nilambur (sample plots 96 to 119 of Aravallikava) and in South Coimbatore (sample plots 2 to 17 in Sichalipallam) in the year 1939, in 1934 regeneration area, were continued. In Nilambur there are six seed origins, namely :—

(1) North Burma,
(2) South Burma,
(3) Travancore,
(4) Anamalais,
(5) South Bombay,
(6) Nilambur ;

and there are four sample plots for each seed origin. In Coimbatore South, four seed origins were tried, viz., (1) South Burma, (2) Anamalais, (3) Mysore and (4) Nilambur. There are four sample plots for each seed origin. In Nilambur plots, last thinning was done in May 1949 at the age of 15 years and last measurement was in May 1949. In Coimbatore South, the last thinning was done in February 1955 and measurements were also recorded. The measurements are yet to be analysed. Measurements of 1949 in Nilambur plots show that as regards both height, diameter breast height and volume production, South Burma and South Bombay are approximately equal and lead the rest of the seed origins. Nilambur

comes next. The volume production per acre as per 1949 measurements are given below for reference :—

	CUBIC FEET.
South Burma	1,110
South Bombay	1,088
Nilambur	845
Travancore	812
Anamalais	775
North Burma	745

Measurements of 1949 taken in South Coimbatore plots showed the following as regards volume production in order of merit :—

	CUBIC FEET.
Mount Stuart	2,400
Nilambur	2,150
Mysore	1,830
South Burma	1,132

While in the Nilambur sample plots, South Burma and South Bombay were leading as regards volume. Production in the South Coimbatore sample plots, the local Mount Stuart origin occupies the first place as regards volume production, while Nilambur origin follows closely behind with South Bombay in the last place. The indications afforded by these two sets of sample plots are therefore contradictory for the present and hence further observations are necessary before we can draw any definite conclusions.

40. *Teak—Imperata grass in plantations.*—The problem of the presence of *Imperata cylindrica* grass in teak plantations has become very serious in parts of Wynaad and Tiruchirappalli. Apart from being a serious fire hazard, it is also smothering the young teak and arresting its rate of growth.

An experiment was tried in Kargudi, Nilgiris Division, of planting cuttings of *glyricidia maculata*. The cuttings failed as they were obtained from Coimbatore and they dried up in transit and did not sprout.

In the following year, *glyricidia maculata* will be introduced by direct sowings and results observed.

41. *Teak—Experiments on espacement.*—Experimental plot No. 149/1938 is an espacement experiment in first quality second rotation teak area to compare $6' \times 6'$ espacement with $8\frac{1}{2}' \times 8\frac{1}{2}'$ espacement. Latest measurements show that the wider espacement gives significantly better mean height.

Experimental plot No. 150/38 of Nilambur is a repetition of the above experiment in second quality teak area. Here the wider espacement gave better mean height but the increment in height was not significant.

41-A. Experimental plot Nos. 159/1940 and 160/1940 of Nilambur form a similar set of experiments to compare the effects and costs of a $6' \times 6'$ espacement (with 1,210 plants per acre) and a $8\frac{1}{2}' \times 8\frac{1}{2}'$ espacement (with 605 plants per acre) in a Nilambur I and II quality (corresponding All-India quality II and All-India quality III) Second rotation teak plantation. Here also the wider espacement gives significantly better mean height growth in both the plots. The measurements are furnished below for reference—

TABLE VIII-A.—*Measurements of mean height growth of teak with two espacements of* $6' \times 6'$ *and* $8\frac{1}{2}' \times 8\frac{1}{2}'$ *in experimental plot No.* 159 *of* 1940 *in I quality teak plantation;*—

Year.	Mean height of teak in feet. $6' \times 6'$	Mean height of teak in feet. $8\frac{1}{2}' \times 8\frac{1}{2}'$	Remarks.
1940	..	..	Year of planting.
1942	10·9	13·8	....
1943	16·2	19·9	Not significant.
1944	21·5	24·3	Do.
1945	27·1	31·9	Significant.
1946	27·8	33·6	Do.
1947	30·1	36 1	Do.
1948	31·7	37·9	Do.
1950	38·0	42·0	Do.

TABLE VIII-B.—*Measurements of mean height growth of teak with two espacement of* $6' \times 6'$ *and* $8\frac{1}{2}' \times 8\frac{1}{2}'$ *in experimental plot No.* 160/1940 *in II quality teak plantation.*

Year.	Mean height of teak in feet. $6' \times 6'$	Mean height of teak in feet. $8\frac{1}{2}' \times 8\frac{1}{2}'$	Remarks.
1942	8·3	8·9	....
1943	12·8	15·1	Significant.
1944	18·9	20·5	Not significant.
1945	25·2	28·5	Do.
1946	27·1	29·9	Do.
1947	29·2	32·3	Significant.
1948	32·1	35·4	Do.
1949	34·0	37·7	Do.
1950	35·6	39·0	Do.

The general conclusions are identical for both experimental plot Nos. 159/1940 and 160/1940 indicating that the results can be applied to both Nilambur I and Nilambur II quality plantations. These are as follows :—

(i) Judged by mean height growth $8\frac{1}{2}' \times 8\frac{1}{2}'$ espacement is significantly better than $6' \times 6'$ espacement.

(ii) Also judged by cost of planting and weeding and tending up to end of the first three years, excluding nursery cost of stumps, $8\frac{1}{2}' \times 8\frac{1}{2}'$ espacement (cost Rs. 18-10-0) is cheaper than $6' \times 6'$ espacement (cost Rs. 23-14-0) by about 22 per cent. This dispels the traditional fear that the wider espacement will induce a more rapid and thicker growth of weeds and climbers which will involve increased cost of weeding and tending.

42. *Teak—Sorting seed according to size.*—Large-scale planting out experiments to determine whether a selection of teak seed by size has any effect on later growth and development of resulting trees and whether such a selection of seed would result in breeding of any particular size of teak, were started.

Experimental plot No. 55/1938 of Begur, experimental plot No. 166/1938 of Wynaad, Palghat, were formed with the above object of comparing the growth of trees raised from seeds of four different sizes as shown below:—

A—District sample seed containing all sizes mixed together;

B—Selected big seed—0·7 inches diameter and above;

C—Medium seed—0·3 inches to 0·5 inches in diameter;

D—Small seed—below 0·3 inches in diameter.

Height measurement in 1946 showed 26 feet mean height and there was no significant difference in the mean heights of trees from different sizes of seeds for both the centres.

Survival per cent has no significance as thinnings have been carried out in the years planted with different sizes of seeds. There has been therefore no significant difference in the height growth of trees raised from seeds of different sizes. This is however a long term experiment and so this will be maintained and further observations made.

It is interesting to observe here that a similar experiment conducted on different sizes of seeds of terminalia chebula by the Central Silviculturist, revealed that there was no significant difference, observed due to the size of the seed (vide Forest Research in India—1950-51—Part I).

43. *The effect of size, age and condition of seed bearers on development of plants.*—The effect on germination of seed from—

A—Old hollow over-mature trees;

B—Well grown trees approaching maturity;

C—Immature trees;

at three centres for *Tectona grandis, Dalbergia latifolia, Pterocarpus marsupium* and *Terminalia crenulata*, was last reported in paragraph 78 of the Annual Report on Silvicultural Research for the year 1949-50. Since then measurements have been recorded in 1954 and analysis of the results shows that in general, seed from over

mature and undermature trees is as good as seed from mature trees. To test whether this observation holds good in the later development of plants, large scale experiments were started for each species in each of the 3 centres, the species being raised by stump planting. Measurements were last taken in 1955 and the following shows the analysis of the data collected up todate. This data reveals that as regards survival percentage and mean height, seeds collected from over-mature trees are even better than seeds from mature trees, etc.

Wynaad— Experimental plot No. 36 of 1937.—Dalbergia latifolia.—No significant difference in height or survival per cent.

Coimbatore South—Experimental plot No. 78 of 1938—Dalbergia latifolio.—Last measured in 1950. Seeds from over-mature trees gives significantly the best mean height, next best from mature, and poorest from immature trees.

Coimbatore South—Experimental plot No. 79 of 1938—Terminalia crenulata.—No significant difference in the mean heights of plants from the three origins. Immature tree seeds gave the lowest survival per cent, over-mature tree seeds the highest survival per cent.

Palghat—Experimental plot No. 157 of 1937—Dalbergia latifolia.—Seeds from over-mature trees gave the best results, next seeds from mature trees and poorest from immature trees.

Generalising the results of all the above experiments we reach the conclusion that seeds from trees below 3 feet in girth (immature trees) should not be collected; seeds from over-mature trees give better results than those from mature trees. We may therefore collect seeds from all trees except obviously immature trees.

44. *Teak—Comparison of trees raised from plantation seed with those raised from seeds from natural forests.*—Experimental plot Nos. 66 of 1940, 79 of 1941, 85 of 1942 of Wynaad (Begur Centre) experimental plot No. 83 of 1940 of Coimbatore South and No. 171 of 1940 of Palghat were started for the purpose noted above.

So far there has been no significant difference in the mean heights of trees raised from the two origins (except in the case of experimental plot No. 85 of 1942 of Wynaad where plantation seed gave better mean height growth). It is not however known whether any desirable or undesirable timber qualities are transmitted by such selection of trees. In view of the fact that the seed from which these plantations were raised, have been obtained from natural forests, there is reason to believe that such is not the case. Besides in Nilambur, Wynaad and South Coimbatore, plantations have been formed on a large scale, cutting natural forests containing teak trees. Seed for local use and for supply to forest officers outside the State is being collected chiefly from teak plantations. Hence the result of this experiment will only be of theoretical interest and will not be of any practical application.

45. *Splitting of teak stumps—Experimental Ground* 334 *of* 1949, *Begur.*—This is a comparison experiment on the growth of teak raised from entire stumps, halved stumps and quartered stumps. Latest measurements in 1955 show as follows:—

TABLE IX.

	Survival per cent.	*Height growth.* FEET.
A—Entire stumps	82·2	15·2
B—Halved stumps	82	14·8
C—Quartered stumps	44	14·6
D—Two quartered stumps	84	13·8

The results confirm the conclusions already reported that both in survival per cent and height growth, there is no significant difference between entire stumps and halved stumps while treatments 'C', 'D' have fared badly. Entire stumps are safer; but at times of short supply of stumps, halved stumps can be used with success. More or less similar results were obtained in Experiment a Ground 234 of 1950 of Kannoth.

If the matter is considered from the point of view of regeneration of maximum number of plants from the same number of stumps quartered stumps and halved are better than entire stumps as they yield 176, 164 plants respectively against 100 plants for 100 stumps in each case. As there is little difference in the maximum number of plants from quartered and halved stumps, halved stumps which give slightly better height growth can be freely recommended at times of short supply of teak stumps.

It is interesting to observe here that a somewhat similar results was obtained by the Central Silviculturist (vide Experiment 26-A of 1950—reported in "Forest Research in India 1950—51").

46. *Teak—Comparison of good and malformed stumps—Experimental Ground* 335 *of* 1949.—This was an experiment to compare the growth of trees from good stumps with those from malformed stumps. Latest measurement in March 1955 show—

TABLE X.

	Survival per cent.	*Mean height.* FEET.
Good stumps	74	13·7
Malformed stumps	78	16·0

The malformed stumps have given better survival per cent and better mean height though the difference is not significant. Malformed stumps can be used as freely as stumps of good form.

47. *Teak—Preparation of stumps in nursery—Stumping teak in nursery bed and puling out the plants from nursery bed after a week or ten days versus district practice—Experimental Grounds* 375 of 1951, 396 *of* 1952 *of Begur and* 265 *of* 1951, 274 *of* 1952 *and* 288 *of* 1953 *of Kannoth.*—A number of garden experiments were conducted in Begur and Kannoth centres with the object of comparing the growth of teak from stumps prepared under the following treatments :—

A—Teak seedlings in the nursery beds are cut at a height of 1 inch to 2 inches above ground level and these are pulled out and made into stumps after an interval of a week.

B—Plants are pulled out and made into stumps straightaway.

An examination of the results of measurements recorded in March 1955 shows that there is no difference between the two treatments.

47-A. *Teak—Cutting back one year old plantation—Experimental Plot* 174 *of* 1953.—In this experiment, the object was to compare the effect of cutting back a one year old teak plantation and non-cutting of the teak plants. One half of an area was cut back and the other half was kept as control. Measurements after one year show that the cut back plant have a mean height of 63·2 inches while the mean height in the control plot was only 50·5 inches. The difference is significant. However, further observations have to be made. If, however, a one year old planatation happens to be accidentally burnt, one need not be sorry and the charred and damaged plants can be cut back.

48. *Teak—Manurial experiment—Experimental Plot* 173 *of* 1953 *of Nilambur.*—Experimental Plot 173 of 1953 of Nilambur was started in Panangode and Walluvaseri to find out the effect of application of superphosphate to teak plants in the 1952 teak plantation. There were four treatments as below:—

A—control.

B—2¾ oz. of superphosphate per plant.

C—4 oz. of superphosphate per plant.

D—5½ oz. of superphosphate per plant.

The superphosphate was applied to the plants after a soil working to a depth of 9 inches to 12 inches round each plant during the third week of April when the teak plants were one year old. Application of 4 oz. of superphosphate is distinctly beneficial when compared with control (no manure). The experiment is however vitiated by the fact that manured plants had a soil working along with the application of manure while the control plots did not have the benefit of this soil working. There was no initial comparability in the heights of the plants allotted to the different treatments.

The following tables compare the increase in height growth between the measurements taken on 1st May 1953 and 12th March 1954 in the Panangode and Walluvasseri experimental plots giving the difference or the increase in height growth during the period. This method of comparison eliminates to a certain extent the

differences in the initial height growth of the plants in the sub-plots allotted to the various treatments :—

TABLE XI.

Panangode.

	A	B	C	D
Measurements of 1953	16·38	16·65	18·56	16·25
Measurements of 1954	56·8	62·3	65·9	56·3
Difference ..	40·42	45·65	47·64	41·05

Walluvaseri.

	A	B	C	D
Initial measurements of 1953 ..	18·49	14·5	13·27	12·26
Measurements of 1954	43·75	41 0	41·5	39·0
Difference ..	25·26	26·5	28·23	26·74

Comparing the increase in height growth during the period it is found that application of manure does have a beneficial effect and that treatment ' C ', viz., 4 oz. of application of manure produces the best results.

Cost of application of manure.—The cost of application of manure at 4 oz. per plant at an espacement of $8\frac{1}{2}' \times 8\frac{1}{2}'$ comes to 150 lb. per acre, or Rs. 18 labour charges for working the soil to a radius of $1\frac{1}{2}$ foot to 2 feet and to a depth of 9 inches and mixing the manure will be about Rs. 8. The total will therefore be Rs. 18+8 =Rs. 26 per acre.

Manurial treatment at a cost of Rs. 26 per acre will be justified financially only, if as a result of accelerated rate of growth due to application of fertilizer, a saving can be effected in weeding charges. For raising teak plantations by the Kumri method, three departmental weedings are done after the Kumridar harvests the Kumri crop in the first year ; and again three weedings in the second year. About two weedings are done in the third year also. The total cost of all these weedings will be Rs. 10 + 20 + 7=Rs. 37 per acre. It is possible that the use of fertilizers will result in savings under weeding. This will have to be examined in further replications of the experiment.

49. *Teak-manurial experiments—Experimental Plot* 175 *of* 1953 *of Nilambur.*—This manuring experiment was formed on 13th September 1953 in 2 acres of the 1953 teak plantation when the plantation was a few months old. The four treatments were—

A—Control—No application of manure.

B—2 oz. of superphosphate applied on 21st October 1953 hen the plants were six months old.

C—3 oz. of superphosphate applied on 21st October 1953 when the plants were six months old.

D—4 oz. of superphosphate applied on 21st October 1953 when the plants were six months old.

The initial measurements taken on 21st October 1953 were computed and the average heights of plants for the four treatments were as follows :—

A—13·05 inches.

B—12·09 inches.

C—11·8 inches.

D—11·9 inches.

As there was no initial comparability between the sub-plots allotted to the four treatments, the measurements of 1954 were analysed taking into account only the differences in height between the dates 21st October 1953 and 19th February 1954 in respect of the four sub-plots. The analysis is as shown below:—

TABLE XII.

	A *Control.* INCHES.	B *2 oz.* INCHES.	C *3 oz.* INCHES.	D *4 oz.* INCHES.
Initial measurements on 21st October 1953.	13 05	12·09	11·8	11·09
Measurements on 19th February 1954.	15·8	15·6	17·7	17·5
Difference, i.e., increase in height growth.	2·75	3·51	5·9	6·41

It is therefore seen that the application of manure has beneficial effect on height growth and that 4 oz. of manure per plant gives the maximum height growth.

50. *Teak—Plantation raised with Kumri—Experimental Plots* 176, 177, 178 and 179 *of Palghat.*—At the present time, teak plantations are raised in conjunction with Kumri (i.e., Taurgya) in the majority of the teak planting areas. It was therefore considered necessary to start experiments to find out which Kumri crop did the least harm to the growth of the teak. Accordingly Experimental Plots 176,177, 178 and 179 of Palghat were started in the years 1943 to 1945 to determine the best field crop for raising teak under Kumri. In each of the experiments there were seven treatments, namely, six Kumri crops and one control without a Kumri crop. The six kumri crops were—

Hill paddy ;
Chillies ;
Cotton ;
Ragi ;
Tapioca ; and
Horsegram.

The indications so far show that there is no significant difference in the mean height of teak under any of the six crops tried. Hence there is nothing to choose between the six Kumri crops and the Kumridars may be permitted to raise whatever crop they like.

51. *Deterioration of site quality in second rotation pure teak plantation crops.*—There has been a widespread apprehension in the past that there is steady deterioration of soil and consequent lowering of site quality under pure teak plantations and that therefore, a second rotation teak plantation raised after clear-felling an existing teak plantation will be appreciably poorer in quality than the first rotation crop.

To ascertain how far this is true, sample plots 17 (a), 18 (a) and 19 (a) were laid in Nilambur in the exact sites occupied by the sample plots 17, 18 and 19 which were first rotation teak plantations, after clear-felling and replanting. The site quality of the first rotation teak plantations in sample plots 17, 18 and 19 is available from measurements. The site quality of the second rotation teak plantations have now been computed; the following tabular statement shows the results :—

TABLE XIII.

Sample plot numbers.	*All-India site quality in first rotation.*	*All-India site quality in second rotation.*	*Remarks.*
17-A	0·1 II	1·7 II	Considerable increase in site quality.
18-A	0·4 III	0·8 III	Slight increase.
19-A	1·6 IV	1·0 IV	Slight deterioration.

The above figures show that there is a slight decrease in site quality in poorer soils such as All-India Quality IV while there is on appreciable increase in site quality in higher quality soils such as All-India Quality II and III.

The above indication is corroborated by observations in other sample plots located in second rotation teak plantations. There are several teak sample plots located in second rotation teak plantations in Nilambur in areas for which site quality in the first rotation had been ascertained and noted in the Working Plans prepared by R Bourne in 1917–18 and by A. R. Brand in 1938. Recent measurements of the site quality of these sample plots show that there is a slight increase in site quality in higher quality classes while there is no appreciable change in site quality in the other cases.

The evidence so far available therefore shows that there is probably a slight increase in site quality in higher site qualities such as All-India Quality II and All-India quality III while there may be a slight but not appreciable reduction in site quality in poor site qualities such as All-India Quality IV. Taken on the whole there is no need for any fear that the quality of pure teak plantations in the second rotation will fall off, due to adverse conditions created by the continued raising of pure crops of a light-demanding species such as teak.

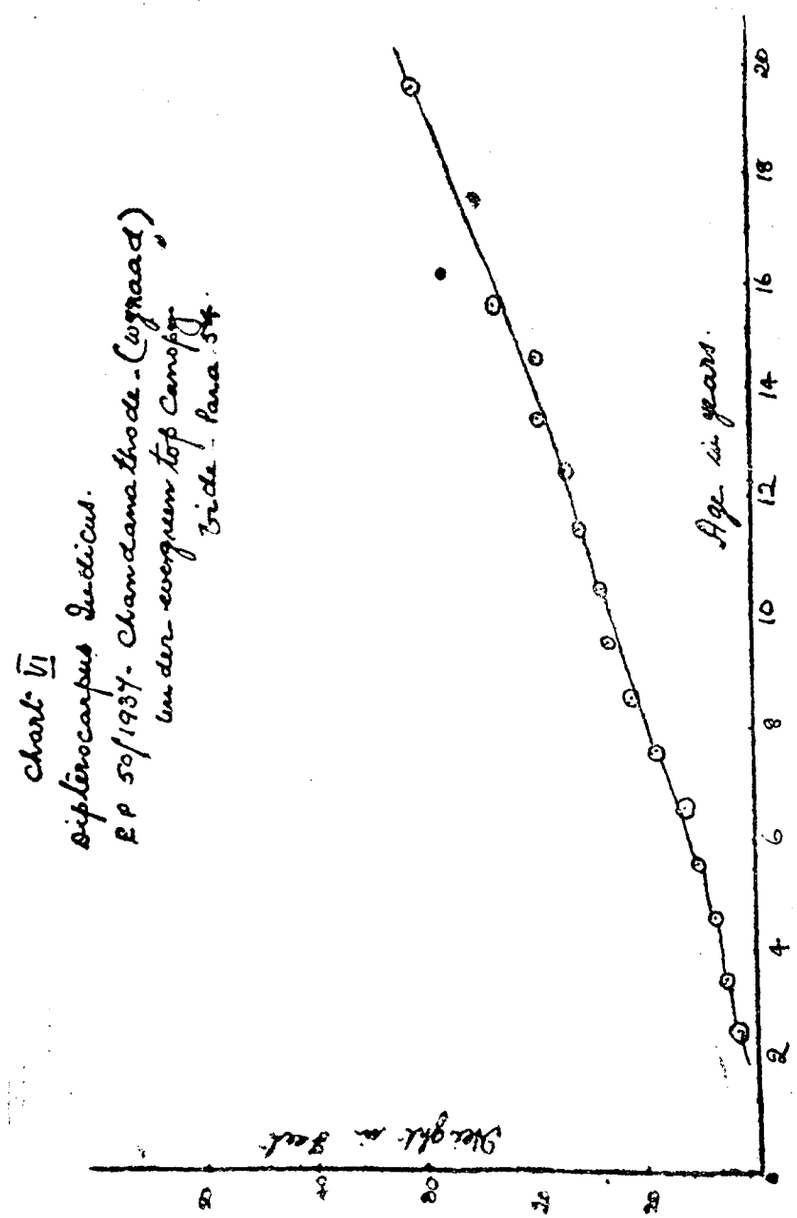
The above is a tentative conclusion which needs confirmation through repetition of the experiment in different localities. The magnitude of the evil effects of the soil deterioration may be so small that they may not be felt in one rotation ; and hence continued research on this problem is essential in view of the settled policy of forest administrations in India to raise pure teak plantations continuously in the same area, on account of these being, probably one of the most profitable forest plantation crops in the world.

(*b*) *Indigenous hardwood species.*

52. *Regeneration of evergreen species after clearfelling and burning tropical evergreen forest.*—In experimental plot No. 70 of South Coimbatore, an attempt was made to regenerate a tropical evergreen forest after clearfelling and burning (on the lines of the Bengal practice), with *Artocarpus hirsuta*, *Hopesparviflora*, *Swietenia macrophylla*, *Cedrela toona*, and *Pallaqium ellipticum* with *Tephrosia candida* as a nurse crop. The results show that unless sufficiently protected against game and elephants, it is impossible to grow *Artocarpus hirsuta*. *Pallaquium ellipticum* had also fared badly. The other species could be grown successfully with a nurse crop of *Boga* and a shade crop of *Trema orientalis*. Results with (i) burning ; and (ii) no burning ; are variable.

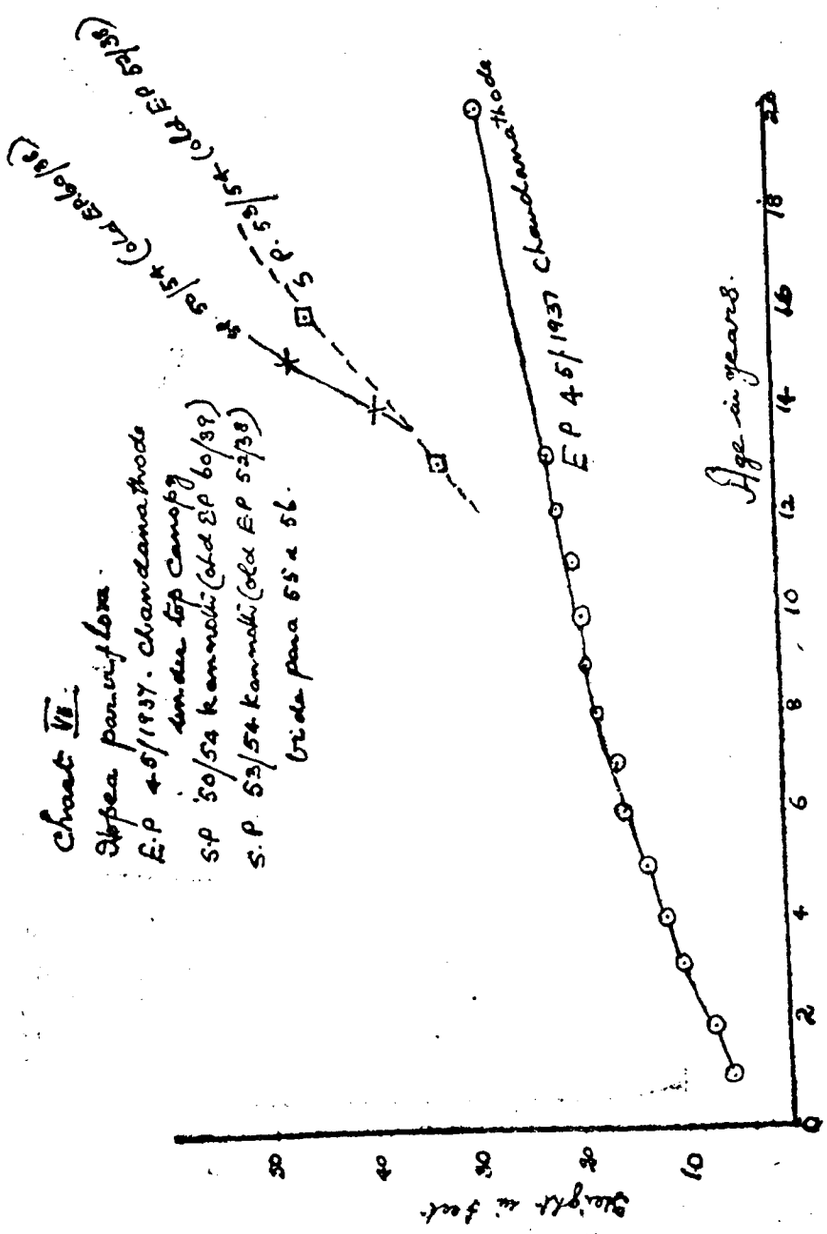
53. *Dalbergia sissoides.*—This is very similar to the *Dalbergia latifolia* and is found in parts of Palghat Division. A permanent preservation plot of this species consisting of eleven trees, exists in Dhoni in Palghat Division. The trees were last measured in 1939 and the average diameter breast height is 21 inches.

54. *Dipterocarpus indicus—Experimental plot* 50/37 *of Wynaad—Growth and development of species.*—Experimental plot 50/1937 was formed in Chandanathode in 1937 out of the old experimental ground plot 60/1934 to study the growth and development of the species from seedlings of known age to the sapling and pole stages under cover of evergreen top canopy. The data collected from 1937 to 1955 is given in a chart herewith. Two thinnings were done at ages 16 years and 20 years and the response to thinning has been quite good. The trees have attained a height varying from 25 feet to 50 feet and girth varying from 12 inches to 18 inches. The species has come up quite well in Chandanathode. As there are only 28 trees and the mean height is about 35 feet, there is no need to record heights hereafter. Breast height diameter will be measured at intervals of five years.



55. *Hopea parviflora—Experimental plot* 45/1937 *of Chandanathode.*—This was formed in 1937 out of experimental ground 52/1934 to observe the growth and development of the species from seedlings of known age to the sapling and pole stage under cover of top canopy only (i.e., removing in the middle storey, trees up to 3 feet girth). Thirty trees are now left after a thinning carried out in

1949. The mean height in 1954 at age 20 years is 28·7 feet. The species can be successfully grown in Chandanathode but the rate of growth is considerably less than in Kannoth. A graph showing rate of growth is below :—



56. *Hopea parviflora—Raising after clearfelling and burning secondary growth in shifting cultivation—Experimental plots* 41, 52 60 *of Wynaad—Experimental plots* 41/1937, 52/1938 *and* 60/1939—*Kannoth Range.*—These were formed in the years 1937, 1938 and 1939 find out whether it is possible to raise evergreen species such as *Hopea parviflora, Cedrela toona, Balanocarpus utilis,* after clearfelling and burning the secondary re-growth from old shifting cultivation. In experimental plot 41/1937 *Hopea* was tried in conjunction with *Artocarpus hirsuta* and *Swietenia macrophylla.* Here *Artocarpus* failed completely. Between *Hopea* and *Mahogany,* the latter has put on better height growth, but *Hopea* has more survivals.

In experimental plot 52/1938 *Mesua* failed and was replaced by *Hopea* in 1940. Mean height of *Hopea* after 15 years is 33 feet.

In experimental plot 60/1939 *Balanocarpus utilis* was replaced by *Hopea* in 1950. *Cedrela toona* is only 13 feet high while *Hopea* is about 39 feet high.

As seen from above the most successful species to raise after clearfelling and burning secondary re-growth in old shifting cultivation is *Hopea* and this can grow to a height of 48 feet in fifteen years.

57. *Hopea parviflora—Experimental plot* 153/1937 *and experimental plot* 167/1938 *of Palghat—Raising evergreens in deciduous clearfelled burnt area.*—The two experimental plots were opened to find out whether it is possible to raise evergreen species such as *Hopea parviflors, Artocarpus hirsuta* and *Cedrela toona* in a deciduous clearfelled and burnt area with a nurse crop of *Boga* and *Trema orientalis.*

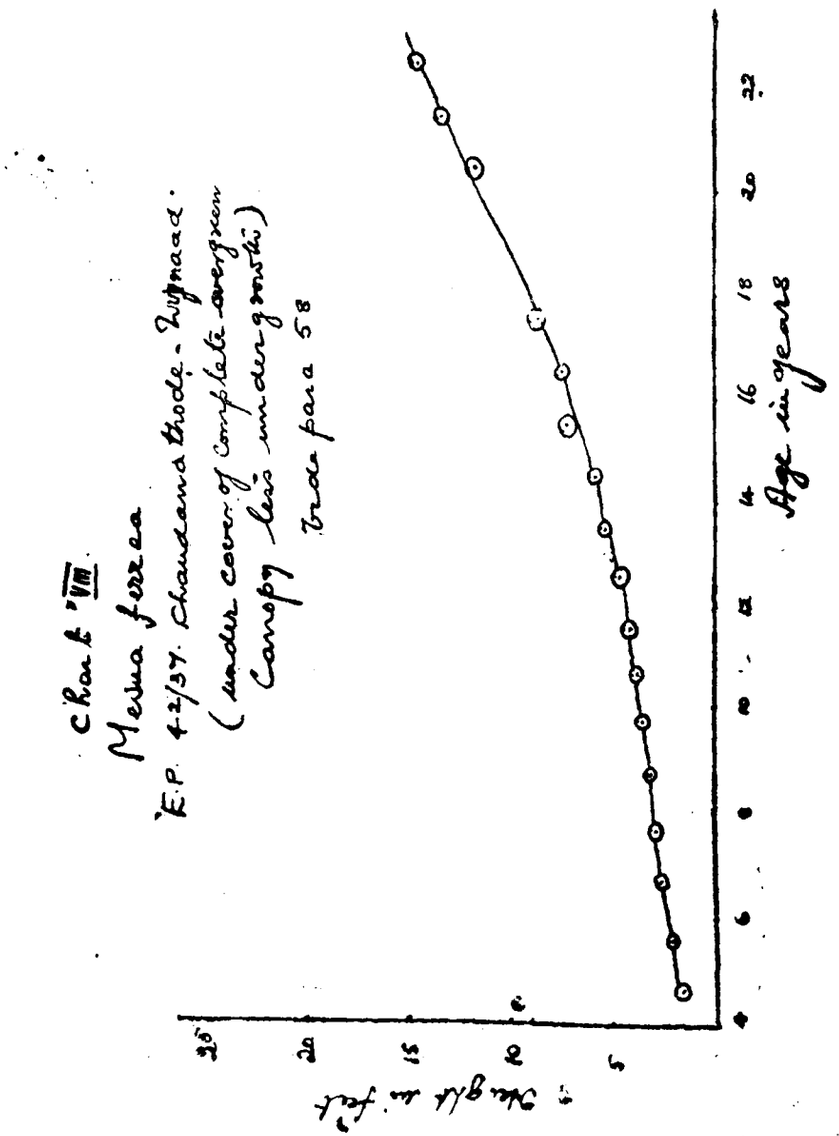
Experimental plot 153/1937.—Indications are that *Hopea* gives a higher percentage of survivals with a nurse crop of *Boga* than with a nurse crop of *Trema orientalis.* After 18 years, *Hopea* has grown to 42 feet, *Mahogany* to 51 feet and *Artocarpus hirsuta* 48·5 feet *Artocarpus hirsuta* has suffered damage from wild game.

Experimental plot 167/1938. Here also *Hopea* raised under a nurse crop of *Boga* has given a higher percentage of survivals than *Hopea* under a nurse crop of *Trema orientalis.* However the mean height under the two treatments are not significantly different being 32·9 feet and 32·6 feet respectively at the end of seventeen years.

Cedrela toona under a nurse crop of a *Trema* gives better survivals and mean height (73 per cent and 28·4 feet height in seventeen years) than *Cedrela toona* under a nurse crop of *Boga* (51 per cent and 26·8 feet). Hence a nurse crop of *Trema orientalis* is more beneficial for *Cedrela toona.*

The general conclusion may therefore be drawn that it is quite possible to introduce *Hopea* and *Mahogany* in a deciduous forest after clearfelling and burning the existing growth and using a nurse crop such as *Boga* during the early stages.

58. *Mesua ferrea—Experimental plot* 42/1937 *of Wynaad—Growth and development of the species.*—Exeprimental plot 42 was formed in Chandanathode in 1937 to study the growth and development of the species from the seedling stage of known age to the sapling and pole stages under cover of complete evergreen canopy less undergrowth. The Experimental plot was formed out of experimental grounds 4 and 8 of 1932 with 26 trees for observation. The trees have attained an average height of 14·2 feet in 23 years. This shows that the species can be raised successfully, but the rate of growth is poor under complete evergreen cover less undergrowth.



59. *Terminalia crenulata—Seeds from figured trees.*—Experimental plot 38/37, Wynaad, was started in 1937 to determine whether the "figure" of *Terminalia crenulata timber* is transmitted through the seed. The trees have now reached a height of 43 feet. Only when the trees are felled we will be able to ascertain whether the "figure" is transmitted. This is a long-term experiment. Hereafter diameter measurements will be taken instead of height. Similarly experimental plot 67/40 of Wynaad is a long-term experiment to determine whether "figure" of *Terminalia crenulate* is transmitted through the seed. In 1952 there were 315 trees with a mean height of 42 feet. Hereafter diameter measurements will be taken, instead of height.

Experimental plot 82/1938 of South Coimbatore is another similar experiment with figured *Terminalia crenulata.* In 1952, when last measured, there were seventeen trees with a mean height of 39·3 feet. In future diameter measurements only will be taken at intervals of five years.

When the trees in these plots are mature, and the seeds from each collected the trees will be felled and the timber examined for figure. Seeds from figured trees may be sown again. By such repeated selection, we may be able to isolate a figured variety of *Terminalia crenulata.*

(c) *Indigenous softwood species.*

60. *Artificial regeneration of gaps in evergreen forests.*—Experiments were started during the year under report in Begur and Chandanathode centres, to find out whether it is possible to fill up the blanks caused by selection fellings in evergreen forests with miscellaneous specis.

In Begur experimental ground 466/54 a 9-acre plot in selection felling coupe IV worked in 1953–54 was devided into six sub-plots and seedlings of the following species were planted at an espacement of 12 feet × 12 feet in the gaps.—

Bombax malabaricum.
Ailanthes malabaricum.
Lophopetalum wightianum.
Mangifera indica.
Sterculia companulata.
Swietenia macrophylla.

} (For Magnifera indica only dibbling of seed was done.)

All the species have come up fairly well. Bombax has done best with 86 per cent survival and 2 feet to 3 feet high and mango with 85 per cent survival and 1 foot to 1½ feet high.

Experimental ground 422/54, *Chandanathode.*—A similar experiment was started in 1954 in Chandanathode to supplement natural regeneration in the gaps caused by selection fellings in evergreen forests by sowing seeds of five different species. In an area near mile 27/7 to 28/0 in selection felling coupe IV worked in 1953–54, three gaps were selected and two to three seeds of the following five species were dibbled in patches at an approximate espacement of 12′ × 12′. Species tried—

Swietenia macrophylla.
Mangifera indica.
Vateria indica.
Bombax malabaricum.
Artocarpus hirsuta.

Here also mango has done well with a survival of 54 per cent and height growth of 15 inches. There is a certain amount of damage to the seedlings from sambhur which browsed the seedlings and porcupines and rats which dug up and ate away the kernels.

61. *Introduction of softwoods in evergreen forests.*—With a view to find out whether it is possible to introduce valuable softwood species in evergreen forests without clearfelling, garden experiments were conducted during the year under report, in the Chandanathode Evergreen Forets. Five species were tried under two treatments for each species. In treatment 'A' only shrubby growth was cleared leaving the full canopy without disturbance, while in treatment 'B' besides clearing the undergrowth, saplings and poles of useless species up to a girth of 3 feet were either felled or girdled leaving only the top canopy. The espacement was 9′ × 9′. The species tried were—

Mangifera indica.
Swietenia matrophylla.
Vateria indica.
Lophopetalnm wightianum.
Sterculia companulata.

Transplants were put in for all species, except for Mango for which seeds were dibbled. Comparison of the figures of growth at the end of the year shows that while Mahoganz and *Sterculia companu leta* have failed generally, the other species have come up well with 70 to 80 per cent survivals and height growth of 1½ feet to 2½ feet. Further observations will be made in future years.

62. *Ailanthus excelsa.*—This is valuable softwood, suitable for the match industry. This is best raised by entire transplanting.

It comes up well in almost all the districts of the State. It's rate of growth is fast. In two years it attains a mean height growth of 72·5 inches in Denkanikota and in four years 48·9 inches in Bennari.

TABLE XIV.

Experimental ground number.	*Locality.*	*Age in years.*	*Survivals.*	*Mean height.*
461	Topslip ..	1	43	1·5
393	Do. ..	3	46	4·7

Defoliator attack—Eligna narcissus.—Aepidopterous defoliator Eligna narcissus (Noctuidae) in plantations and nurseries of the species is noticed in Madras State in the following places :—

(1) Ayerangal Softwood Plantations, Coimbatore South Division ;

(2) Edacode Block (1951 Softwood Regeneration Area), Nilambuur Range, Nilambur Division ;

(3) Matchwood Nursery, Kannoth Range, Wynaad Division.

Experiments for the control of this pest through the use of chemical insecticides are being contemplated, and the results of such experiments will be included in the next year's report.

63. *Ailanthus malabarica.*—The timber of this species is in great demand for the match industry. To ascertain the growth and silvicultural requirements of the species, several experiments were laid out at both Topslip and Dhoni. The height growth and survival per cent are given below :—

TABLE XV.

Experimental plot number.	*Centre.*	*Age.*	*Mean height.*
Experimental plot 184 ..	Dhoni ..	3	2
Experimental ground 193 ..	Do. ..	4	7'3
Experimental ground 406 ..	Topslip ..	3	2·0
Experimental ground 469 ..	Do. ..	1	0·8

To find out the best method of raising the species, comparison experiments were started in Dhoni in experimental grounds 402, 409 and 418. The general indications are that enttire transplants give the best results.

In both Nilambur and Topslip, this plant is liable to attack by a defoliator Eligna narcissus (Lep., Noctuidae). Experiments for the control of this pest through the use of chemical insecticides are proposed and the results of such experiments will be included in the next report.

64. *Bombax malabaricum* (*Semul*).—This is one of the best matchwoods of the State and attempts are being made in all districts to increase the area under Semul. The best method of raising this species is through one year old transplants. Direct sowing gives satisfactory results though the mean height growth is not so good as transplants.

Shoot borer attack on Bombax.—The species is subjected to a shoot borer attack known as 'Thonica neviferana' (Aecophoridae).

The best method of control of this pest is by the mechanical method by destruction of pupae. Secondly by planting in wide espacement and mixing with other species, since, Semul is in nature non-gregarious.

Experiments for the control of this insect through the use of chemical insecticides are being contemplated and the results of such experiments will be included in the next year's report.

65. *Manurial experiments on Bombax malabaricum.*—With a view to ascertain the effect of nitrogenous and phosphatic manures on the growth of *Bombax malabaricum* seedlings experimental plots 98 and 99 were formed during 1953 in 1952 and 1953 softwood regeneration areas of Kannoth. In experimental plot 98 an area of 3·5 acres planted up with *Bombax* was selected and divided into sixteen sub-plots of 36 plants each with an espacement of 17′ × 17′. There were four treatments with four replications. The treatments were—

A—Control—soil working done but no manure applied,

B—One oz. of ammonium sulphate mixed into the soil,

C—One oz. of super-phosphate mixed into the soil,

D—One oz. of ammonium sulphate plus one oz. of super-phosphate.

Analysis of measurements at the end of one year show that there is no significant difference in the mean height or survival percentage with any of the treatments.

In experimental plot 99 formed in 1953 softwood plantation at the time of planing of the plantation the plot was 0·35 acre in extent divided into six sub-plots of 35 plants each. Plots A, B, C were controls in which only soil working was done, while in A-1 one oz. of ammonium sulphate ; in B-1 one oz. of super-phosphate ; and in C-1 one oz. of each of the above, were put in. Analysis of 1954 measurements shows that one oz. of super-phosphate gives better height growth than control without manure, while in the other two cases there is no appreciable difference between control and treatment. The same experiment was repeated again in 1954 in experimental plot 120 in softwood plantation of 1954. This was a Latin Square design with four treatments and four replications. The treatments were—

A—Control,

B—2 oz. of manured mixture recommended for potato gardens,

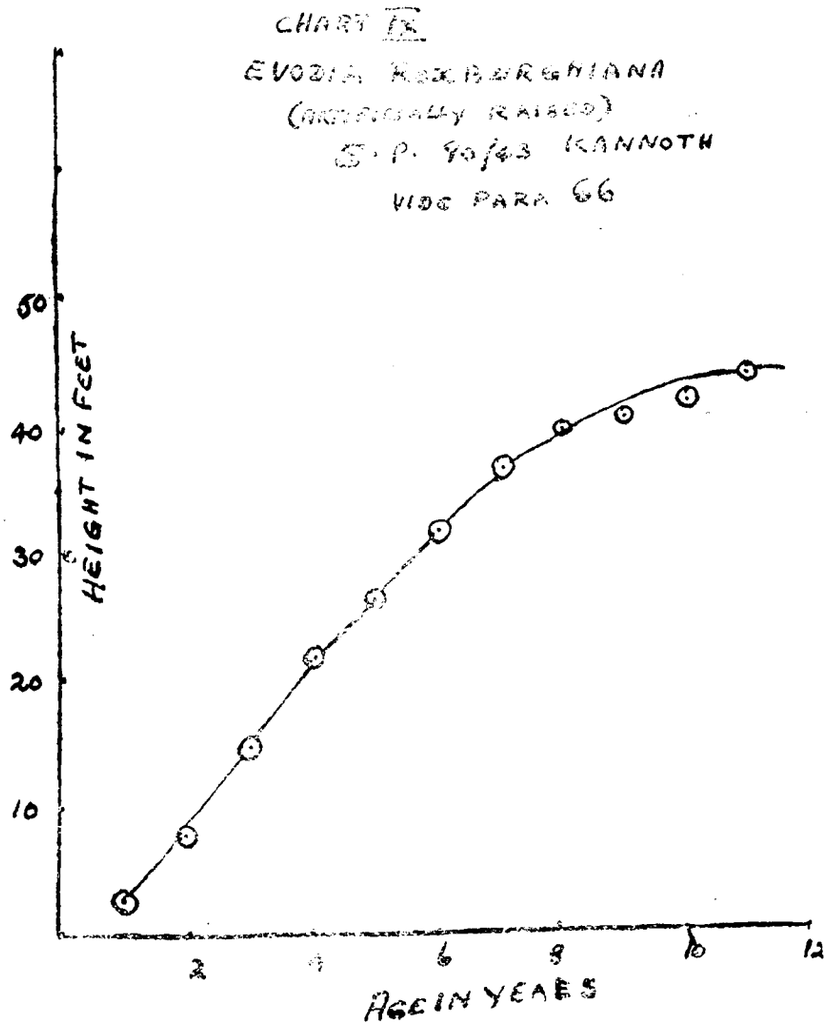
C—1 oz. of manure mixture and 1 oz. of super-phosphate,

D—2 oz. of super-phosphate.

Initial height measurements were recorded in 1954 and were found to be equal for all treatments. The experiment is in progress and will yield results only later on. The general conclusion which can

be derived from all the above experiments is that treatment with manures has not proved to be definitely beneficial so far.

66. *Evodia roxburghiana—Rate of growth.*—Experimental plot 90/43 was started in Kannoth to study the growth and development of the species in the locality. Natural forest seedlings ranging from 12 inches to 29 inches in height were planted at an espacement of 6′×6′ in 1943. The plot was thinned in 1949. Measurements in 1955 at the age of twelve years show 119 stems with a mean height of 46·4 feet. From next year onwards it is proposed to measure both the diameter and the height to determine the rate of growth of the species. A graph showing the height increment with age is below :—



67. *Effect of thinning of Evodia plantations.*—Experimental plots 91, 92 and 100 were started in the years 1950, 1951, and 1953 in Kannoth regeneration areas of 1946, 1947 and 1948 respectively, to study the effect of a 50 per cent mechanical thinning on the rate of growth as also on its resistance to fungus disease. In the third year 50 per cent of the trees were removed in the treated plot during thinning. It is seen that trees in the thinned plot are of greater girths and are healthier.

In experimental plots 92 and 100 there has been no fungus attack so far either in the thinned plot, or in the control (unthinned) plot. But in experimental plot 91 while the thinned plot was free from attack, four trees in the control plot got the fungus attack bringing the total attacks in this plot to eight. The trees attacked with fungus were cut flush with the ground and removed far away from the area and burnt. The indications are that thinning induces vigorous growth of the species and probably affords greater power of resistance to the fungus disease.

Experimental plots 91/50 and 92/51 show that the mean diameter of the crop is greater in the thinned plot than in the unthinned plot. But in experimental plot 100/53 there was no significant difference in the diameter in the thinned and unthinned plots in 1954. The plants will have to be watched.

The thinned plants in general look more vigorous and healthy than unthinned plants. Plants growing in the district plantations in the vicinity are badly attacked even though the incidence of attack in the unthinned plants in the research plots is only four so far. The indications are that as a result of thinning, the plants grow more vigorously and so have got greater power of resistance to the attack of the disease.

68. *Pruning of Evodia, experimental plots* 118/54—*Kannoth Centre.*—This experiment was started to study the effect of pruning a pure *Evodia* plantation, the trees being pruned to two-thirds of their heights. The plot was laid in 1951 regeneration area, Kannoth, where the plants are three years old. Pruning was done in two sub-plots of one-fourth an acre each, and there is a control plot of two sub-plots of ¼ an acre each without pruning. As the experiment was started only in 1954, observations will be recorded in future reports.

69. *Melia dubia.*—The timber of this species has been tested and found to be satisfactory for slate frames, packing cases and cheap plywood. Hence the importance of the species.

All experiments to accelerate and increase the germination per cent of the species have so far proved unsuccessful. The only method which has given fair results, is burying the seeds in a pit for about a year and then sowing them in a nursery bed. Round about mother trees, if a light ground fire is taken immediately after seed fall, there is a fair amount of natural regeneration. But

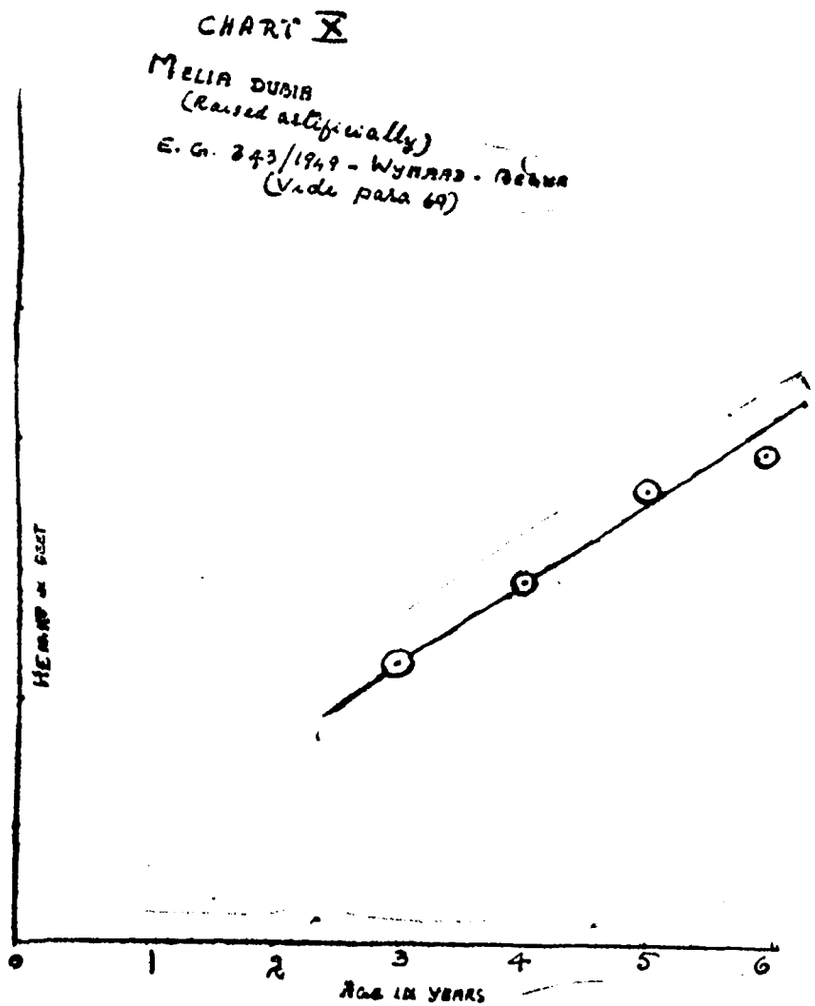
burning of seeds in nursery beds or elsewhere has not yielded satisfactory results. Of the three methods of artificial regeneration, viz., direct sowing, entire transplanting and stump planting, entire transplanting is significantly the best method of raising this species. Both nursery raised and natural seedlings of height 9"—12" can be transplanted as the beginning of the south-west or the north-east monsoon. The rate of growth is extremely rapid even in regions of poor rainfall of 30"—40" per annum. A height growth of 10'—15' is obtained in two years and 40 feet in six years.

Experimental ground 115/53—*Denkanikota.*—Transplanting seedlings in crowbar holes and 1 foot cube pits, both gave 100 per cent survival and height growth of 43·1 inch and 41 inches respectively at the end of one year. Hence crowbar hole planting is possible.

Experimental plot 29/53—*Denkanikota.*—Half acre was planted at an espacement of 22 feet × 9 feet. The plants are well established and at the end of two years, the maximum height is 25 feet.

Wynaad.—No experiments on this species was done during the year. Experimental ground 343 of 1949 was maintained. Here 60 plants were planted at 3' × 3' in 1949 and these were thinned in 1952. Now there are 16 plants with an average height of 39·4 feet (at the age of six years). Hereafter D.B.H. measurements will be given in place of height growth.

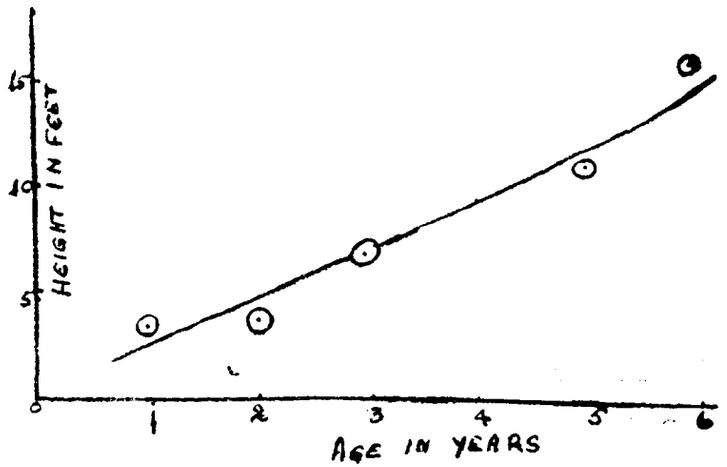
During the coming year, cuttings of the species will be tried along with the plant *Harmone seradix.*



70. *Spondias mangifera.*—Experiments with this species have been continued at Topslip, Dhoni, Kannoth and Begur and Bennari. There is no significant difference between stumps and transplants as regards survivals or height growth and so both methods may be used freely.

Wynaad—Experimental ground 229/1949.—In Kannoth was maintatained during the year to observe the growth and development of the species. There are now twelve plants of an average height of 15·6 feet on 26 January 1955 at the age of six years. A graph showing height growth with age is attached. The plants reach a height of 15½ feet in six years.

CHART XI
SPONDIAS MANGIFERA
(RAISED ARTIFICIALLY)
EG 229/1949. KANNOTH
VIDE PARA 70



Dhoni—Experimental ground 365/49 of *Dhoni*.—This is a comparison experiment to determine the best method of raising the species. Four methods were tried, viz.—

A—Stumps 0·3 to 1·0 inches diameter.

B—Sowings.

C—Transplants (two months old).

D—Cuttings of 1 inch to 2 inches diameter.

Latest measurements in 1955 are as below :—

A—10/40 survival and 13′ 10″ average height.

B—13/40 survival and 10 feet 8″ average height.

C—10/40 survival and 9′ 5″ average height.

D—8/40 survival and 8′ 6″ average height.

No conclusions are possible as casualities were replaced in all treatments without record.

Topslip—Experimental ground 464/53.—Fifty-one year old seedlings were planted. At the end of one year the average height was 13·8 inches and survivals 49 out of 50. In 1955 at age two years, the survivals are 37 ; all the plants have broken top due to browsing by wild game ; hence height is not taken. As the species is very liable to damage by wild game, particularly deer, it is not worth trying this species in localities subject to such damage.

71. *Sterculia alata*.—Entire transplanting of nine months to one year old seedlings is the best method of raising this species. Experiments were started in 1950 in Kannoth, Dhoni, Topslip, and Begur to study the rate of growth and development of the species. The follwoing statement furnishes the data collected so far :—

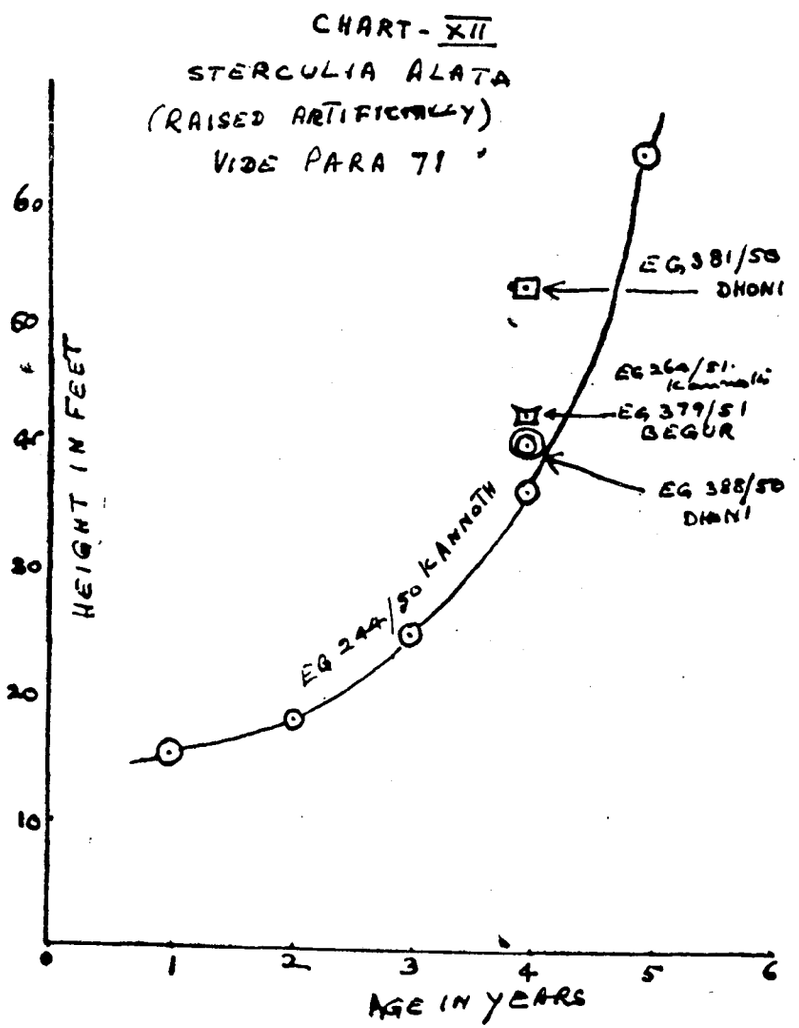
TABLE XVI.

Serial number and locality.	Experimental ground number.	Latest measurements. Age. YEARS.	Number.	Average height. INCHES.
1 Kannoth	244/50	5	12	64
2 Dhoni	388/50	5	9	39·6
3 Begur	379/51	4	58/100	41·3
4 Kannoth	264/51	4	33/50	42·0

Sterculia alata—Comparison experiment.—Experimental ground 347/49 was started in Begur to compare the growth of two-year old transplants with two months old transplants (small plants with cotyledons.) Thirty plants were put for each treatment. At age of six years the two-year old transplants show a survival of 36·7 per cent and a mean height of 8·3 feet, while the small plants with cotyledons show a survival per cent of 53·3 and a mean height of 6·6 feet. One year transplants give higher survival per cent ; but two-year old transplants and two months old transplants give good height growth.

Sterculia alata—Comparison of 3′ × 3′ *espacement with* 6′ × 6′ *espacement*.—This was started in 1950 experimental ground No. 381/50 of Dhoni. After four years, 6′ × 6′ espacement gave 30 per cent survival and 52·7 inches mean height, while the other espacement gave 10 per cent survival and 33·2 inches mean height. The under-espacement is distinctly better.

Sterculia alata—388/50 *of Dhoni*.—This is a demonstration plot to observe the growth and development of the species. Latest measurements in 1954 at age four years shows a mean height of 40 inches with a survival of 9 out of 50.

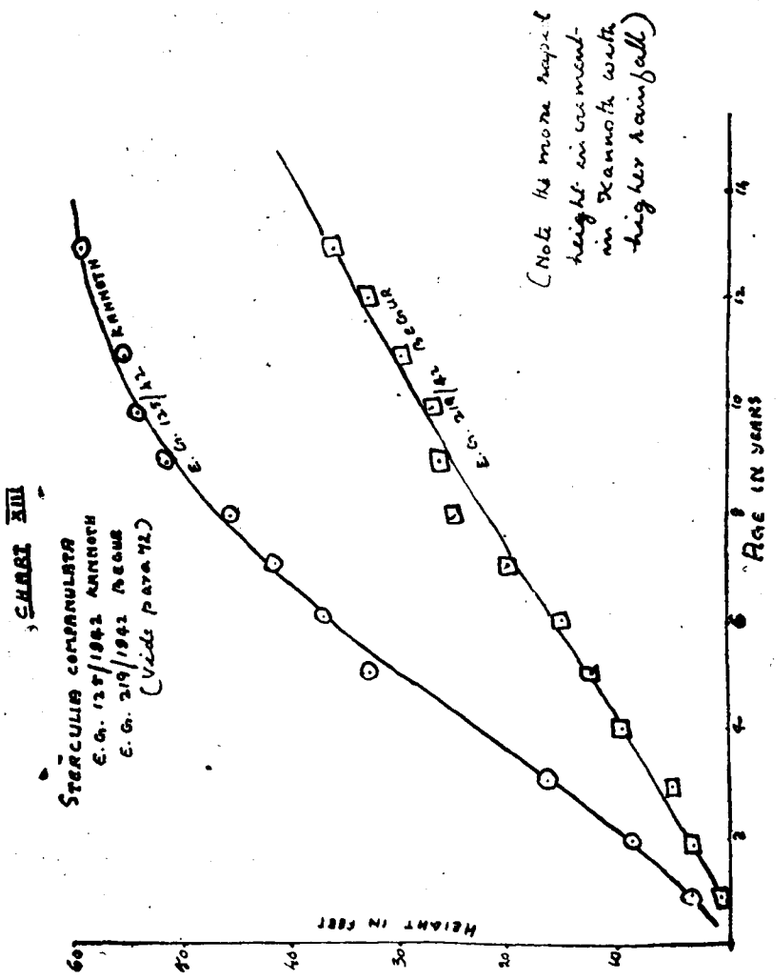


72. *Sterculia companulata.*—The viability of the seed is completely lost if the seed is stored for more than one month. Freshly collected seeds sown within one week of collection gives 80 to 90 per cent germination.

The best method of regenerating the species is to transplant nine months to one year old seedlings in crowbar holes or pits between the first and third week of June. Shoot cuttings are not successful as they give only 40–45 per cent survival against 80–90 per cent survival with transplants.

Experimental ground 125/42 of Kannoth and experimental ground 219/42 of Begur were started for studying the rate of growth and development of the species. Measurements in March 1955 show that in 13 years, it reaches a mean height of 61 feet in Kannoth and of 37·4 feet in Begur. A graph showing the rate of height growth with age is attached. It is clear that the growth is much more rapid in Kannoth with a rainfall of 165 inches than in Begur with a rainfall of 72 inches.

During the current year, sample plot 55 has been formed in the 1951 plantation area of Kannoth with 36 saplings of Sterculia companulata. These were of an average height of 13·5 feet on 10th May 1954 and of 17·7 feet on 12th March 1955.



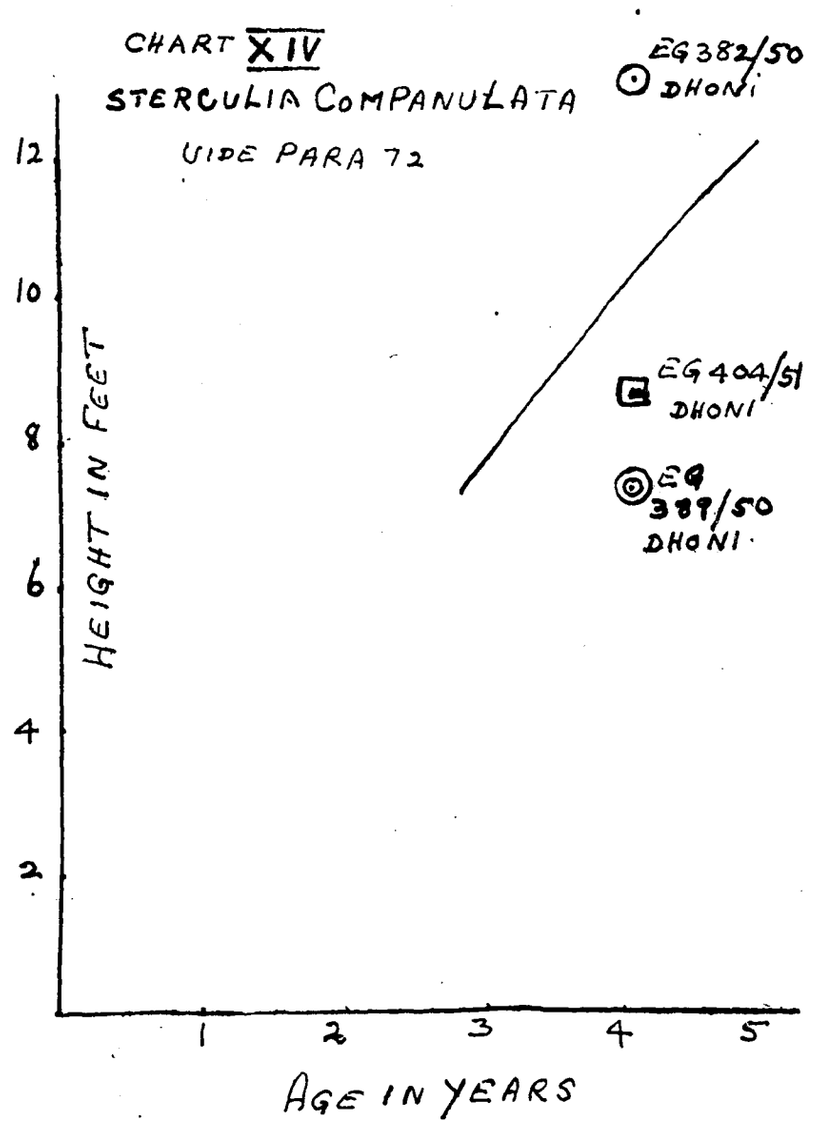
Topslip Centre—Experimental grounds 468/53 *and* 493/54.—Owing to heavy and frequent browsing by deer no useful results are available in this centre.

In *Kannoth and Begur* this species has succeeded fairly well due to absence of damage from deer.

Experimental ground 382/50 of *Dhoni* was a comparison experiment to compare 6′ × 6′ espacement with 3′ × 3′ espacement. Measurements in 1954 at the end of four years show that while 3′ × 3′ espacement gave 40 per cent survival and mean height of 156·7 inches, 6′ × 6′ espacement gave 26 per cent survival and mean height of 113·8 inches only.

Experimental ground 389/50 was a demonstration plot to ascertain the growth and development of the species. Fifty plants were transplanted in one foot cube pits on 17 June 1950 at an espacement of 9′ × 9′. In 1954 after four years there were 20/50 survivals with an average height of 86·2 inches.

Experimental ground 404/51 is a comparison experiment between three espacements. Measurements in 1954 after four years show that 9′ × 9′ is the best espacement giving 60 per cent survival and a mean height of 8·8 feet, even though 3′ × 3′ espacement gives 41·2 per cent survival and a mean height of 10·8 feet. 6′ × 6′ espacement is the poorest both as regards survival per cent and height growth.



Experimental ground 420/53 *of Dhoni* is a comparison experiment between—

A—Sowings ;
B—Stump planting ; and
C—Transplants.

Measurements in 1954 show that stumps have failed altogether and that transplanting is better from the point of view of mean height giving 26·1 inches mean height against 18·2 inches for sowings.

Experimental ground 428/53 *of Dhoni* is a comparison experiment on three espacements, viz., A—9′ × 9′; B—6, × 6′; and C—3′ × 3′. Results will have to await for another year or two.

Experimental plot 182/52 *of Dhoni* is a comparison experiment between espacements 6′ × 6′ and 9′ × 9′. Latest measurements show in 1954 that there is no significant difference in mean height between the two espacements.

Experimental plot 193/53 *of Dhoni* is a comparison experiment between two espacements 9′×9′ and 6′×6′. The measurements in 1954 show that 9′×9′ gives slightly better height growth than 6′×6′, but this cannot be taken as final and further measurements will have to be taken before any deductions can be made.

The indications so far are—

(i) that 9′×9′ espacement is probably better than 6′×6′ espacement;

(ii) transplanting entire seedlings is significantly the best method of raising the species.

73. *Vitex peduncularis—Experimental plot* 68/40 *of Wynaad.*—This plant is of importance on account of the use of the leaves in the treatment of Black Water fever. This experiment was started in 1940 by planting 30 two-year old seedlings of height 18 inches to 58 inches and 45 one-year old seedlings of height 8 inches to 30 inches at an espacement of 12′×12′ on 28th June 1940. This was done with a view to observe the growth and development of the species.

In April 1941, it was found that the smaller one-year old transplants were more vigorous than the larger two-year old transplants and the stocking fell to 57 from 75.

The statement below furnishes a summary of height measurements with age :—

TABLE XVII.

Year.	Number put in.	Number surviving.	Mean height.
			INCHES.
1941	75	57	17·7
1942	75	56	38·8
1943	75	53	63·3
			FEET.
1944	75	45	8·6
1946	75	40	17·5
1948	75	36	25·5
1949	75	35	28·3
1950	75	35	31·6
1953	75	35	37·0

The indications are that planting one year old transplants is the best method of raising the species. It reaches a height of 37 feet in twelve years.

74. *Zanthoxylum rhetsa.*—Entire transplanting of nine months to one year old seedlings is significantly the best method of raising species. Clearing the undergrowth around the mother trees just before seed fall encourages natural regeneration and these seedlings can be easily established by weeding twice a year till they attain the height of 4 feet to 5 feet.

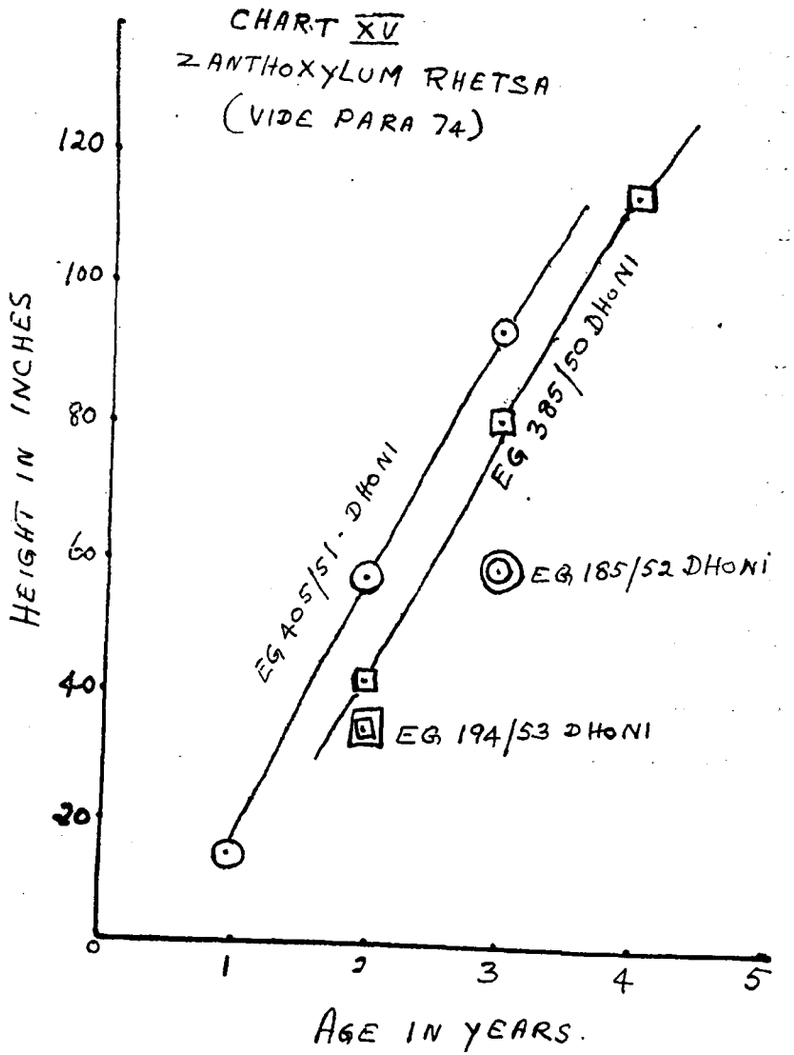
Experiment started in 1950 in Dhoni to study the rate of growth and development of the species—vide experimental ground 385/50 of Dhoni—shows a survival of 9/50 and a mean height of 118·7 inches in four years.

Experimental ground 405/51 *of Dhoni* planted with 50 plants at an espacement of 6′×6′ after three years, i.e., in 1954 shows 18/50 survivals with a mean height of 96·9 inches.

Experimental plot 185/52 *of Dhoni.*—Fifty natural seedlings were transplanted at an espacement of 6′×6′. At the end of three years in 1955 there is a survival of 13/50 with an average height of 60 inches.

Experimental plot 194/53 *of Dhoni.*—Forty natural seedlings were transplanted at an espace nent of 6′×6′. At the end of two years in 1955 there are 26/40 seedlings with an average height of 35 inches.

A graph showing the rate of growth of the species as disclosed by the above experiments is below. A scrutiny of the graph shows that the rate of growth of the species is slow for the first two years and that thereafter it is co-oparatively rapid.



The timber of the species is light and strong and is specially useful for making camp furniture and also for plywood, etc. As it can be raised easily and grows fast, it deserves more attention.

(*d*) *Exotics.*

75. *Acacia mollissima* (black wattle).—When exactly wattle was introduced in the Nilgiris is not known ; probably, it was about 1840. To begin with, wattle was planted only in the tea estates as a nurse crop for tea. But the Forest Department focussed attention and started systematic planting only in 1939, when trade relations with South Africa became strained. In the beginning, both the black and green wattles were planted. The bark of the black wattle (*Acacia mollissima*) is preferred to that of other *Acacias* both on account of its high tannin content (33 to 34 per cent of the dry bark weight) and the desired finish and colour, its extract gives to the leather after tanning. The green wattle (*Acasia decurrens*) also yields a bark with nearly equal tannin content ; but unfortunately the proportion of the red and yellow colouring matter in its bark is so high that it produces a tanned leather of a colour not favoured in the trade. Hence the cultivatiom of only black wattle (*Acasia mollissima*) will be done in future.

76. Its valuable tan bark plays a great role in the national economy and its wood is a potential raw material for the paper and the rayon industries. Therefore in the Nilgiris it is being planted over thousands of acres. With the advent of such large-scale planting, research is necessary to investigate into various problems of the best methods of artificial regeneration, best rotation, best espacement, etc.

77. *Acasia decurrens—Espacement experiment—Experimental plot No.* 8/47.—An experiment was started in 1947 in Andy Corner with Acasia decurrens with the three espacements, $6' \times 6'$, $9' \times 9'$ and $12' \times 12'$. In 1948, the sub-plot with $12' \times 12'$ espacement got burnt by an accidental fire leaving only the other two sub-plots. Measurements of 1955 showed that $9' \times 9'$ espacement had a significantly better height growth than the $6' \times 6'$ espacement.

78. *Acasia mollissima—Pre-monsoon planting experiment—Experimental plot No.* 26/54.—The general practice is to plant mossed seedlings of wattle during the south-west monsoon. Experimental plot 26/54 was started to find out if wattle can be planted during the pre-monsoon showers in April and thereby enable them to grow sufficiently tall to withstand the frost. One hundred basket plants and 100 mossed seedlings were planted in May 1954 with the addition of two ounce of fertiliser per plant. The experiment is under observation.

79. *Acasia mollissima—Manurial experiment—Experimental plot No.* 24/54.—Here there are four treatments—

A—Addition of 1 oz. of manure mixture and scraping to three feet diameter.

B—2 oz. of fertiliser added and scraping to three feet width.

C—2 oz. of fertiliser added—but no scraping.

D—Seeds sown in patches with 2 oz. fertilisers. Results are being watched.

80. *Acacia millissima—Experiment with different rotations—Sample plot 10 of the Nilgiris.*—In 1948, Sample plot No. 10 was laid out at Muthorai in the 1941 *Acacia mollissima* plantation. The area was divided into eight sub-plots which were allotted to four treatments at random. The treatments were—

A—Rotation of 7 years.

B—Rotation of 10 years.

C—Rotation of 13 years.

D—Rotation of 16 years.

In previous years, the sub-plots A, B were clearfelled and yield of green and dry bark measured. Similarly in 1954 at the age of 13 years, the sub-plots 'C' were clearfelled and the yield of bark measured. Measurements for the six sub-plots already felled show that the M.A.I. of green bark cultiminates at about the 10th year. But the M.A.I. of dry bark shows a continuous increase up to age thirteen years. Previous experiments have shown that the tannin contents in the dry bark increases up to age six years and then decreases. Hence the M.A.I. for effective tannin content per acre will cultiminate somewhere between six years and thirteen years. Further indications will be available in 1957 when the sub-plots allotted to sixteen years rotation will be clearfelled.

The following statement furnishes the data obtained so far :—

TABLE XVIII.

Year of felling.	*Age in years.*	*Yield in lb. per acre.*		*M.A.I.*		*Percentage of dryage.*
		Green bark.	*Dry bark.*	*Green bark.*	*Dry bark.*	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1948	7	6,261	3,145	894	449	49·8
1951	10	11,413	5,250	1,141	525	46'0
1954	13	12,336 + 1,461 windfalls. = 13,797	7,117 + 618 windfalls. = 7,735.	1,061	595	42·3

The indications are that as the M.A.I. increment for dry bark increases continuously up to thirteen years, a rotation of thirteen or more years will yield the maximum production of bark. In fixing rotation, we have also to consider the yield of fuel and fix the rotation in such a way that the maximum value of bark and wood is obatined. The experiment has to be repeated in other centres to confirm indications already obtained.

81. *Albizzia falcata.*—Tests made by the Colonial Products Advisory Bureau have shown that it is commercially possible to produce a high grade paper, by mixing *Albizzia falcata* pulp with a highe rgrade pulp. The great advantage of *Albizzia falcata* for this purpose is its rapid growth reaching exploitable dimension in ten years. In view of the importance of the species artificials regeneration is being attempted in this State.

In paragraph 66 of the last year's report there is reference to a plant of 1950 in the Dhoni Research Garden which was Fifteen feet high in 1953. This was broken due to severe storm and was coppiced subsequently. It was eight feet high in 1954. This plant is now dead.

NOTE.—There is one seedling of 12 feet high existing in Dhoni nursery which is from the earliest sowings of 1950,

It is reported in the last year's report that pre-treatment with cold and warm water did not give any difference in the percentage of germination. The seedlings raised were planted in 1954–55 in Kannoth, Dhoni and Topslip. In Kannoth (experimental ground No. 312/54) 100 seedlings were planted in one foot cube pits on 10th June 1954. There were 17 per cent survivals in September 1954 and none in November 1954.

Dhoni experimental ground No. 438/54.—In June 1954, fifty seedlings about 4 inches to 13 inches high were transplanted in Dhoni deciduous garden. Owing to the seedlings being weak and lanky, they gradually died out during the hot season. There were 6/50 survivals in November and in March 1955, 5/50 survivals and subsequently all died.

Topslip experimental ground No. 490/54.—Results similar to above. Our attempts so far in artificial regeneration of *Albizzia falcata* have not been successful. Attempts are bing made to procure seed from Jamaica and results will be reported in subsequent year's report.

82. *Aleurites fordii and A. montana*—(Tung oil trees).—These trees are much valued for the Tung oil which is extracted from the seeds of these plants. *Aleurities forddii* occurs in the warm temperate parts of China, ascending up to 5,000 feet elevation while *A. montana* is a tree of warmer localities rarely ascending higher than 1,500 feet.

The following plants now exist in the Aramby Research garden in Ootacamund :—

TABLE XIX.

Locality.	*Year of planting.*	*Species.*	*Serial number of plant.*	*Height.*	*Average height.*
(1)	(2)	(3)	(4)	(5)	(6)
				FT. IN.	FT. IN.
Aramby nursery.	1950	*Aleurites fordii.*	1	2 0	1 11
			2	4 2	
			3	1 6	
			4	1 3	
			5	1 8	
			6	1 0	

TABLE XIX—*cont.*

Locality.	*Year of planting.*	*Species.*	*Serial number of plant.*	*Height.*		*Average height.*	
(1)	(2)	(3)	(4)	(5)		(6)	
				FT.	IN.	FT.	IN.
Aramby nursery.	1952	*A. montana* ..	1	2	9	1	9
			2	2	9		
			3	2	0		
			4	1	0		
			5	1	2		
			6	1	0		

83. *Bursera delpechina* (Linaloe).—This is a native of Mexico and yields the well-known Linaloe oil of commerce. The oil is distilled from the wood and the fruits of the plant. There are three plants in the Denkanikota Pot Culture garden of heights, 15½ feet, 13½ feet and 9 feet. The plants flowered during April-May 1954; but did not yield any fruits. Attempts to raise plants by vegitative propagation, through cuttings or air Layerings were fruitless. Last year it was reported that cuttings planted with Seradix powder gave good sprouting. But the sprouted cuttings died subsequently. So far not even a single cutting has been established. The experiments are being repeated.

84. *Brousennatia papyrifera*.—This is a fast growing softwood species which is much valued for manufacture of paper pulp and for match splints. The wood can be used for pencil making. The quality of the pencils made of this wood is fairly good but not very superior.

The home of the species is in China, Japan, Siam and Borneo and indigenous in Southern Salween tributaries. It is sucessfully introduced in Dehra Dun, Sharanpur, Lahore, Calcutta and Madras (Chandanathode, Topslip, Begur and Denkanikota Research Centres).

It starts seeding when about two to three years old. The seed weight is about 15,000 to 17,000 per oz. Germination capacity about 40 to 50 per cent with a plant per cent of about 25 to 30.

Once it is introduced under favourable locality factors, it often takes possession of the ground and it is difficult to eradicate it. It also freely regenerates itself by root suckers and by seeds.

The species comes up well both by stumps and transplants and attains a mean height growth of 28 feet. and 27 feet, respectively in three years. In Denkanikota (Noganur Reserve Forest) it has attained a height of Fifty feet and D.B.H. of 20 inches in eight years.

85. *Casuarina cunninghamiana*.—Fifty layered cuttings received from Thailand were planted in Markuanum in July 1951. There are now 21 survivals. The growth is more rapid than for the indigenous *Casuarina equisetifolia*. The last measurement, taken in February 1954, two and half years after planting gave an average height of

25½ feet for the 21 plants and a maximum height of 28 feet. Successful vegetative propoagation of this species is possible through air layerings. The trees have not so far flowered or fruited.

86. *Ceratonia siliqua* (The Carob tree).—This is a small tree, native of Cypress and is suited to dry climates. Its chief value is in yielding edible pods used as food for cattle. It is resistant to drought.

The seeds were obtained from the Director of Agriculture, Cypress, and were sown in three centres, viz., Topslip, Dhoni and Begur, and the results are furnished below:—

Seed weight—154 per oz.

Germination capacity—36 per cent to 50 per cent.

Plant per cent—28 to 37.

In Dhoni Centre, the seeds were sown under four standard treatments to ascertain the best method of germination:—

A—Control—No treatment;

B—Soaking in cold water for 24 hours;

C—Soaking in hot water for 24 hours; and

D—Soaking in boiling water and allowed to cool for 24 hours.

The results were as follows:—

	Germination capacity.	*Plant per cent.*
A	49	37
B	49	42
C	Nil.	Nil.
D	Nil.	Nil.

The indications are that seeds sown without treatment and seeds sown with soaking cold water for 24 hours give equally good results. Soaking in warm water and in boiling water destroy the germinative capacity completely.

The practice in Cypress is to sow the seeds in baskets and then transplant the seeds with baskets. By mistake the seeds were sown in beds and now there are about 400 seedlings in Dhoni, 400 seedlings in Topslip and 200 seedlings in Begur. These will be potted and tried in all Research Centres including Vemburili and Markanum.

87. *Cholorophora excelsa* (South African teak).—The best method of artificially regenerating this species is through stump planting. Transplanting and planting cuttings are also successful. Trees of this species exist in Begur Research Garden.

88. *Cinnamomum camphora* (Japan or Formosa Camphor tree).—This is a native of Japan, Farmosa and China, which yields camphor by the west destillation of the wood, leaves and twigs On account of the synthetic manufacture of camphor, the importance of this plant had waned in recent years. Besides the her bacious. fast growing *Ocimum kilimanjaricum* also comes up well in the

medium to high rainfall tracts of this State and as this can be grown comparatively easily, the importance of *Cinnamomum camphora* is well nigh gone.

The following plants exist in the research gardens :—

TABLE XX.

Locality.	Method of propagation.	Year of propagation.	Number now surviving.	Height. Maximum.	Height. Average.	Height. Minimum.	Remarks.
				FT. IN.	FT. IN.	FT. IN.	
1 Aramby.	Transplants.	1943	1	..	20 0	..	Girth 2 feet experimental grounds No.223/1943.
2 Wynaad.	Do.	1943	..	..	..	..	
3 Topslip ..	Do.	1946	97	..	9 0	..	Experimental plot No. 92/1951.
4 Aramby Reserve nursery.	Do.	..	13	13 0	8 5	4 2	Year of planting Not traceable.

89. *Cinnamomum camphora—Experimental plot No.* 92/51 *of South Coimbatore.*—Two hundred *Cinnamomum camphora* seedlings were planted in 1946 in Experimetal ground No. 339/46 of Topslip at an espacement of 6′ × 6′ in the open (without top canopy). The Annual Report for 1949–50 had already indicated that the species can grow better in the open than under shade and that in Wynaad and Topslip it can grow to 72 inches height in seven years and 42 inches height in three years respectively.

Experimental ground No. 339/1946 was converted into experimental plot No. 92/1951 of South Coimbatore and 49 seedlings were selected at random and labelled for height measurements. Now there are 48 labelled plants with a mean height of 8 feet 3 inches. The plot is reported to have suffered from a ground fire on 1953–54. Hence lesser mean height in 1953–54. The teak poles, introduced originally in the casualty stakes require to be removed for the benefit of the *Cinnamumom camphora.*

The following data shows the development of height growth of the plants :—

TABLE XXI.

Year.	Number put in.	Number surviving.	Mean height.
			INCHES.
1952	200	99	85·7
1953	200	99	91·5
1954	200	98	79·7
1955	200	97	99·0

90. *Cinnamomum zelyanicum.*—Experiments to study the growth and silvicultural requirements of the species were continued during the year under report. The results are furnished below :—

TABLE XXII.

Research centre.	Experimental plot or experimental ground number.	Sandy variety. Survival per cent.	Sandy variety. Height in feet.	Laterite variety. Survival per cent.	Laterite variety. Height in feet.
Kannoth (all one year old transplants).	Experimental plot No. 75/40.	75	20	..	..
Do.	Experimental plot No. 76/40.	..	..	57	18
Do.	Experimental ground No. 237/1950.	70	8½	..	..
Do.	Experimental ground No. 238/1950.	..	..	50	9
Do.	Experimental ground No. 269/1951.	60	5½	..	..
Do.	Experimental ground No. 271/1951.	..	..	76	5

There seems to be no difference in the rate of growth between the sandy variety and the laterite variety at Kannoth.

It is understood that in Ceylon the plants are cut at the fourth year near ground level and the bark is collected from shoots when they are two years old. It is proposed to collect bark from Wynaad and South Kanara for analysis at Dehra Dun.

Comparison experiments on the best method of raising the species started already in Kannoth were continued during the year. The results are given below :—

TABLE XXIII.

Centre.	Experimental ground.	Transplants. Survival per cent.	Transplants. Height.	Stumps. Survival per cent.	Stumps. Height.	Cuttings. Survival per cent.	Cuttings. Height.
			IN. FT.		FT. IN.		FT. IN.
Kannoth.	241/50 sandy.	50	9 0	57	10 0	40	9 7
Do.	242/50 laterite.	33	8 8	47	9 7	30	9 4
Do.	256/51 sandy.	43	4 0	47	3 0	23	4 0
Do.	257/51 laterite.	57	4 6	33	4 0	20	4 0

The indications are that both transplants and stump plants come up well with a survival per cent of 45 and a height of 9 feet to 10 feet in two years. There does not seem to be much difference in growth or survival per cent between the sandy and laterite varieties although the figures for laterite varieties are slightly lower than for sandy variety.

In paragraph 70 of last year's report it was stated—

"In the initial stages, i.e., till the plants reach an average height of about 15 feet, a overhead canopy is beneficial. When the plants have reached a height of 15 feet to 20 feet, admitting full overhead light seems to encourage growth and development of the plants."

The results of the above four experiments indicate that the species can thrive very well in the open attaining a height of 9 feet to 10 feet in five years, whereas under canopy manipulation a height of 18 feet to 20 feet was attained only in 15 years.

91. *Underplanting of Cinnamon in teak plantations.*—For the first time an experiment on the use of *Cinnamomum zeylanicum* (sandy variety and laterite variety) as an underplant in teak plantations was started in Kannoth and Topslip and Nilambur.

The results obtained are tabulated below :—

TABLE XXIV.

Item number.	Name of centre.	Locality under planted.	Planting material used.	Survival.	Height growth.
1	Nilambur sandy variety.	Experimental plot No. 188 of 1954 in 1924—R.A. (plantation 30 years old).	Seedlings two years old.	Nil.	..
			Stumps of two years old plants.	Nil.	..
2	Topslip sandy variety.	Experimental Ground No. 487 of 1954 in 1937—R.A. (i.e., plantation—17 years old).	Stumps of two years old seedling.	24/60 Sprouting Survival in February 2/60.	
				PER CENT.	
3	Kannoth sandy variety.	Experimental Ground No. 301 of 1954 (Teak Preservation Plot of 1876—78 years old).	50 sowing	2	.. 6"
			50 transplants	60	.. 2½'
			1 year old 50 stumps.	38	.. 9"
4	Kannoth laterite variety.	Experimental Ground No. 302 of 1954 (Teak Preservation Plot of 1876—78 years old).	Sowing 50	6	.. 6"
			Transplant 50	76	.. 2½'
			Stumps 50	44	.. 9"

Item number.	Name of centre.	Locality under planted.	Planting material used.	Survival.	Height growth.
5	Begur sandy variety.	Experimental Ground No. 449 of 1954 in 1924 (Teak plantation—Age 30 years).	The plots were accidentally burnt and so results are not furnished.		..
6	Begur laterite variety.	Experimental Ground No. 450 of 1954 in 1924 (Teak plantations—Age 30 years).			

The seedlings for the experiment at Topslip and Nilambur were obtained from Wynaad. It appears that due to an interval of four days in transit and due to unavoidable damage in transit, the survival per cent of both stumps and transplants, were poor. In the teak preservation plot of Kannoth (age 78 years) one year old transplants have given 60—76 per cent survival and height growth of 2½ feet— 2½ feet for sandy and laterite varieties respectively.

Planting one year old seedlings will be tried once again in the the failed experimental plot 188/54 of Nilambur and experimental ground 487/54 of Topslip during the current year. The seedlings in the Kannoth plot will be kept under observation.

The preliminary indications are that it is possible to raise a crop of *Cinnamomum zeylanicum* as an under crop in teak plantations transplants of one year old seedlings give significantly better survival per cent and height growth than stumps of one year old plants. The results of direct sowings cannot be evaluated as it appears that only about ten seeds were sown in each patch and this number is inadequate in view of the low germinative capacity of the species. Also the seed is liable to lose its viability quickly and it may be that the seed had lost its viability by the time the seeds were sown.

92. *Introduction of Cinnamomum zeylanicum (laterite variety) as an under plant in evergreen forests.*—This was tried for the first time during the current year at Topslip (Experimental Ground 498/54 two years old seedings; and Experimental Ground 500/54 stumps of two-year old plants). In each of these experiments there are two treatments, viz.,

A—Removing the shrubby growth only and planting.

B—Removing middle storey and shrubby growth and planting.

The results at the end of the year are furnished in the following statement :—

TABLE XXV.

	Treatment.	*Survival.*	*Height.*
Experimental ground 498/54 seedlings.	Shrubby growth only removed.	24/30	Top dried but will sprout again.
	Shrubby growth and middle storey removed.	13/18	....
Experimental ground 500/54 stumps.	Shrubby growth only removed.	4/30	Three inches to four inches high.
	Shrubby growth and middle storey removed.	1/18	

Except that seedlings give a higher percentage of survival than stumps, no other conclusion can be drawn. The experiments will be watched.

Introduction of Cinnamomum zeylanicum (sandy variety) by stumps and seedlings as an underplant in Karianshola evergreen forests.—After removing shrubby undergrowth in Experimental Ground 501/54 two-yearold transplants and stumps from two-year old plants were tried at an espacement of 12′ × 12′. Due to paucity of stocks there were only 12 plants for each treatment. The results at the end of the year were as follows :—

Transplants—Survival—11/12 ; height—Top dried and so not measured.—Stumps—Sprouting—Nil.

93. *Copernicia cerefera* (*Carnuba wax palm*).—Experiments on this species were continued in Topslip, Dhoni, Begur and Kannoth. The following seedlings of previous years exist :—

(i) *Topslip.*—Two seedlings of 1951 in the premises of Research Forester's Quarters. There is a stem of three inches high above ground with leaves similar to young palmyra leaves.

(ii) *Dhoni.*—Eighteen seedlings were put in, in 1953, in the Dhoni deciduous garden. Now only seven seedlings survive. There is no stem above ground but only a few leaves for each plant.

(iii) *Begur.*—Seeds sown in 1953–54 in bamboo tubes. Twelve seedlings were obtained and these were planted out in Kannoth and Begur in 1954–55. All died except one plant in Kannoth. During 1954–55, 48 plants were raised in baskets in Dhoni ; 20 basketed plants were planted in Topslip deciduous garden ; 28 were planted in Dhoni. Seven in Dhoni and seventeen in Topslip survive.

All the above plants will be kept under observation.

94. *Dalbergia cochinchinensis—Experimental Ground* 378/50 *of Palghat.*—Twenty-one entire transplants of mean height 8 inches, put in Dhoni deciduous garden, in 1950 are growing up well. In 1955 there were sixteen survivals out of twenty-one with a mean height of 16 feet. The further growth and development of the species is under observation.

95. *Dalbergia sissoo* (sissu).—This is indigenous to the sub-Himalayan tract and the Gangetic plains. It is a good cabinet and furniture timber. This species comes up easily in all the plains districts of the State and also in sandy areas in the coastal districts. This is best raised by transplants of one year old. The species attains a mean height of 28·7 feet in seven years. Large quantities of seeds of this species were procured during the year and supplied to all District Forest Officers in the State.

96. Experiments with this species were continued in Begur, Top slip, Dhoni, Denkanikota and Bennari. Transplanting one-year old seedlings with or without a kumri crop such as Ragi (*Elucine coracana*) or Thenai (*Setaria italica*) or horsegram (*Dolichos biflorius*) appears to be the best method of raising the species. Transplanting two-year old plants and stump planting of one year, two years old plants are also successful.

Experimental Ground 369/50—*Begur.*—4½ feet high with 75 per cent survival in five years (one year old transplants).

Experimental Ground 416/52—*Begur.*—1¾ feet with 35 per cent survival (with two-year old seedlings—transplanting.

Experimental Plot 181/52—*Dhoni.*—One-year old stumps of diameter ·3 inch to ·8 inch, gave 90 per cent survivals and average height of 81 inches in three years.

Experimental Plot 198/53—*Dhoni.*—One year old stumps of diameter ·3 inch to ·5 inch gave 80 per cent survivals and average height of 5 feet in two years.

Experimental Ground 460/53—*Topslip.*—One-year old transplants gave 63 per cent of survival and an average height of 50 inches in two years.

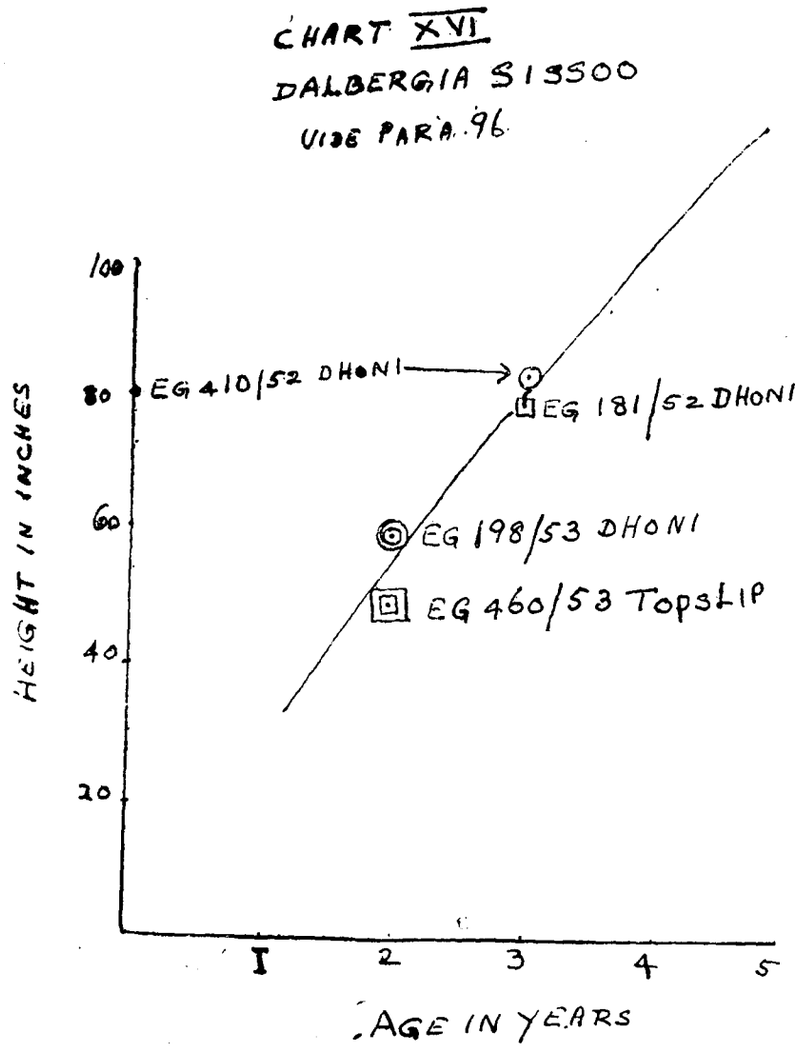
Experimental Ground 410/52—*Dhoni.*—Comparison of (i) sowing seeds, (ii) transplanting of seedlings 15 inches–20 inches high and (iii) stump planting (·3 to ·5 inch diameter) showed the following results :—

Sowing—27 per cent survival and 78 inches high in 1954.

Stumps—27 per cent survival and 82 inches high in 1954.

Transplanting—22 per cent survival and 84 inches high in 1954.

Direct sowing in situ can be done in areas with climate similar to Dhoni.



Denkanikota Experimental Grounds 61/47 *and* 62/48.—The object of the experiment was to regenerate the fire burnt lantana area with *Dalbergia sissoo* by means of stump plants and transplants. The results are very encouraging. There is no significant difference between stumps and transplants. It can grow to a height of 25 feet in six years.

This is one of the most useful species in reafforesting areas where lantana has invaded and suppressed all other vegetation. Seeds of this species has been procured from the Hosur Cattle Farm and supplied to almost all District Forest Officers in the

State for being introduced in the Conservator's plots. The results are generally quite satisfactory.

97. *Eucalyptus species.*—There are over 300 species of this genus of aromatic evergreen trees, which are natives of Australia. Attempts have been made during the last several years to introduce some of the economically important species in suitable localities in Madras. During the year, seeds of the following species were obtained and tried :—

1 *Eucalyptus camaldulensis* (*Syn. E. rostrata*).
2 *Eucalyptus gomphocephala.*
3 *Eucalyptus patens.*
4 *Eucalyptus rudis.*
5 *Eucalyptus redunca.*
6 *Eucalyptus marginana.*
7 *Eucalyptus diversicolor.*
8 *Eucalyptus saligna.*

98. *Eucalyptus* globulus which was introduced in the Nilgiris in the year 1843 has acclamatized iteself and it grows very well in this locality. The oldest plantation now existing was raised in 1863. *Eucalyptus citriodora* comes up in medium elevations (5 000 feet) and also at low elevations (1,000 feet). *Eucalyptus rostrata* (hybrid variety) comes up very well in all plains districts and also in sandy soil in the coastal districts. The various species of *Eculyptus* will be dealt with in the alphabetical order of their specific names. There was considerable difficulty in securing seeds of these species for trials and every effort is being made to secure these seeds for future trials.

99. *Eucalyptus citriodora.*—At present only the leaves of *Eucalyptus globulus* are distilled on a commercial scale for the production of *Eucalyptus* oil. It is believed that the leaves of *Eucalyptus citriodora* contain a valuable essential oil which is more valuable than *Eucalyptus* (*globulus*) oil for trade purposes. There is a project for analysis of the leaves by the Forest Research Institute, Dehra Dun. Leaves collected from the trees in Sims Park, Coonoor, have been forwarded to Forest Research Institute for analysis along with samples of bark and sample of wood also. The results of analysis by Forest Research Institute will be furnished in the next year's report.

Eucalyptus citriodora —(i) *Begur Experimental Ground* 462/54.—Hundred tubed plants were planted at an espacement of 9 feet × 9 feet on 8th July 1954 in one foot cube pits. By June 1955, there were 66 per cent survivals with an average height of 4 feet and a maximum hieght of 8 feet.

(ii) *Begur Experimental Ground* 456/54.—This is a comparison experiment between direct sowings at ten seeds per stake and planting tubed plants 3 inches–4 inches high (i.e., plants raised in bamboo tubes). The seeds were sown on 7th June 1954 and transplants

were planted on 14th June 1954. Observation in June 1955 showed 10 per cent survivals for sowings as against 67 per cent survivals for tubed plants. The average height of tubed plants is 6 feet with maximum height of 10 feet as against 3 feet average height for sowings.

(iii) *Dhoni Experimental Ground* 456/54.—Naked seedlings of 3 feet 6 inches high were got from Benneri Nursery to Dhoni and put in bamboo baskets in June 1954. The seedlings were planted in July 1954 at 9 feet × 9 feet espacement in deciduous research garden. In June 1955, there were 20 per cent survival with an average height of 3 feet 6 inches and a maximum height of 6 feet. Considering that the seedlings had the shock of transport from Benneri to Dhoni prior to basketting, the seedlings were not as vigorous as could be excepted.

(iv) *Topslip Experimental Ground* 491/54.—Seeds were sown in bamboo baskets in July 1954. When the seedlings were 3 inches—6 inches high in September 1954, they were planted out at 9 feet × 9 feet espacement, in 100 stakes. In February 1955 the survivals are 91/100 and the average height is 38 inches and maximum height 64 inches.

The preliminary indications are that *Eucalyptus citriodora* can be successfully grown in all the above research centres and that it has rapid height growth of an average of 6 feet in one year (maximum up to 12 feet) if tubed plants are used.

100. *Eucalyptus globulus (bluegum).—Eucalyptus globulus* was first introduced in Nilgiris in 1843 by Captain Cottan of the Madras Engineers. The first European settlement dates back to 1820, and thereafter the regular cutting of the sholas in the Nilgiris for fuel led to an acute scarcity of fuel. This led to the discovery of suitable Australian exotics for the Nilgiris. The pride of place for early naturalization of an Australian species in this country goes to bluegum. From 1856 extensive areas were planted with bluegum as it solved the fuel problem. At present there is a scheme to plant bluegam on parts of the Wenlock Downs on a very extensive scale. Bluegum is now worked on a coppice rotation of fifteen years for three successive rotations after which the area is replanted with seedlings. With increase in area and the importance it has assumed, research on various directions has become necessary.

101. *Eucalyptus globulus—Tree increment plot* 1 *of Aramby Shola.*—The tree increment plot at Aramby, which was formed out of the oldest *Eucalyptus globulus* plantation of 1863, was maintained. The trees are now 92 years old. The tallest tree was 242 feet high in 1951, probably the tallest tree in peninsular India. The mean girth of the trees is 10 feet 11 inches at age 91 years in 1954.

102. *Eucalyptus globulus—Manurial experiment—Experiment Plot* 25/54—*Ootacamund.*—This was started in 1954 to ascertain whether the growth of the plants can be accelerated by the addition of fertilizers. There were two treatments—

A—Control—No manure.

B—2 oz. manure added to each plants.

The results are being watched.

103. *Grevellia robusta* (*Noganur Reserve Forest, Salem North Division*).—There is a plantation of *Grevellia robusta* raised in 1947. The average height growth is 50 feet and the mean D.B.H. is 21 inches. Within the plot there are scattered paper Mulberry trees of size 50 feet high and 20 inches D.B.H. There are also a few *Melia dubia* trees of size 50 feet high and 22 inches D.B.H. The growth of the three species is remarkably good. Paper Mulberry seeds profusely and natural seedlings are found.

Melia dubia is best raised by transplanting four to eight months old seedlings. It can reach a height of 25 feet in two years.

104. *Hypheni thebaica* (*Dumbnut*). —At present the following seedlings are available in the Research Centres :—

Topslip.—One seedling in the nursery (seed sown in 1949). There is no stem above ground but leaf is 20 inches long.

Dhoni.—Three seedlings in 1949 nursery. Stem above ground is just forming. Leaf 12 inches long.

Begur.—Eight seedlings out of 1952. Sowings are available in Begur Nursery. There is no stem above ground. The leaves are 2 feet long.

During the current year, a fresh supply of seeds was obtained from Cairo (Egypt) and seeds were sown in December 1954 in the different centres. The results are furnished below :—

Topslip.—Four seeds sown in bamboo tubes. All the four seeds germinated and they have been planted out in the Research Forester's quarters.

Dhoni.—Two seeds germinated out of four sown in baskets. These will be planted in the nursery adjacent to Range Quarters, Olavakkot, and watched.

Begur.—Two seeds out of four germinated in the nursery after a couple of months. The seedlings will be transplanted in the Research Nursery and results watched.

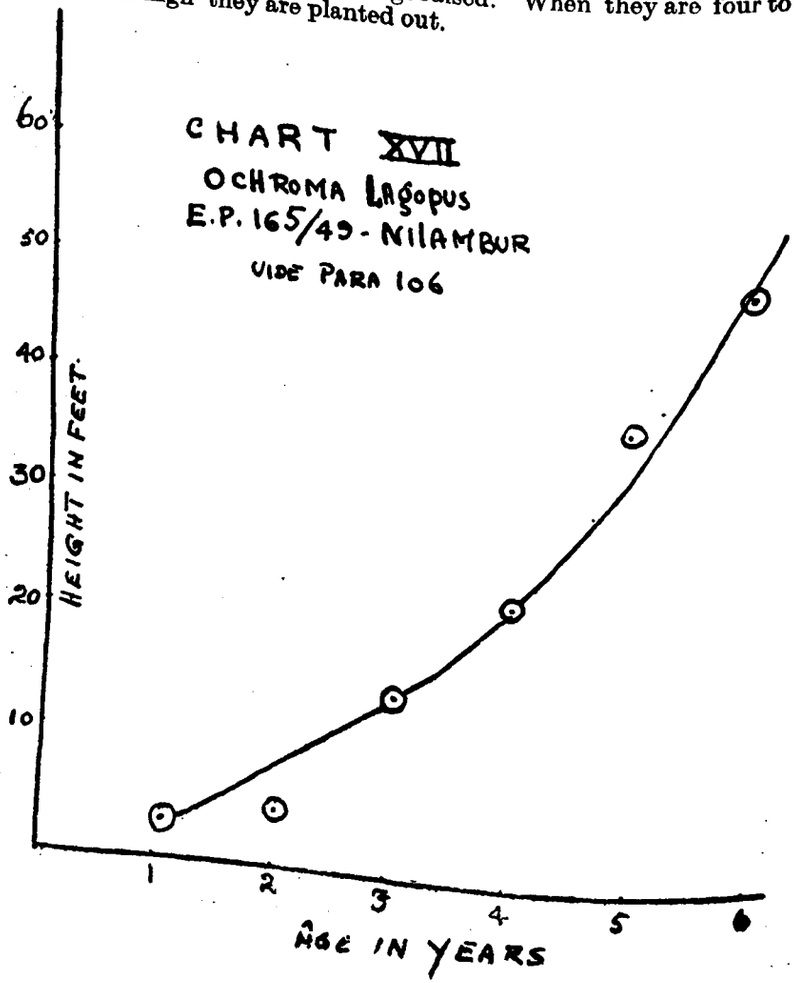
105. *Morus alba* (*Mulberry*). -This is probably a native of China. This has been cultivated extensively in irrigated plantations in the Punjab where the wood is used in the Sports Goods Industry.

According to research experiments carried in Madras in previous years the best method of raising the plant is by transplanting one year old plants.

During the year, seeds were obtained from the Sericultural Expert Kollegal, and supplied to District Forest Officers, Vellore East, Vellore West, Salem South, Coimbatore South, Madurai West, and Salem North Divisions for raising plantations

106. *Ochroma lagopus* (Balsa).—This is a tree which is a native of tropical America. It has an extremely soft light wood much used in air craft manufacture Wood of this species was sent to the Hindustan Aircraft, Limited, Bangalore, for trials. It was found that the density of the wood is 12–13 lb. per cubic foot For air craft manufacture, wood with a density of 7 to 8 lb. per cubic foot is required. Hence the trees in the plantations have to be thinned so as to promote rapid growth with consequent lower density.

The best method of raising this species is through planting out with containers (bamboo tubes) The seeds are sown in bamboo tubes filled with earth and seedlings raised. When they are four to nine inches high they are planted out.



107. *Ocimum camphora* (*Syn. Ocimum Kilimanjaricum*).—This species was tried in Topslip, Dhoni Begur and Kannoth centres. In Kannoth, due to heavy showers, the seeds were washed away and the following results are from the other three centres only.

During the year, a plot of ½ acre was divided into two sub-plots. In one, the existing growth was clearfelled, burnt and seeds of Ocimum camphora sown broad cast at the rate of 2 lb. per acre and at the same time teak stumps were put at an espacement of 6 feet into 6 feet. In the other sub-plot, the same treatment was given with the addition of hoeing the soil to a depth of 3 inches before broad cast . Sowing of seeds and teak stumps were put in. Raking of soil before sowing increases the yield of leaves by about two to there times. Hence raking of the soil prior to sowing is distinctly beneficial.

In all the centres, the *Ocimum* plants have come up luxuriantly to a height of 3 feet to 5 feet and smothered the growth of teak plants. Hence sowing *Ocimum* in the year of plantations does not appear to be beneficial. Experiments in 1955–56 will therefore be done in one year old teak plantations where the teak plants are about 6 feet height and so will be free from suppression by a thick growth of *Ocimum* plants.

Plucking of the leaves was done thrice during the year (August, November and March) . The leaves plucked were separately graded as mature and tender and after drying they were sent to Dehra Dun for analysis. The ngures are furnished below for all the three pluckings taken together :—

TABLE XXVI.

Serial number.	*Research centre.*	*Mature leaves or tender leaves.*	*Green weight per acre in lb.*	*Dry weight per acre in lb.*	*Total distillate in dry weight in lb.*	*Percentage of camphor in total distillate.*	*Percentage of camphor on dry weight of leaves.*
			I. Seeds sown after raking the soil.				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Topslip.	Mature.	14,050	1,893	5·11	40 to 50	2·3
2	Do.	Tender.	3,920	710	6·48	per cent	2·9
3	Dhoni.	Mature.	3,920	590	3·96	in all	1·8
4	Do.	Tender.	960	180	4·87	cases.	2·2
5	Begur.	Mature	3,736	716	3·65		1·6
6	Do.	Tender.	1,444	284	4·63		2·0
			II. Seeds sown without raking of the soil.				
1	Topslip.	Mature.	15,230	2,150	4·76		2·2
2	Do.	Tender.	4,320	700	5·97		2·7
3	Dhoni,	Mature,	1,120	200	4·33		1·9

II. Seeds sown without raking of the soil—cont.

Serial number.	Research centre.	Mature leaves or tender leaves.	Green weight per acre in lb.	Dry weight per acre in lb.	Total distillate in dry weight in lb.	Percentage of camphor in total distillate.	Percentage of camphor on dry weight of leaves.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
4	Dhoni.	Tender.	480	80	4·88	..	2·2
5	Begur.	Mature.	2,032	392	3·69	..	1·6
6	Do.	Tender.	824	140	4·74	..	2·1

NOTE.—Begur figures are ignored for analysis of the total yield of leaves as due to vagaries of climate at the time of sowing or for other reasons, the crop was not quite good. In Topslip, the raked plot and the unraked plot were one above the other in a hill slope. Hence they were not comparable and hence results cannot be analysed for raked and unraked plots separtely.

From the above, it is clear that the yield of leaves is greater at higher elevation (Topslip 2,500 feet, Dhoni 400 feet). In Topslip, the yeild of dry leaves per acre for all the three plucking for both tender and mature leaves was 18,000 lb. In Dhoni the yield for both tender and mature leaves for all the three pluckings in the raked plot was only 4,900 lb.

The yield of camphor from the leaves is greater from tender leaves than from mature leaves as noted below :—

TABLE XXVII.

Centre.	Particulars of soil working.	Tender leaves.	Mature leaves.
(1)	(2)	(3)	(4)
Topslip	Raked	2.9	2.3
Do.	Unraked ..	2.7	2.2
Dhoni	Raked	2.2	1.8
Do.	Unraked ..	2.2	1.9
Begur	Raked	2.0	1.6
Do.	Unraked ..	2.1	1.6

The dry weight of *Ocimum* leaves is about one-fifth to one-sixth of the green weight.

The percentage of camphor on dry weight of leaves is greater in Topslip than in Dhoni. Hence there is reason to believe that camphor content of leaves at higher elevations is larger ; but this is not supported by the figures given for Begur alone. Further observations are therefore necessary.

One acre of *Ocimum camphora* will yield about 18,000 lb. of mature and tender leaves (green weight) yielding 3,300 lb. of air dried leaves As per the analysis conducted by the Officer-in-charge, M.F.P. Branch, Forest Research Institute, Dehra Dun, the percentage of total distillate (0 misture basis) varies from 4 to 6. Of this total distillate the camphor content is 40 to 50 per cent. So the camphor content in the air dried leaves is of the order of 2·5 per cent or one acre yielding, 3,300 lb. of air dried leaves will yield on distillation, about 82·5 lb of camphor.

During the year 1954–55, the leaves were plucked by hand singly differentiating between tender and mature leaves. This kind of plucking was extremely expensive and it will not be possible to justify commercial exploitation on these lines. It has therefore been decided for the year 1955-56 to pollard the plants at a height of 1 or 2 feet above ground level and utilise all the pollarded leaves without any differentiation being made between tender and mature leaves. This will result in a considerable cheapening of the process of collection of the leaves.

The cost of cultivation if undertaken on a large scale will be about Rs. 20 per acre. The cost of collection of leaves by the pollarding method will be about Rs. 10 per acre. The cost of distillation of 80 lb. of oil on a cottage industry basis will be Rs.100 at Re. 1–4–0 per lb. of camphor (10 annas per lb. of total distillate being the rate furnished by the Officer-in-charge, M.F.P. Branch, Forest Research Institute). Hence the total cost of production of 80 lb. of camphor will be Rs. 130 or the rate per lb. will be Rs. 1–10–0. The ruling price of camphor at present is about Rs. 4 per lb. and hence it is believed that the cultivation of Ocimum camphora and distillation of the leaves for camphor on a cottage industry basis is commercially profitable. Experiments on improved methods of cultivation and harvesting of the leaves of Ocimum camphora are in progress during the year 1955–56 and further indication will be furnished in the next Annual Report.

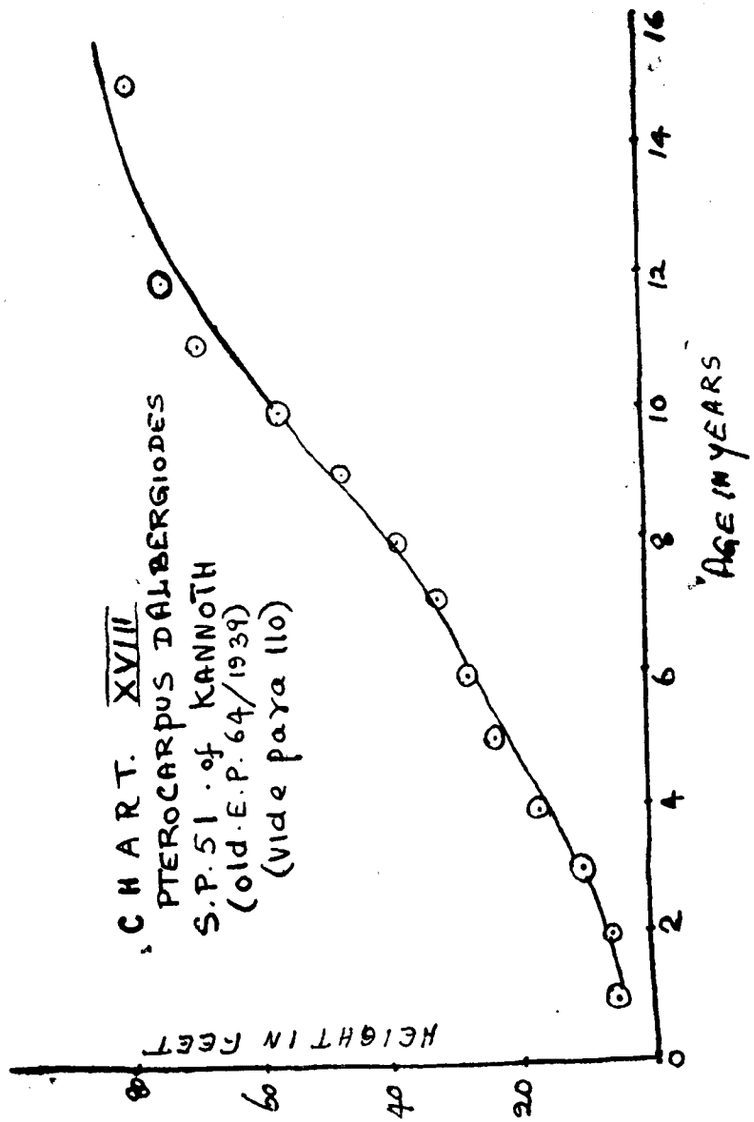
108. *Pinus caribæa* (Slash Pine).—A tree of the sub-tropical regions of the U.S.A., Cuba, Honduras, growing at low elevations and showing best growth in moist low-lying ground. The tree yields a high grade of resin.

Seeds were obtained from British Honduras and tried in the Research Centres of Begur, Chandanathode and Ootacamund.

109. *Pinus tædæ* (Loblolly Pine).—This is a native of Southern and Eastern U.S.A. It yields timber for general purposes and is sometimes tapped for resin, seeds are being obtained for trials in the following year.

110. *Pterocarpus dalbergiodes*.—In paragraph 67 of last year's report it was stated that the species could be raised successfully in Kannoth where it has attained the height of 82 feet in twelve years. This is based on the results in experimental Plots 64/39 and 82/41.

In order to collect further data regarding the growth and development of the species at Kannoth sample plot No. 51 has been formed in 1954 with an area of 0·75 acre in experimental plot 64/39.



Dhoni centre experimental plot 189/52.—There were only eight survivals out of fifteen fifth mean height of 4 feet in three years.

Kannoth experimental ground 309/54.—Two year old seedlings were transplanted in Kannoth where it has been given 56 per cent survival and a height of 4 feet in one year excluding two years in the nursery.

One-year old seedlings of *Pterocarpus dalbergiodes* is available at Dhoni and Topslip. These will be planted during the current year and results watched.

Topslip experimental ground 459/53.—Owing to damage by browsing by wild game no results are furnished.

Fresh seeds will be obtained from Andamans and further trials will be made with the species at Topslip, Nilambur, Begur and Kannoth.

111. *Willows.*—The Salix babylonica plot in double crossing has been maintained out of 82 cuttings planted in 1936, there are now only nine with an average height of 33·9 feet and a mean D.B.H. of 12·9 inches. The statement below shows the rate of growth of the trees since 1944 :—

TABLE XXVIII.

Year.	Age in years.	Survivals.	Mean height in feet.	Mean D.B.H in inches.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)
1936	0	82	..	..	Forest planting.
1944	8	12	15·8	4·8	Do.
1947	1	12	23·3	8·1	Do.
1950	14	11	30·2	11·5	Do.
1951	15	10	29·9	12·2	Do.
1954	18	9	33·9	12·9	Do.

(c) *Bamboos and canes.*

112. *Dendrocalamus strictus.*—Experimental plot 71/1937 of South Coimbatore was started in 1937 to find out the best method of raising *Dendrocalamus strictus* after clearfelling and burning a poor mixed deciduous forest of poor quality, for the purpose of intensive working when mature. The plot had been severally damaged by elephants and at present there are only 11 survivals with an average height of 2.5 feet. The survivals are low and not suitable for statistical analysis. This plot is proposed to be closed.

Experimental plot 84/1940 of South Coimbatore was started as an experiment to raise *Dendracalamus strictus* with a ponam crop of ragi (*Eleusine coracana*) in a poor mixed deciduous forest. One year old Rhizomes were planted at 9′ x 9′ espacement. Due to heavy and repeated damage by elephants, there are only fifteen survivals with a mean height of 19 feet after ten years. The experiment is proposed for closure.

113. *Bambusa arundinacea.*—Experimental plot 85/1941 of South Coimbatore was started in 1941 to raise the species with a taungya crop in a deciduous forest of good quality. Bamboo has grown to a mean height of 30 feet with an average of 22 culms per clump. This result may be considered fairly satisfactory.

114. *Introduction of canes.*—In view of the importance of artificial regeneration of local canes in this State, nursery experiments were conducted in Begur, Chandanathode and Kannoth of Wynaad

and Dhoni and Topslip of Nilambur Research Range. Seeds of *Calamus rotang, Calamus pseudotenuis* were obtained from South Kanara and sown under 'A' test. The results showed conflicting results. While *Calamus rotang* germinated well in Chandanathode and Begur only, *Calamus pseudotenuis* germinated well in Dhoni and Topslip. The trials will be repeated again in the coming years.

	Seed weight.	*Germinative capacity.*	*Plant.*
	PER OZ.	PER CENT	PER CENT
Calamus rotang	25—50	50	50
Calamus pseudotenuis	60—80	6	6

The seedlings are now small with three or four radical leaves without the formation of a stem. These will be planted out with balls of earth in adjoining evergreen sholas and the development of the seedlings will be watched.

115. *Calamus scipionum.*—Seed wieght 93—100 per oz. There was no germination at all.

(*f*) *Medicinal plants.*

116. *Rauwolfia serpentina.*—This is a small shrub found in the forests of the Western Ghats. The roots of this species are used as tonic febrifuge and as a specific remedy for high blood pressure.

This species has acquired very great importance in the recent years for the medicinal value of the root of the plant. Two varieties are said to occur; but only one variety whose root section shows a central white core surreunded by a slightly brown tissue is commonly found in Nilambur. The other variety with a complete white root section is also found occasionally. It is believed that botanically there is no difference between the two. The species is found in the districts of Coimbatore, Malabar, South Kanara and Salem in deciduous forests and teak plantations up to 2,000 feet. The roots are collected in the months from May to December.

In Madras State forests, the plant occurs generally at elevations below 1,500 feet. Approximately one acre may contain ten plants and the roots of 50 plants will roughly yield one lb. of dry roots or one acre of forest will yield 1/5 lb. of dry root. Including private forests of Malabar, there are about 1,000,000 acres of forests which will yield 200,000 lb. annually. The maximum practical yield may be taken as one-fourth of the potential yield. Hence the sustained annual yield in practice may be about 50,000 lb.

117. It is used as an ingredient in very small quantities in the preparation of Ayurvedic medicines, but this quantity is negligible when compared with the quantity exported.

Almost the entire production is exported and the species has almost come to a stage of extinction. Knowing the importance of

the species Union Government has prohibited the export of the dried roots of *Rauwolfia serpentina.* In order to enable the Customs authorities to identify the dried root and enforce the prohibition of export the State Silviculturist, Ootacamund, had forwarded samples of dried roots to all Customs Officers in the country. Herbarium specimens also will be perpared and sent to them.

118. During 1955–56, the species will be raised experimentally in several divisions including South Kanara, Malabar, Wynaad, Nilambur, Palghat, Nilgiris, Coimbatore South and Tirunelveli. In the research gardens also, experimental planting is being done under several conditions and valuable data is being collected in the best method of artificially regenerating the species.

119. *Underplanting of* Rauwolfia serpentina *in teak plantations.*—Garden experiments were carried out in Begur and Kannoth centres to find out whether this species can be raised as an underplant in teak plantations.

Experimental ground.

Kannoth E G. No. 314 *of* 1954.—Here underplanting was done in teak permanent preservation plot aged 79 years. The survival here was only 27 per cent in September 1954 and this dwindled down to 5 per cent in June 1955. The species was raised up shoot cutting.

Begur E.G. No. 463 *of* 1954.—This is located in sample plot 36 of Begur in 1892 regeneration area, i e, teak plantation, aged 62 years. Here *Rauwolfia serpentina* was put in as root cuttings and shoot cuttings with root attached. Here the percentage of survival was 90 per cent in October-November 1954 and this gradually fell down to 57 per cent in June 1955. The heavy casualities in Kannoth are due to the inliability of the seedlings to withstand the heavy drip drip in the early periods and the dry conditions in the later stage. In Begur it has come up better with 57 per cent survival at the end of the hot weather.

120. *Raising* Rauwolfia *by shoot cuttings—Experimental Ground* 297/53, *Kannoth and Experimental Ground* 429/53, *Begur.*—This were started with the object of finding out whether it is possible raise *Rauwolfia serpentina* by planting shoot cuttings. At the end of a year there were 71/100 survivals in Kannoth and 96/100 survivals in Begur. The height of the plants was generally 1 feet to 2 feet.

121. *Comparison experiment to find out the best method of raising* Rauwolfia serpentina—*Experimental Ground* 464/54, *Begur.*—This was started with a view to find out the best method of raising the species Direct sowings, shoot cuttings with ½ inch to 1 inch of root

and shoot cuttings without roots, were tried. The results are furnished below :— .

TABLE XXIX.

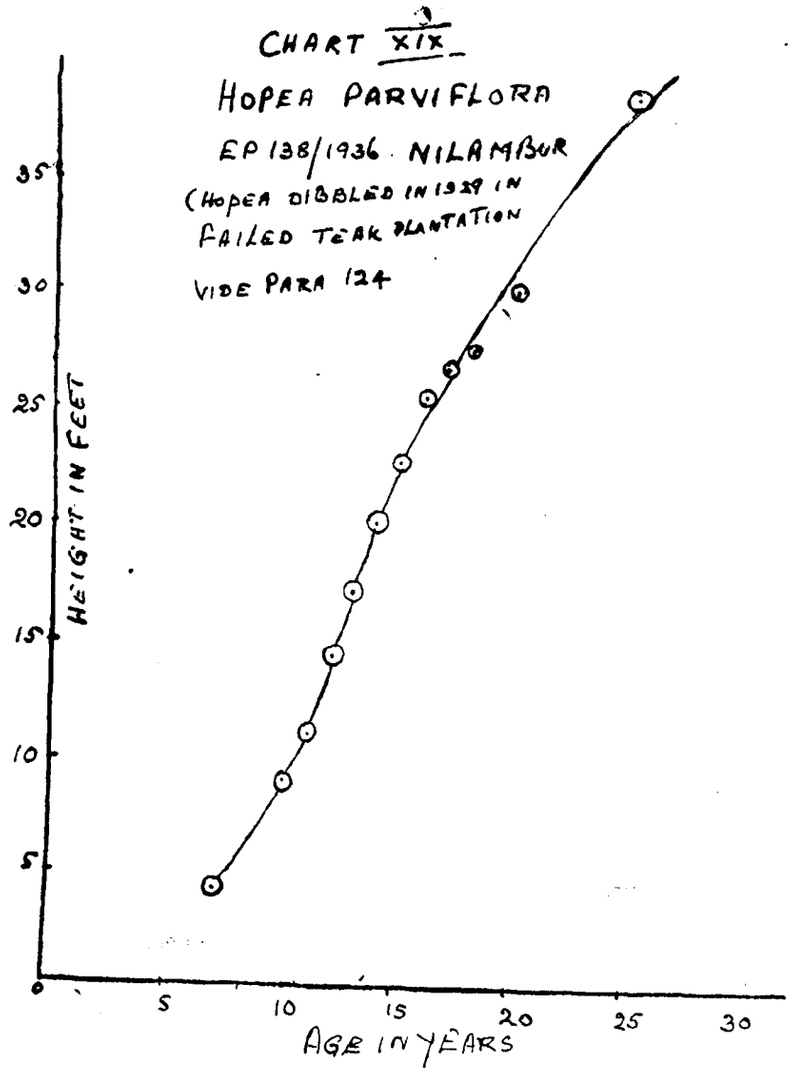
	Number put in.	Number surviving.	Percentage of survival.	Average height. FT. IN.
Direct sowings	30	14	47	1 3
Shoot cuttings with root ..	30	11	37	1 2
Shoot cuttings alone ..	30	7	23	1 2

122. The indications are that the plant can be raised by all the three methods even though direct sowings and shoot cuttings with root attached give significantly better survival per cent than shoot cuttings alone. Comparison with the previous experiment indicates that the plant grows well in the open and does not seem to grow well under a canopy of teak trees.

(vi) RECLAMATION AND AFFORESTATION INCLUDING IRRIGATED PLANTATIONS.

123. *Afforestation of the Nilgiris grass lands.*—The two experimental gardens located at Jacosnullah within the grass lands in Wenlock Downs, were maintained ; but no new experiments were started during the year.

124. *Hopea as an underplant or as an alternative species in a failed teak area.*—Experimental plot 138 of 1936 was started in Nilambur to study the growth and development of *Hopea* in a lateritic soil where teak almost failed. In the 1888, teak plantation, Hopea was introduced in 1929 by dibbling seeds at an espacement of 9 feet × 9 feet. While most of the teak has practically disappeared the *Hopea* plants have grown steadily and at the end of 26 years have an average height of 39·8 feet and the tallest plant is 60 feet. More than 60 per cent of the plants are above 45 feet in height with a girth of 28 inches to 30 inches.



The measurements recorded in 1955 show that the average height was 39·8 feet at the age of 26 years. At present, there are 125 plants in an area of half an acre and a thinning is indicated. A thinning will be done in the following year. The desirability of converting this experimental plot into a sample plot will also be considered after the thinning is done. The indications so far obtained are—

(i) *Hopea* is a very valuable species to afforest a poor ocality particularly where the soil is lateritic ;

(ii) The growth during the first five to ten years is very slow. After the 10th year, the growth is vigorous and maintains steady rate till the fifteenth year. Thereafter it falls down. In other localities, it has been observed that a thinning at this stage results in rapid height and girth increment.

125. *Afforestation of grass land in Chandanathode.*— With a view to find out the best and cheapest method of afforesting grass land at Chandanathode, experiments were started in 1953 and continued in 1954. In 1953, eleven species were tried over an area of two acres, the seedlings being planted in pits at an espacement of $8\frac{1}{2}$ feet $\times 8\frac{1}{2}$ feet. In 1954 the experiment was continued over an area of $5\frac{1}{2}$ acres with six species. The treatment adopted in 1954 was slightly modified. Each plot was divided into two sub-plots and pitted at an espacement of 12 feet $\times$ 12 feet. In one sub-plot grass was scraped to a diameter of 3 feet while in the other no scraping was done.

Species tried in 1953.

Sterculia companulata.	*Sterculia alata.*
Ailanthes malabarica.	*Evodia roxburghiana.*
Pterocarpus dalbergiodes.	*Artocarpus hirsuta.*
Mimosopsis literalis.	*Machilus macrantha.*
Lophopetalum wightianum.	*Mangiferra indica.*
	Vateria indica.

Species tried in 1954.

Vateria indica.	*Ailanthes malabarica.*
Artocarpus hirsuta.	*Mangiferra indica.*
Sterculia companulata.	*Pterocarpus dalbergiodes.*

It is too early to draw conclusions. Further observations will be made in future years.

(vii) TENDING, THINNING, CLEANING, CLIMBER AND WEEDS.

126. *Pruning in teak plantations—Nilambur Centre.*—Experimental Plot 151/38 and Experimental Plot 158/39 were started in Nilambur to determine whether pruning up to the height of a man can reach annually up to the first thinning in a one-year old crop is beneficial or not. In the plot of 1938 unpruned plot showed a better mean height during the latest measurements in 1953 (pruned 40·2 feet high; unpruned 41·69′ feet high), while the reverse was the case in the other Experimental Plot 158/39 (1954 measurements : pruned 39·6 feet ; unpruned 39·1 feet). In the past pruned plots were slightly better in height. There does not appear to be any benefit from pruning as regards height growth.

As regards branchiness in the unpruned plot it is found that the trees can naturally shed their branches in course of time and there is therefore no need for pruning of the trees. The tentative conclusions are that pruning is not beneficial. The experiment will be continued.

Experimental Plot 172/47.—The above experiment was repeated in 1947 in a one-year old teak crop. Judged from the measurements of 1954 the pruned plot showed a slightly better mean height, but the difference was not significant.

Experimental Plot 171/47, *Nilambur.*—The same experiment was repeated, but this was done now in a two-year old crop as compared with one-year old crop in the previous cases. Judged by height growth in 1954, the unpruned plot showed a slightly better mean height, but the difference was not significant. The tentative conclusion noted above is confirmed by the above two experiments, viz., that pruning is not beneficial from the point of view of height growth of the unpruned plants.

As regards branchiness the general observation is that pruning is not necessary and the unpruned plants are capable of natural pruning themselves.

The pruning experiments were repeated in 1954, but this time the experiments were started in plantations of ages ranging from 2 to 6 years, in the centres of Begur, Kannoth, Topslip, Nilambur and Elival (of Palghat Division). The following statement shows the localities where the experiments were started. Only initial measurements have been taken in most cases and so no conclusions are possible. These experiments will be measured and commented upon in future reports.

Pruning will generally have to be done for three consecutive years if it is to be effective and the bole is to be clean. The estimated cost will be Rs. 3 per acre for the first pruning ; Rs. 2 per acre for the second pruning and Re. 1 per acre for the third pruning. The total cost of pruning would be about Rs. 6 per acre and based upon the results so far obtained this pruning at a cost of Rs.6 does not appear to be beneficial.

TABLE XXX.

Teak Pruning Experiments.

Serial number and centre.	*Experimental plot number and year 1954.*	*Regeneration area where located.*	*Age of teak plantation. years.*	*First pruning done on*
(1)	(2)	(3)	(4)	(5)
1 Begur	107	1950 regeneration Garden.	4	9th June 1954.
2 Do.	198	1948 regeneration area.	6	14th July 1954.

Serial number and centre.	Experimental plot number and year 1954.	Regeneration area where located.	Age of teak plantation. years.	First pruning done on
(1)	(2)	(3)	(4)	(5)
3 Begur	109	1949 regeneration area.	5	13th June 1954.
4 Kannoth	115	1949 regeneration area.	5	12th July 1954.
5 Do.	116	1950 regeneration area.	4	Do.
6 Do.	117	1951 regeneration area.	3	20th July 1954.
7 Do.	119	1948 regeneration area.	6	28th July 1954.

TABLE XXXI.

Serial number and Centre.	Experimental plot number and year.	Area of experimental plot.	Regeneration area where located.	First pruning done on.	Age of plantation when pruned.
(1)	(2)	(3)	(4)	(5)	(6)
		ACS.			
1 Topslip ..	94	2	1949	12th February 1955.	6
2 Do. ..	95	2	1950	12th November 1954.	5
3 Do. ..	96	2	1951	4th December 1954.	4
4 Nilambur ..	176	1	1948	May 1954	6
5 Do. ..	177	1	1949	Do.	5
6 Do. ..	178	1	1950	Do.	4
7 Do ..	179	1	1951	Do.	3
8 Do. ..	180	1	1952	Do.	2
9 Dhoni ..	201	1	1952	August 1954 ..	2
10 Do. ..	202	1	1951	Do. ..	3

127. *Teak Plantations, Wynaad—Experiment to find out the best time for first thinning.*—Sample plots 26 to 34 of Wynaad were formed in 1936 in 1931 regeneration area to determined the best time for carrying out first thinnings. There were three treatments as follows :—

(i) First thinning at age 5, sample plots 26, 27 and 34 ;

(ii) First thinning at age 7, sample plots 28, 30 and 31 ;

(iii) First thinning at age 9, sample plots 29, 32 and 33.

Each treatment was replicated thrice. Sample plots 26, 27 and 34 were thinned in 1935 ; sample plots 28, 30 and 31 in 1938 and sample plots 29, 32 and 33 in 1940, and sufficient sample trees were selected and measured. Sample plots 26, 27 and 34 which were thinned in 1936 was given a second thinning in 1941 silviculturally, according to All-India standards. In 1947 sample .plots 26, 27, 29, 32, 33 and 34 were thinned and sample trees measured.

128. The measurements of the sample plots as taken in March 1952 are furnished below :—

TABLE XXXII.

Measurements of 1952 in Teak Sample Plots 6 to 34 of Wynaad.

Sample plot number.	Main crop number of stems per acre after thinning.	Main crop top height in feet.	Main crop average diameter.	Basal area per acre after thinning.	Stem timber volume standing.	Stem timber plus small wood standing plus thinning.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
			INCHES.			
26	198	59	8·0	69·5	420	1,741
27	189	60	8·6	75·5	547	1,766
34	176	61	9·2	79·3	706	2,263
Total ..	563	180	25·8	224·3	1,673	5,770
Average ..	187·6	60	8·6	74·4	557·6	1,923·2
28	193	51	7·9	66·3	282	1,937
30	198	59	8·2	72·2	475	1,968
31	181	61	8·2	66·2	475	2,104
Total ..	572	179	24·3	204·7	1,232	6,009
Average ..	190·6	59·6	8·1	68·2	410·6	2,003
29	163	58	8·1	58·9	321	2,057
32	203	58	7·8	67·6	356	1,989
33	184	59	8·2	68·3	310	1,862
Total ..	550	175	24·1	194·8	987	5,908
Average ..	183·3	58·3	8·0	64·9	329	1,969·3
Comparative statement.						
A—First thinning at age five years.	187·6	60·0	8·6	74·4	557·6	1,923·3
B—First thinning at age seven years.	190·6	59·6	8·1	68·2	410·6	2,003·0
C—First thinning at age nine years.	183·3	58·3	8·0	64·9	329·0	1,969·3

129. Analysis of these measurements show that the thinning at the age of five years yields an average diameter of 8·6 inches in 21 years as against an average diameter of only 8·1 inches and 8·0 inches for first thinning at age seven years and nine years respectively. This trend is being maintained even as regards useful basal area and stem timber volume (standing) per acre.

The conclusion that can be drawn is that the first thinning at the age of five years is definitely superior to first thinnings at age seven years or nine years in the Wynaad plateau.

As per sanctioned Working Plan for the Wynaad Division, the espacement for Begur and Chedleth Ranges is 6 feet × 6 feet and the first thinning is done at age four years or five years according to the quality of the crop.

130. The continuance of this experiment is not necessary; but the sample plots 26 to 34 may be maintained in order to observe periodic volume increment of teak, giving all the plots uniform treatment in future.

131. *Teak plantations—Best intensity of thinning—Wynaad.*— An experiment was started in 1931 regeneration area of Begur in Wynaad Division in 1936, to ascertain the best intensity of thinning to be adopted in teak plantations. Sixteen sample plots 10 to 25, each with an extent of about 0·5 acre were laid out and allotted to four grades of thinning, viz., C grade, D grade, E grade and X grade, as follows :—

C grade sample plots 12, 18, 23 and 25.
D grade sample plots 10, 14, 17 and 24.
E grade sample plots 11, 16, 21 and 22.
X grade sample plots 13, 15, 19 and 20.

The plots were originally marked to a C grade thinning and execution of thinning was re-adjusted as far as was silviculturally possible to make the plots more nearly comparable at the time of formation.

The mode of thinning prescribed at the time of formation for the different grades are as follows :—

C grade thinning will be as defined in the Statistical Code, but slightly lighter than the usual district practice;

D and E grade thinnings will also be carried out approximately as laid down in the Code, but all will be regulated by the removal of a definite percentage of the basal area in each case (say approximately 40 per cent, a 50 per cent and 60 per cent in C, D and E), but actual figures to be determined by trial and (if possible) measurements of some typical district work.

The X grade thinning will approximate to an increment felling. The trees of the future will be selected and marked permanently at the time of second thinning. They will be spaced evenly by eye at about 25 to 30 trees per acre and the trees will be favoured at all stages.

132. In November 1941 thinning was done in all the plots. In March 1947 another thinning was done in all the plots according to the intensities and sample trees measured. The plots were last measured in 1952. The results of the analysis of 1947 measurements are tabulated below since the figures of 1952 measurements are not computed yet. (They are being forwarded to Forest Research Institute for computation now.)

133. *Measurements of* 1947 *for sample plots* 10 *to* 25 *of Wynaad Experiment on different intensities of thinning* :—

TABLE XXXIII.

Intensity of thinning.	*Sample plot number.*	Main crop. *Number of stems.*	Main crop. *Top height.*	Main crop. *Average diameter.*	*Basal area per acre after thinning.*	*Stem timber volume standing.*	*Stem timber and small wood standing and thinning.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			FEET.	INCHES.	SQ. FT.		
C grade	12	275	57	1·2	78·41	215	2,407
	18	244	52	6·5	55·64	53	2,212
	23	388	49	5·9	63·86	36	2,060
	25	359	48	5·7	63·70	..	1,706
Total ..		1,266	206	22·3	259·61	306	8,465
Average ..		316·5	51·5	5·6	64·90	76·5	2,116·2
D grade	10	217	56	7·5	66·99	179	1,835
	14	258	51	6·9	67·47	128	1,725
	17	242	54	7·0	64·49	135	2,059
	24	283	49	6·2	58·33	48	1,550
Total ..		1,000	210	27·6	257·28	490	7,169
Average ..		250	52·5	6·9	64·32	122·5	1,792·7
E grade	11	155	54	7·9	52·74	177	1,575
	16	179	50	7·4	52·93	120	1,427
	21	176	52	7·3	50·85	111	1,505
	22	192	49	7·1	53·28	101	1,499
Total ..		702	205	29·7	209·80	509	5,806
Average ..		175·5	51·2	7·4	52·45	127·2	1,451·5
X grade	13	106	56	8·6	42·58	200	1,185
	15	127	56	8·0	44·40	192	1,331
	19	131	49	7·5	40·47	75	1,157
	20	132	52	7·8	43·94	199	1,382
Total ..		496	213	31·9	171·39	666	5,055
Average ..		124	53·2	7·97	42·85	166·5	1,263·7
		Comparative statement.					
C grade		316·5	51·5	5·6	64·90	76·5	2,116·2
D grade		250·0	52·5	6·9	64·32	122·5	1,792·7
E grade		175·5	51·2	7·4	52·45	127·2	1,499·0
X grade		124·0	53·2	7·9	42·85	166·5	1,263·7

134. *Analysis of the* 1947 *measurements show that*:—

(i) The different intensities of thinning have no appreciable effect on height growth as the top heights are 51·5, 52·5 51·2 and 53·2 for the four treatments;

(ii) heavier grades of thinning give progressively higher diameter increments as noted below :—

C grade—5·6 inches diameter in 16 years.

D grade—6·9 inches diameter in 16 years.

E grade—7·4 diameter in 16 years.

X grade—7·9 inches diameter in 16 years.

(iii) At the end of 16 years, in 1947 the yield of useful basal area decreases as the intensity of thinning increase—as shown below :—

C grade—64·9 square feet.

D grade—64·32 square feet.

E grade—52·45 square feet.

X grade—42·86 square feet.

(iv) At the end of 16 years in 1947, the yield of total volume (stem timber and stem small wood volume) produced to date, is highest for the 'C' grade thinning and lowest for 'X' grade thinning:—

C grade—2,116·2 cubic feet per acre.

D grade—1,792·7 cubic feet per acre.

E grade—1,499·0 cubic feet per acre.

X grade—1,263·7 cubic feet per acre.

This indication is confirmed by similar results obtained in sample plots 120 to 126, referred to in paragraph 146 below.

135. Hence the conclusion can be drawn that heavier thinnings yield progressively more rapid diameter increment; but the total volume production is greatest with an ordinary 'C' grade thinning and lowest with a heavy thinning of the type of 'X' grade.

136. *Teak plantations—Best intensity of thinning—Nilambur.*—As a repetition for the above experiment, sample plots 69 to 86 of Nilambur were opened in 1934 in the 1929 regeneration area of Edacode (second rotation). The object was the same as in the case of sample plots 10 to 25 of Wynaad referred to in paragraph 131 above.

The sample plots were allotted to different grades of thinnings as follows :—

C grade thinning—sample plots 77, 80, 81 and 76.

D grade thinning—sample plots 86, 82, 75 and 71.

E grade thinning—sample plots 74, 83, 73 and 69.

X grade thinning—sample plots 85, 84, 72 and 70.

137. The definitions of the different grades are as for sample plots 10 to 25 of Wynaad (vide paragraph 131).

The first thinning was carried out in 1936. During January-February 1940, the plots were given a second thinning according to the intensities and the sample trees measured. The third thinning was carried out in March 1950. The results of the analysis of 1950 measurements are tabulated below :—

138. *Measurements of* 1950 *of sample plots* 69 *to* 86 *of Nilambur Experiment on different intensity of thinning* :—

TABLE XXXIV.

Main crop.

Intensity of thinning.	*Sample plot number.*	*Number of stems.*	*Top height.*	*Average diametre.*	*Basal area per acre after thinning.*	*Stem timber volume standing.*	*Stem timber and small wood standing and thinning.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			FEET.	INCHES.	SQ. FT.		
C grade	76	179	67	7·8	59·0	261	1,639
	77	175	68	7·1	48·6	156	1,591
	80	174	65	6·9	45·8	158	1,491
	81	182	63	7·4	54·0	207	1,625
Total ..		710	263	29·2	207·4	782	6,339
Average ..		177·5	65·7	7·3	51·8	195·5	1,584·7
D grade	71	124	71	9·2	57·3	528	1,741
	75	128	72	9·0	56·1	563	1,839
	82	150	66	7·3	43·9	..	309
	86	149	60	7·4	44·4	152	1,371
Total ..		551	269	32·9	201·7	1,243	5,260
Average ..		137·2	67·2	8·2	50·4	310·7	1,315·0
E grade	69	79	74	10·0	43·6	532	1,495
	73	93	68	8·9	40·1	300	1,472
	74	118	67	7·7	38·3	136	1,190
	83	112	62	7·7	36·3	161	890
Total ..		402	271	34·3	158·3	1,129	5,049
Average ..		100·5	67·7	8·6	39·6	282·2	1,262·2
X grade	70	87	72	10·0	47·3	565	1,333
	72	98	69	8·8	41·6	336	1,246
	84	112	60	8·3	42·1	282	1,063
	85	101	65	8·5	39·9	291	1,178
Total ..		398	266	35·6	170·9	1,474	4,820
Average ..		99·5	66·5	8·9	42·7	368·5	1,205
		Comparative statement.					
C grade		177·5	65·7	7·3	51·8	195·5	1,584·7
D grade		137·2	67·2	8·2	50·4	310·7	1,315·0
E grade		100·5	67·7	8·6	39·6	282·2	1,262·2
X grade		99·5	66·5	8·9	42·7	368·5	1,205·0

139. Analysis of the 1950 measurements show that—

(i) the different intensities of thinning have no appreciable effect on height growth as the top heights are as below:—

C grade—65·7 feet.

D grade—67·2 feet.

E grade—67·7 feet.

X grade—66·5 feet.

(ii) Heavier grades of thinning give progressively higher diameter increments as noted below :—

C grade—7·3 inches diameter in 21 years.

D grade—8·2 inches diameter in 21 years.

E grade—8·6 inches diameter in 21 years.

X grade —8·9 inches diameter in 21 years.

(iii) At the end of 21 years the yield of useful basal area decreases as the intensity of thinning increases, but due to some reasons which are not clear, there is little difference in basal area between C, D or between E, X.

C grade—51·8 square feet per acre.

D grade—50·4 square feet per acre.

E grade—39·6 square feet per acre.

X grade—42·7 square feet per acre.

(iv) At the end of 21 years, in 1950, the yield of total volume (stem timber and stem small wood volume produced to-date) is highest for the ' C ' grade and lowest for ' X' grade thinning as noted below:—

C grade—1,584·7 cubic feet.

D grade—1,315·0 cubic feet.

E grade—1,262·2 cubic feet.

X grade—1,205·0 cubic feet.

140. These indications are identical to the conclusions drawn already from sample plots 10 to 25 of Wynaad, which have been detailed in paragraph 134 above and similar to results obtained from sample plots 120 to 126 of Nilambur described in paragraph 146.

141. *Heavy and early thinnings to anticipate and not to follow likely suppression teak plantations, Nilambur.*—On the lines of the work done by Dr. Craib in South Africa sample plots 120 to 125 of Nilambur Division were laid out in 1934 teak plantations in the year 1938. In this experiment three sample plots 120, 121 and 122 are allotted to thinning under Craib's theory, viz., heavy thinnings to anticipate suppression and not to follow suppression and the three sample plots 123, 124 and 125 are treated as control, i.e., thinning as

in ordinary district practice. The object of the experiment was to observe the growth and development of the teak under the two types of thinnings and to ascertain whether the rotation of the teak can be reduced by inducing rapid diameter increment by heavy (Craib's) thinning. On examination the results obtained in both the control and treated plots during 1954-55 are given below : —

TABLE XXXV.

—	*Sample Plot No. 120.*	*Sample Plot No. 121.*	*Sample Plot No. 122.*	*Average for all three plots taken together.*
(1)	(2)	(3)	(4)	(5)
	Treated plots.			
Number per acre ..	49	49	52	50
Maximum diameter ..	15·3″	17·05″	19·85	19·85
Minimum diameter ..	9·5″	9·8″	9·1	9·1
Average diameter ..	12·6	14·3	15·02	14·0
	Control plots.			
—	*Sample Plot No. 123.*	*Sample Plot No, 124.*	*Sample Plot No. 125.*	*Average for all three plots taken together.*
(1)	(2)	(3)	(4)	(5)
Number per acre ..	137	161	124	141
Maximum diameter ..	13·9	11·0	18·5	18·5
Minimum diameter ..	7·45	6·1	6·8	6·8
Average diameter ..	9·9	8·8	11·2	10·0

142. Comparison of the figures in the above two tables shows that in ordinary district practice there are 141 stems with an average diameter in 10 inches while in the treated plot there are only 50 stems per acre with an average diameter of 14 inches. The age of the plots is 21 years at the time of measurements in 1955.

143. *Abstract of measurements recorded in* 1949 *for treated and control plots*—

TABLE XXXVI.

Treated or control.	*Main crop number of stems,*	*Main crop top height.*	*Main crop top diameter.*	*Useful basal area.*	*Stem timber volume produced to-date.*	*Steam timber and small wood volume produced to-date.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		FT.	IN.	SQ.FT.	C.FT.	C.FT.	
Treated..	50	63	10·9	59·0	490	1,293	Measurements of 1955 are awaiting computation at Forest Research Institute, Dehra Dun.
Control..	142	64	9·5	75·2	271	1,732	

144. Analysis of the measurements recorded in 1949 at age 15 years which are re-produced above show that—

(i) the treatment has no appreciable effect on height growth ;

(ii) the treatment increases the rate of diameter increment, giving an annual diameter of increment of 0·93 inch in the treated plots as against annual diameter increment of only 0·67 in the control plots ;

(iii) at the end of 15 years, in 1949, the yield of useful basal area for the treated plot is 59 square feet as against 75 square feet for control ;

(iv) at the end of 15 years in 1949, the yield of total volume (stem timber plus stem small wood volume produced to-date), is only 1,293 cubic feet in the treated plot as against 1,732 cubic feet in the control plot.

145. Hence Craib's thinning (i.e., heavy thinning to anticipate suppression and not follow suppression), yields rapid diameter increment ; but the total volume production is greater with an ordinary 'D' grade thinning as adopted in the district. This indication is confirmed by similar results obtained in sample plots 10 to 25 of Wynaad Division and sample plots 69 to 86 of Nilambur Division referred to in paragraphs 135 and 140 supra.

146. *Thinning research plots—Sample plots* 136 *to* 141 *of Nilambur.*—As a repetition to the thinning experiment noted above, sample plot numbers 136 to 141 of Nilambur were laid out in compartment 134 of Panangode (in the 1948 plantation) in 1950. The plots are in the second rotation teak crop, the first rotation plantation teak crop having been clear-felled in 1947. The object of the experiment was to confirm the results that may be obtained in sample plots 120 to 125 above.

The three sample plots 136, 139 and 141 were allotted to Craib's thinning (i.e., heavy thinning to anticipate suppression and not to follow suppression) and the remaining three sample plots were treated as control (thinnings as per district practice—viz., a 'D' grade thinning.)

147. In sample plots 136, 139 and 141, thinnings were done at ages two, six years. In the control plots, these were done at the ages three six years. Inspections in 1954 showedt hat the thinnings done in sample plots 136, 139 and 141 do *not* correspond to the treatment proposed—namely thinnings to anticipate suppression and not to follow suppression. Several trees were found dominated and the thinning done was not sufficiently heavy. In fact there was very little difference as regards intensity of thinning, between the treated sample plots and the control sample plots. These six sample plots will therefore be abandoned and a fresh set of sample plots will be laid out in second rotation teak crop, as a repetition of the experiment in sample plots 120 to 125 of Nilambur.

148. *Eradication of Lantana through bamboos.*—In experimental plot 67/1936 of South Coimbatore Division, an attempt was made to suppress *Lantana* by the introduction of *Bambusa arundinacea* under the *Lantana*. As pointed out in paragraph 294 of the Annual Report for 1946–47, the results indicated that if casualties are systematically replaced during the first few years and the under-planted bamboos helped by opening funnels through the Lantana to let in more light for the bamboos, till the bamboos overtop the Lantana, then the bamboos can hold their own and in time displace the *Lantana*. It was also observed that in localities such as Coimbatore South where the bamboo is not fast growing and the bamboos are liable to elephant damage, protection for the bamboos may be required for an uneconomically long time. In eleven years, the bamboos had reached a height of only 9·1 feet to 9·5 feet against 13 feet which was the height of the *Lantana*.

In March 1949, there was an accidental fire which burnt away the experimental plot. The plot was also badly damaged by wild elephants and no measurements were taken after 1951, when there were 51 culms with a height of 9 feet. Repeated cutting back of the *Lantana* had also vitiated the object of the experiment. Hence this experiment will be closed.

A similar experiment done in Denkanikota range had showed that if *Dalbergia sissoo* is planted under the *Lantana*, on account of its fast growth, the *Lantana* can be suppressed. The indications are that only a fast growing species like Sissoo an suppress the *Lantana*.

149. *Eradication of Lantana through clearfelling and burning and planting forest crop with Kumri.*—The invasion and dense growth of *Lantana* has become a major problem in the Salem North Division and experiments were started during the year under report. (Experimental Plots 31) to see whether it is possible to eradicate the *Lantana* and re-afforest the area with valuable timber and fuel species. An area of 6 acres was demarcated and divided into six sub-plots of one acre each. In the three sub-plots strips 3 feet to 4 feet wide were cut at 22 feet apart through the *Lantana* bushes and seedlings of *Dalbergia sissoo*, *Melia dubia*, *Eucalyptus citriodora* and *Eucalyptus hybrid*, were planted at the beginning of North-East monsoon at 9 feet apart. In the other three sub-plots the *Lantana* was cut and burnt and along with an agricultural crop of Ragi (*Elusine corecana*) the above four species were tried at an espacement of $22' \times 9'$. The results at the end of one year show that cutting and burning *Lantana* although costly is significantly better than planting in strips. In the strip planting, the survival percentage is extremely low.

150. *Loranthus infestation in teak plantation.*—In the teak plantations of Nilambur, South Coimbatore and Wynaad, particularly in plantations past the age of mid-rotation, it is found that the branches are attacked by Loranthus. The intensity of

attack would in some trees be as much as 25 per cent. At present the Loranthus affected branches are being cut along with periodical thinnings. Owing to the difficulty in reaching the tips of the branches affected with Loranthus, very often the basis of the affected branches are cut and this practically amounts to lopping of the crown of the tree to the extent of half or one-third. Sometimes the tress are full of red ants and men cannot climb such trees and cut the Loranthus affected branches. It is therefore necessary to devise new methods of eradicating Loranthus from teak trees. New experiments in this direction will be undertaken in the coming year.

151. *Salix babylonica—Pruning of branches.—Salix babylonica* when raised through cuttings, has the habit of throwing off numerous side branches from near the ground and the plant has a bushy appearance. In 1953, experimental plot 23/53 was started to find out the effect of pruning of the side-branches on the growth of the species. An area of 3 square chains was taken and divided into three equal sub-plots. In one sub-plot nothing was done, while in the remaining two, the trees were all pruned of their side branches flush with the stem and tarred at the cut ends. In 1954 when the plot was last measured there were 55 trees in the pruned plots with an average diameter of 1·6 inches and 32 trees in the unpruned plot with an average diameter of 1·6 inches. Thus there is no difference in diameter between the pruned and unpruned plots. Despite pruning epicormic branches sprouted, it is too early to draw any conclusions.

(viii) MIXTURES—*Nil.*

(ix) UNDERPLANTING.

152. *Teak plantations* in *Wynaad, Nilambur—Is underplanting necessary.*—Inspection of teak plantations in Nilambur andWynaad shows that ordinarily there is an appreciable amount of undergrowth in teak plantations and that this is generally adequate to protect the soil from the adverse effects of exposure, desiccation and erosion.

Underplanting may be considered from the point of view of producing a valuable subsidiary crop of timber or other products, such as *Ocimum kilimanjaricum* for production of camphor or *Rauwolfia serpentina* for production of the medicinal roots. Under planting does not seem to be necessary solely from the point of view of soil protection. Attention is invited to paragraph 51 wherein the question of deterioration in the second rotation in pure teak plantation crops has been discussed and it has been established that there is no fear of such deterioration in site quality in the second rotation.

153. Again previous experiments on underplanting of teak with *Cephalostacyium* pergracile have indicated that there is a slight decrease in the volume production of teak as a result of underplanting. The loss of increment of teak due to underplanting may well outweigh the money value of the subsidiary crop. Hence looked at from this point of view also, underplanting of pure teak plantations does not appear to be desirable.

154. However, in the past there was a genuine apprehension that continued cultivation of pure teak plantations will gradually lead to deterioration of the soil unless effective measures are taken to protect the soil with suitable underplants, particularly in the latter half of the rotation. Hence several experiments were designed and started on underplanting in teak plantations.

155. *Effect of bamboo as an underplant on the growth and development of teak.*—Experimental plot 153/38 was started in Nilambur to study the effect of *Cephalastachyum pergracile* grown as an underplant in teak plantations on the growth and development of teak. Yearly measurements have been recorded up to date. The figures have not yet been analysed since 1951. The measurements for 1954 taken in March 1954 have now been analysed. The average diameter in the treated plot with bamboo as underplant is 16·5 inches as against 16·9 inches in the control plot without bamboo as underplant.

In another set of experiments in Panayangode *Bamboosa polymorpha* and *Melacona bamboosoides* significantly affected both the height and diameter increment of teak—vide experimental plot 163/40 and 146/37. The tentative conclusion that in poorer localities it is not advisable to have bamboo as underplant, should be investigated.

156. *Underplanting in teak plantations.*—Experimental plots 166 to 169 of 1950 in Nilambur Centre were started in 1950 to study the effect of underplanting teak and to find out the best species and time for underplanting. In these four experiments, *Artocarpus hirsuta, Swietenia macrophylla, Evodia roxburghiana* and *Hopea parviflora* were tried. *Artocarpus* was only 1 foot to 4½ feet in height in 1953. It has not established itself sufficiently to affect the growth of teak in height or diameter. Observations are to be continued. *Swietenia macrophylla* was only 1 foot high in 1953 due to damage by deer. Also half the plot got burnt in 1953. *Evodia roxburghiana* suffered heavy casualties which were replaced with *Ailanthes malabarica.* Hence this experiment is vitiated and it is not possible to say how far *Evodia roxburghiana* is suitable as an underplant in teak plantations. *Hopea parviflora* plot was damaged by a severe fire which burnt all the underplants.

157. The underplanting experiments were repeated in 1954 in Nilambur, Begur, Kannoth, Topslit and Palghat Centres. The results are summarized in the following statement :—

TABLE XXXVII.

Serial number.	Experimental plot or Experimental ground number.	Year of plantation.	Species underplanted.	Number put in.	Number of survivals.	Survival per cent.	Mean height in inches.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Nilambur experimental plot 182/54.	1943 regeneration area.	*Artocarpus hirsuta.*	164	118	72	12
2	Nilambur experimental plot 183/54.	Do.	*Mahogany* ..	226	171	75	24
3	Nilambur experimental plot 184/54.	Do.	*Sterculia companulata.*	170	151	88	28
4	Nilambur experimental plot 185/54.	Do.	*Ailanthes malabaricum.*	177	82	46	36
5	Nilambur experimental plot 186/54.	Do.	*Evodia roxburghiana.*	146	14	96	24
6	Nilambur experimental plot 187/54.	Do.	*Dalbergia latifolia.*	209	148	70	36
7	Topslip experimental ground 486/54.	1937 regeneration area.	*Swietenia macrophylla.*	111	62	55	16
8	Do.	Do.	*Ailanthus malabarica.*	111	75	67·6	8·7
9	Do.	Do.	*Mangifera indica.*	111	40	36·0	7·5
10	Dhoni experimental ground 453/54.	1930 regeneration area.	Do.	72	21	29·0	14·7
11	Dhoni experimental ground 454/54.	Do.	*Ailanthus malabarica.*	72	55	76·40	15·4
12	Dhoni experimental ground 458/54.	Do.	*Artocarpus hirsuta.*	77	11	14·30	6·8

Serial number.	Experimental plot or Experimental ground number.	Year of plantation.	Species underplanted.	Number put in.	Number of survivals.	Survival per cent.	Mean heigh in inches.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
13	Dhoni experimental ground 459/54.	1930 regeneration area.	*Mahogany* ..	77	42	54·50	15·2
14	Dhoni experimental ground 460/54.	Do.	*Sterculia companulata.*	77	51	66·20	79·9
15	Begur experimental plot 102.	1939 regeneration area.	*Mangifera indica.*	146	128	88	14
16	Begur experimental plot 103.	Do.	*Sterculia companulata.*	147	7	5	48
17	Begur experimental plot 104.	Do.	*Ailanthus malabaricum.*	146	75	51	28
18	Begur experimental plot 105.	Do.	*Evodia roxburghiana.*	148	9	6	15
19	Begur experimental plot 106.	Do.	*Swietenia macrophylla.*	150	80	53	27
20	Kannoth experimental plot 110.	1941 regeneration area.	*Artocarpus hirsuta.*	134	66	49	6
21	Kannoth experimental plot 111.	Do.	*Evodia roxburghiana.*	130	102	78	30
22	Kannoth experimental plot 112.	Do.	*Ailanthus malabaricum.*	140	71	51	18
23	Kannoth experimental plot 113.	Do.	*Sterculia companulata.*	152	74	49	36
24	Kannoth experimental plot 114.	Do.	*Swietenia macrophylla.*	133	86	65	48

158. An examination of the height growth and survival per cent of the various species, reveals that, though the survival per cent is high the height growth is poor, varying from a few inches to 2 or 3 feet. The species put in as underplants have not yet established themselves ; they are still below the level of the surrounding shrubby growth. No conclusions can be drawn at this

stage about the suitability of the species or their effect on the growth of teak or on their utility in the protection of the soil. The experiments will be continued.

159. Moreover, in the teak plantations, there is a sufficiency of natural shrubby undergrowth to protect the soil and prevent soil erosion. Hence there is no need to undertake expensive underplanting with the object of providing soil cover. Experiments already conducted with *Cephalostacyium pergracile* as the underplant have shown (vide experimental plot 153/38) that the underplant decreases the rate of diameter increment of the teak. Hence if a financially valuable undercrop is used, the loss of increment of teak may be more than the revenue realized through the accessory crop. Looked at from this point of view there is no case for underplanting in teak plantations.

160. *Underplanting of teak with Rauwolfia serpentina.*—Attention is invited to paragraph 154, wherein the reasons for starting experiments on the underplanting of teak plantations were described. Among other species tried as underplants, *Rauwolfia serpentina*, which has come into the lime light in recent years as a plant of great medicinal value, was also tried—especially as it is found in nature in moist deciduous timber forests and in teak plantatons.

Nilambur Experimental grounds 1/53 *and* 2/54 *in the* 1917 *teak plantation in sample plot* 56 of *Aravallikava.*—Inspection in March 1955 showed that there were about 30 per cent survivals; but the plants had not established themselves being only 9 inches high without leaves and it was doubtful whether they will survive the hot weather and sprout up again after the rains.

Rauwolfia serpentina underplanting in teak plantations is also found in Dhoni sample plot 3 and in Topslip in woods plantation of 1916.

This experiment is still in the preliminary stage and it is too early to form any conclusions regarding the suitability of *Rauwolfia serpentina* as an underplant in teak plantations.

(x) Miscellaneous including fires, grazing, lac, etc.

161. *Lac cultivation in Denkanikota.*—During the year, lac cultivation was carried on at Denkanikota on a small scale. One hundred and thirty lb. of Kusum brood lac was obtained from the Lac Research Institute, Ranchi, in January 1955 and these were used to infect—

Twenty two trees of *schleichera trijuga*;

One tree of *shorea talura*;

Two trees of *zizphus jujuba* in pot culliure garden;

Eight trees of *Zizyphus jujuba* in Noganur Reserved Forest.

Average quantity of brood lac per tree was about 4 lb. The trees had not been specially pruned for the purpose previously. Harvesting was done in June 1955 and July 1955. This gave 246 lb. of brood lac and 214 lb. of rejected lac. The proportion of brood used to that harvested was 1 : 3·6.

162. *Scheme for lac cultivation in the Nilgiris Forest Division.*—A scheme for lac cultivation on *Schleichera trijuga* natural trees found round about Kargudi in the Nilgiris Forest Division was prepared by the State Silviculturist and submitted to the Chief Conservator of Forests for consideration.

163. *Manufacture of lac products at Denkanikota.*—During the year the following quantities of lac products were manufactured utilizing 1,187 lb. of washed lac for their manufacture :—

	LB.
Spirit composition polish (French polish) ..	4,902
Superior sealing wax	87½
Cheap grade wax	150½
I.V. superior grade wax	51

164. The total revenue realised by sale of lac products was Rs. 8,922–3–9. Deducting Rs. 5,561–9–9 which was the expenditure incurred in their manufacture, the net profit realised through manufacture of lac products was Rs. 3,360–10–0. There are proposals for expanding production on a larger scale in the future.

PART III.

WORKING PLANS AND STATISTICS.

(i) Working Plans.

165. The State Silviculturist was in touch with the working plan officers of the several districts and gave whatever information was required by them with reference to ledger files.

The revision of the Working Plans of Nilambur, Tiruchirappalli and Coimbatore North Divisions, was in progress. The draft chapters of Coimbatore South Division were finalized.

(ii) Yield, Volume and Form Factor Tables.

166. *Sample plots.*—Eight new sample plots were opened during the year. None were closed during the year. There are now 191 sample plots representing 21 species in 7 forest divisions. An abstract is furnished under paragraph 6 giving the distribution of the sample plots by divisions and species.

Appendix 'C' furnishes a detailed list of all sample plots in existence in Madras State at the close of the year.

167. *Permanent preservation plots.*—No new plots were opened during the year. There are now fourteen permanent preservation plots at the close of the year. Appendix 'C' furnishes a detailed list. These are situated in four divisions and cover eight species.

168. *Tree increment plots.*—No new tree increment plots were opened during the year. There are now sixteen tree increment plots. Appendix 'C' furnishes a detailed list of all tree increment plots. These are situated in six forest divisions and cover eleven species.

The yield tables for teak compiled by M. V. Laurie and published as Indian Forest Records No. 1, Volume IV-A, have been in use for a long time. During the current year the new multiple yield tables for teak compiled by the Statistical Branch of the Central Silviculturist have been issued in a typed form.

(iii) BARK MEASUREMENTS, HEARTWOOD MEASUREMENTS, ETC.

169. "*Nil.*"

(iv) MISCELLANEOUS FORMULAE, ETC.

170. In addition to research conducted by the State Silviculturist, Ootacamund, small scale experiments were also carried out by the various District Forest Officers in the State. An abstract of such experiments is furnished in Appendix 'F'.

PART IV.

MISCELLANEOUS.

A. FOREST BOTANY.

171. *Fungus disease of Casuarina equisetifolis.*—In the Padugais adjoining the Cauvery River in the Thiruchirappalli Forest Division *Casuarina* is planted on a large scale. The plants grow tall and healthy for three or four years and then began to wilt in patches or groups or even singly. This has been explained as due to attack by a parasitic fungus (Trichosporeum Vesciculosum). Further investigations in the nature of the disease have to be made and suitable control measures devised.

B. FOREST ENTOMOLOGY.

(*a*) *Systematic Entomology.*

172. "*Nil*".

(*b*) *Economic Entomology.*

(i) Specific Investigations.

173. *Teak-Defolictor attack—Investigations.*—During the year, the Entomologist of the Forest Research Institute (Dr. Roonwall) and the Statistician (Dr. K. R. Nair) toured in Nilambur Division during February 1955. The question of teak defoliation, on which no research of value had been done in the past was considered. A note prepared as a result of discussions at a Conference in which the Entomologist, the Statistician, the Conservator of Forests, the State Silviculturist, the District Forest Officer and the Working Plan Officer participated. is given as Appendix 'G'.

The suggestions contained in the Note, will be considered and experiments on these lines will be initiated in the coming year.

(ii) Miscellaneous Investigations and Records.

174. *Ailanthes excelsa, Ailanthes malabarica Defoliator.*— The plonts of *Ailanthas excelsa* and *Ailanthas malabarica* are subject to the attacks of a defoliator. The Forest Entomologist has collected samples of the defoliator "*Eligna narssius* (Noctuidae)". Investigations are undertaken by the Forest Entomologist to study the life history of this insect.

175. *Bombax malabaricum—Shoot-borer.—Bombax malabaricum* is subject to the attacks of the shoot-borer 'Tonica neviferana'. No remedial measures are available against this pest except hand-picking of the insects and destruction of the insects.

(iii) Unclassified or Unidentified Damage.

176. "*Nil.*"

C. FOREST ZOOLOGY.

177. "*Nil*".

D. UTILIZATION.

178. *Utilization and Economic Research Report for* 1954-55—*Madras State*—I.*General Work of Administration.*— 1) The Forest Utilization Branch continued to function as a section of the office of Chief Conservator of Forests, Madras, for a greater part of the year and the duties of the Forest Utilization Officer were performed by the Personal Assistant to Chief Conservator of Forests, Madras. This arrangement continued up to 10th December 1954. The post of Forest Utilization Officer was revived in G.O. Ms. No. 3148, Agriculture, dated 21st October 1954, and the Forest Utilization Division began to function as a sepatrate unit from 11th December 1954 the date on which Sri T. Jayadev took charge of the post of Forest Utilization Officer. From this date this division was placed under the control of the Conservator of Forests, Development Circle, Madras, under orders of Government.

(2) The main activities of the Utilization Division during the year were :—

(*a*) Organizing supply of timber to State Government Departments which consume timber, Co-operative Building Societies, Government sponsored industrial and other institutions.

(*b*) Negotiating and arranging supply of timber to Railways against Purchase Orders issued by the Directorate-General of Supplies and Disposals, New Delhi.

(*c*) Organizing supply of sleepers to the Railways and inspecton of departmentally produced sleepers on behalf of the Railways.

(*d*) Inspection of Ascu and Creosote treated poles of the Electricity Department on field tests.

(*e*) Joint inspection with Railway Officers of test length sleepers laid in the track.

(*f*) Liasion with the Forest Research Institute, Dehra Dun, by arranging supply of timber and minor forest products for test purposes.

(*g*) Studying market conditions and the trade trend in timber and minor forest products and keeping Divisional Officers of the State informed.

(*h*) Maintenance of ledger files for important timbers and minor forest products.

(*i*) *Propaganda.*—Answering enquiries and participating in exhibition.

II. *Experimental and Commercial Activities.*—(1) *Wood Technology.*—(*a*) The Superintendent, Development Technical Development Establishment Laboratories, Kanpur, required the following species of timber specimens 2 feet in length and 35″—47″ girth for purposes of studying the dynamic elastic properties of these woods :—

1. *Artocarpus hirsuta.*
2. *Adina Cordifolia.*
3. *Artocarpus integrefolia.*
4. *Cedrela toona.*
5. *Tectona Grounds.*
6. *Dalbergia Latifolia.*
7. *Dycoxylum malabaricum.*
8. *Terminalia paniculata.*
9. *Terminalia tomentosa.*
10. *Lagerstroends Lanceolata.*
11. *Albizzia lebbeck.*

Items 1 to to 10 are being supplied by the District Forest Officer, Coimbatore South and item 11 by the District Forest Officer, South Kanara.

(*b*) As a substitute for willow wood for artificial limba the Director of Technical Development, Army Headquarters, Delhi, required for billets of *melia azedirach* for test purposes. The District Forest Officer, Vellore west Division is arranging for the supply.

(*c*) Messrs Curson & Co., Madras, were supplied with a few logs of also wood for test purposes as fillars for laminated works The company has since reported that the wood is heavier than the imported variety but can be used satisfactorily as fillers for laminated works. They want to know the quantity that can be supplied immediately and also our regular annual out put.

(*d*) Messrs. Pioneer Sports, Limited, Bombay, were supplied with one log of *Salix babylonica* (Willow) from our experimental plots to test the suitability for making cricket bats should be much lighter in weight than our log and it should be absolutely white in colour and not reddish, should have straight parelle grains, free from knots, betterfly marks and water marks. They also sent a pair of smaller size cricket bats prepared from our wood which is kept as exhibits.

(*e*) Messrs. Vithaldas Maknaji & Sons, Navsari required Parottia wood (*Parotia jacquinantiana*) for manufacture of Tex Pins or the substitute for this wood. As Parotia is indigenous to Kashmir, it was proposed to supply one log in each of *Anogeissus lat folia* and *Grewia tiliaefolia* as substitute. It seems they have peviously tried *grewia tiliaefolia* which did not give satisfactory results. Hence they are typing *Anogeissus latifolia* for which supply is being arranged.

(2) *Timber seasoning.*—Nil.

(3) *Timber testing.*—(*a*) During the year under review the following species of timber were supplied to the Forest Research Institute, Dehra Dun. for test purpose :—

Species.	*Division from which supplied.*	*To whom supplied.*	*Number of logs supplied.*	*Purpose.*	*Results.*
(1)	(2)	(3)	(4)	(5)	(6)
Dysoxylum malabaricum.	South Kanara.	Chief Res. Officer, Composite Wood Branch, Forest Research Institute, Dehra Dun.	2	For experimental purposes.	..
Canarium strictus.	Do.	Do.	2	Do.	..
Dichopsis elliptica.	Do.	Do.	2	Do.	..
Hardwickia binnata.	Do.	Do.	6	Do.	..
Spondias mangifera.	Do.	Do.	5	Do.	..
Zanthoxylum rhetsa.	Do.	Do.	[illegible]	Do.	..

(*b*) The Superintendent, Explosives Project House, Kirkee, Poona, to whom sample logs of *Salix tetrasphorma* were supplied in connection with the manufacture of high grade charcoal for gun powder had not yet communicated the results. (Vide paragraph 6 of 1953–54 report.)

(*c*) One thousand and eight hundred lb. of wood of *Euphorbia tirucalli* were supplied from Vellore East Division to the Superintendent, Ministry of Defence, Explosives Project Office, Kirkee for manufacture of gun powder from charcoal of the wood. Results of tests are awaited.

(*d*) The Hindustan Aircraft Limited, Bangalore, were supplied with two logs of indigenous Balsa from the experimental plot of this State for test purposes. The Hindustan Aircraft Limited, Bangalore, have reported that though the wood compares favourably with the foreign product in respect of grain structure, yet it is not conformity with required specifications so far as density factor is concerned. The densities of the above two logs were stated to be 15 lb. and 12 lb. per cubic foot. respectively with moisture content of 9 per cent in both cases against the prescribed weight of 3 lb. per cubic foot. for aircraft purposes. Six logs of Balsa wood from other plots were also sent for test purposes but it was found that the density of these also was very high and the Hindustan Aircraft, Limited, reported that they could not be used for aircraft purpose.

(4) *Wood preservation*—(*a*) *Test length sleepers.*—Treated and untreated sleepers laid in the track in various localities in this State were inspected along with the concerned officers of the Railway. The results of the tests were communicated to all concerned. A statement showing details of the inspection is appended (Statement I).

(*b*) *Inspection of Ascu and creosote treated poles.*—The Ascu and creosote treated wooden poles erected at various localities by the Electricity Department could not be inspected at all places during the year, because for a major portion of the year, the Personal Assistant to Chief Conservator who was entrusted with the work of the utilization branch could not find sufficient time to do this work in addition to his own duties as Personal Assistant and other important activities of the utilization branch. This work could be taken up only when the post of Forest Utilization Officer was revived on 11 December 1954 and the new Forest Utilization Officer could inspect the poles in and around Coimbatore. The results of the insection made during the year given in Statement II.

(5) *Minor forest products.*—(*a*) The Officer-in-charge, Minor Forest Products Branch, Forest Research Institute, Dehra Dun, to whom supply of commercial drugs was made for purposes of investigation in previous year had reported that the results of the instigation. [Vide paragraph 6 (*c*) of the report for 1953–54.]

(*b*) During the year enquries for supply of roots and and seeds of Rauwolfia serpentina were particularly heavy both from research institutes and private firms. As the species had not been cultivated on a large scale by the department supplies of roots and seeds were limited to bona fide research institutes from avilable quantities that could be collected from the West Coast Division. where it is found to occur sparely. Attempts are being made to raise experimental plots with a view to extend its cultivation on account of recent knowledge of its theropeutic value.

(*c*) Lac cultivation is carried on in Madura West, Coimbatore South and Salem North division and during the year attempts were made to raise in the Nilgiris and South Kanara divisions also. All the quantity of scrapped lac is disposed of in auction sales by the District Forest Officers concerned and seed lac obtained is used in our experimental lac factory at Dankanikotta for manufacture of lac products. Advice regarding market rates prevailing in Calcutta market is given periodically to District Forest Officers.

(*d*) *Honey and bee wax.*—Honey collected departmentally was processed, bottled and soldin Madras City by the Forest Utilization Officer under orders of Government in the previous year. As the post of Forest Utilization Officer was abolished from 1st October 1953 this scheme was given up under orders of Government and was entrusted to the Additional Rural Welfare Officer for Bee-keeping, Madras, to whom the departmentally collected honey is being sent. Bees wax collected departmentally was supplied to Jails as usual.

(6) *Paper-pulp.*—Nil.

(7) *Tans.*—(*a*) The Director, Central Leather Research Institute, Adyar, to whom two bags of leaves of *Chuckrasia tabularies* were supplied in the previous year to determine the chemical and tannin characteristic had not yet been communicated the results of the test. [Vide paragraph 6 (*a*) of 1953–54 report.]

(*b*) The Principal, Institute of Leather Technology, Madras, to whom tender and mature leaves of Bhawa leaves (*Anogeissues latifolia*) were supplied from Madurai. West Division in the previous year had not communicated the results yet. [Vide paragraph 6 (*a*) of 1953–54 report.]

(*c*) The Principal, Institute of Leather Technology Madras. who required the barks of (1) *Cassia Javanica*, (2) *Cassia marginate*, (3) *Cassia nodosa not*, (4) *Cassia siamea* could be supplied only with barks of *Cassia marginata* from Tiruchirappalli divisions. Results of the tests are awaited.

(*d*) Information regarding the market conditions and prevalling rate for wattle bark of both important variety and indegenous mark was being communicated to District Forest Officers, Madurai West and Nilgris division in order to enable

them to guage the reasonableness or otherwise of the offers got in auction for our indigenous wattle barks extracted in these two division.

(8) *Wood working.*—Nil.

(9) *Miscellaneous.*—The Chief Conservator of Forests, Andamans, sent sample piece of *Cycrocarpus americanus* and *Tetremalis nudiflora* to the Director of Industries and Commerce, Madras, with a view to find out whether the fishermen of Madras would use them for making catamarans. The Director of Industries and Commerce, Madras, has informed this Department that the local fishermen prefer the *Cyrocarpus* variety and they have been advised to get their requirements of this wood from the Officer-in-charge, Andaman Timber Depot, Madras.

APPENDIX.

I. *Publication.*—Nil.

II. *Statement showing rank, designation and address of Forest Officer employed exclusively on research work in States.* —Nil.

PART IV.

STATEMENT No. I—*Statement showing the result of joint inspection of test length sleepers*, 1954—55.

Serial number.	*Number laid.*	*Date of laying.*	*Location.*	*Description of sleepers.*	*Date of Inspection.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	800	March 1943.	Between Tiruthuraipoondi and Manali, mile 215/12 to 215/9.	Creosoted test length sleepers of Pali, Pillamarudu, Irul, Irumbogam, Karimarudu and Vayal.	3rd April 1954.	The sleepers of Vayal species are faring very poor. Fifteen sleepers now in the tract showing signs of rot in varying degrees. Next to Vayal comes Pali. In other species there is very little deterioration during the year since the last inspection. In fact in nineteen cases, the grading previously was obviously severe and had to be revised and these sleepers have been upgraded now.
2	999	July 1946 ..	Between Tirupathi East and Renigunta Railway Station, mile 168/13-14 and 169/4 to 5.	Creosoted test length M.G. sleepers.	2nd June 1954.	Mathi does well as track sleepers. Common defects developed so far are only cracking splitting and warpping to a slight extent.
3	266	March 1943 ..	Between Tanmalai and Edaman, mile 434/3½ to 435/4½.	Creosoted test length sleepers of Vayal, Irumbogam, Karimarudu, Nangal, Irul, Pillamarudu. Pali.	26th September 1954.	Almost all the sleepers have deteriorated now and developed cracks badly. They may last for another year of two at the most. However they have withstood the test on account of creosoting creditably.
4	999	July 1946 ..	Between Tenmalai and Edaman at mile of 435/13 to 436/1 Rail Section 50 lb. R.F.B.	Creosoting test length M.G. sleepers of Mathi.	Do.	The sleepers are faring well and creosoting has definitely strengthened them and prolonged their life. From what I have seen, I have no doubt in my mind that they will last for another five years.
5	344	March 1943 ..	Between Omalur and Mecheri road SMD 214/16, 215 of Mettur line.	Creosoted test length sleepers (B.G.) of Pillamarudu, Pali, Karimarudu Hopea and Vayal.	Do.	*Hopea* and Karimarudu have stood the test marvelously well. *Hopea* is likely to last another ten years and Karimarudu another five years. Vayal and Pillamarudu are showing signs of deterioration and a few have decayed badly.
6	500	1937..	Between Cannanore and Azhikkal, mile 549/0 to 549/2.	Unseasoned Sal B.G. sleepers.	28th December 1954.	During the period of seventeen years there had been about 57 per cent rejections. Under the West Coast conditions Sal sleepers appear to have not less than 15 years of life on track.
7	320	April 1943 ..	Between Cannanore and Azhikkal, miles B 468/25 469/4.	Creosoted test length B.G. sleepers of Vayal Karimarudu. Hopea, Pali, Pillamarudu and Irul.	Do.	Among the species on test *Hopea*, *Measua* and *Irul* have done well during the period 11 years they have been on the track. In Pali there had been the maximum rejections (60 per cent). Pali had fared worse than Pillamarudu. The average life of Pali sleepers appears to be less than 10 years.
8	320	July 1941 ..	Between Cannanore and Azhikkal, 549/0 to 549/2.	Air seasoned and unseasoned B.G. sleepers.	29th December 1954.	*Hopea* (both seasoned and unseasoned) appear to have life of not less than 12 years on the track. Seasonal *Hopea* had done very well. There had been over 50 per cent rejections in the course of thirteen years in *Xylia* even when seasoned wood had been used. With unseasoned Xylia the corresponding rejection is 80 per cent.

STATEMENT No. II—*Statement showing Ascu treated poles inspected under field tests and their location villagewar with details of inspection during* 1954–55.

Serial number and description of poles.	*Number chisseled of on the erecsoting depot.*	*District number.*	*Date of treatment.*	*Date of erectioner supply to the Electricity Department.*	*Location.*	*Date of inspection by Forest Utilization Officer.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sennanur (Strictly in Mathipalayam).							
13 Wynad Teak pole.	12	3528	21st October 1941.	29th November 1941.	Mathipalayam—Transformer station L.T. line feeding to S.O. 65, Sennanur area, Coimbatore taluk.	30th March 1955.	The post was dug up to 1 foot below ground level. The sap wood position of the to post below ground level has a been eaten away, drowned depth of about 4 inches but the position is strong and sound. The position above groundlevel is also strong but for shallow longitudinal cracks. Will last another five years. The post is pointed green.
15 Do.	16	1696	23rd October 1941.	Do.	Sennanur No. 2 Transformer station L. T. line feeding to the S. C. 64, Sennanur.	Do.	The post is painted green and the portion under ground is larrided. Portion underground has been eatan away to a depth of about 1½" around but it is strong and sound. Their longitudinal cracks to a depth of 1 inch to 1½ inch have been developed in a portion above the ground level. The post should last for atleast another 2 years. This post is in a field where there is wet cultivation going on.
16 Wynad Teak pole.	18	1667	23rd October 1941.	29th November 1941.	Sennanur No. 2 Transformer station L.T. line feeding to the S.C. 64 sennanur.	...	The portion below ground level has been slightly eaten above eaten away alround but is sound and strong. The portion above ground level is very strong and cracks are conspicuous by their absence. This post should last for another five years. This is the best of all the six posts.
17 *Hopea* poles	22	Not visible.	14th August 1941.	10th November 1941.	Mathipalam II Transformer Station L.T. line feeding to S.C. 65.	30th March 1955.	But for the longitudinal superficial cracks the portions below and above ground level are sound and strong. The portion below ground level has been tarried and no signs of decay were found. This will last another five years. This is standing the test very well.
18 Do.	19	Do.	17th January 1941.	Do.	Sennanur No. II. Transformer Station L.T. line feeding to S.C. 65, Sennanur.	Do.	But for the superficial cracks the portion below and above ground level are sound and strong. Should last another five years. Standing the test very well.
19 Do.	11	Do.	14th July 1941.	Do.	Sennanur II. Transformer, Masthigoundan well L.T. extension (Coimbatore taluk).	Do.	The portion above and below the ground level are solid and strong. There are this superficial cracks alround but these will not affect the soundness or durability of the post. No signs of decay in the portion below ground level should last another five years.

STATEMENT No. II—*Statement showing Ascu treated poles inspected under filed tests and their location villagewar with details of inspection during* 1954–55—cont.

Serial number and description of poles.	*Number chiselled on the creosoting depot.*	*District number.*	*Date of treatment.*	*Date of erectioner supply to the Electricity Department.*	*Location.*	*Date of inspection by Forest Utilization Officer.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
20 Pine poles	8	Not visible	11th September 1941.	10th November 1941.	Podanur 100 KVA Transformer L.T. lines feeding to S.C. 364.	18th February 1955.	Pole sound; minor surface cracks.
21 Do.	11	Do.	12th September 1941.	Do.	Do.	Do.	Pole sound; few longitudinal cracks noticed.
22 Do.	14	Do.	13th September 1941.	Do.	Do.	Do.	Pole sound; surface longitudinal cracks noticed; few of them 2 feet in length and half an inch in depth.
23 Do.	19	Do.	15th September 1951.	Do.	Do.	Do.	Pole sound; few surface cracks.
24 Do.	21	Do.	16th September 1951.	Do.	Do.	Do.	Pole sound; surface longitudinal cracks throughout the length of the pole.
25 *Hopea* pole	25	Do.	17th September 1941.	Do.	Do.	Do.	Pole sound; surface cracks all along the length of the pole were found.
26 Pine pole	17	Do.	Do.	Do.	Do.	Do.	Pole sound; longitudinal cracks found.
27 Vayal pole		Do.	5th August 1941.	29th November 1941.	Do.	Do.	Pole sound; few border holes and minor cracks along the length of the pole noticed.

Kalledimadai—

1 Pine pole	9/PL/41.	Not visible.	8th September 1941.	18th November 1941.	S.C. 483, Sowripalayam.	19th February 1955.	Pole sound; few cracks.
2 Do.	10/PL/41	Do.	12th September 1941.	10th November 1941.	S.C. 480 Sowripalayam.	Do.	Pole sound; few pronounced cracks some two feet long.
3 Do.	17/PL/41	Do.	14th September 1941.	Do.	Do.	Do.	Pole sound; few surface cracks.
4 Do.	23/PL/41	Do.	16th September 1941.	Do.	Do.	Do.	Do.
5 Do.	6/PL/41	Do.	9th September 1941.	Do.	Do.	Do.	Do.

APPENDIX A.

Statement showing plan of operations for the Research Centres for the year 1954—55.

(Referred to in paragraph 1.)

Serial number.	Particulars of work.	Centres in which done.	Remarks.
(1)	(2)	(3)	(4)
1	To study the effect of pruning in teak plantations and determine the earliest age to start pruning. The experiments will be done in 2, 3, 4, 5 and 6 year-old plantations as shown below. To start with a half acre plot will be divided into two sub-plots; one to be pruned and the other as control. (As far as possible, the teak experimental plots and experimental gardens that have been closed, will be used for this experiment.)	Begur, Nilambur, Topslip, Kannoth, Dhoni.	
2	To study the effect of underplanting teak and determine the best species and age for underplanting: The following species will be tried in a 15—20 year old plantation:— (1) *Mahogany*—Seedlings. (2) *Ailanthus malabarica*—Seedlings. (3) *Evodia roxburghiana*—Seedlings. (4) *Wild mango*—Seeds. (5) *Sts ruelia companulata*—Seed'irgs. Five one-acre plots will be selected. Each plot will be divided into two sub-plots; one will be underplanted and the other will be treated as control. All the seedlings will be planted at 12′ × 12′ in one foot cube pits. The mango seeds will be sown in prepared patches.	Begur, Dhoni, Nilambur, Kannoth.	
3	To find out whether it is possible to induce natural regeneration in a pure plantation of teak after the last thinning. The following treatments will be tried:— A.—Clearing the undergrowth just before seed fall. B.—Clearing the undergrowth and running a light ground fire after the seed fall. C.—Sowing the seeds in prepared patches. D.—Sowing seeds in worked patches and then running a light ground fire.	Begur. Nilambur.	
4	To find out whether it is possible to raise *Cinnamomum zeylanicum* (Ceylon variety) as an undergrowth in a teak plantation. In a 30 year old teak plantation, one acre will be chosen and seeds, seedlings and stumps of *Cinnamomum zeylanicum* will be planted individually randomised at an espacement of 12′ × 12′ (100 replications per treatment).	Begur, Nilambur, Kannoth, Topslip.	
5	To find out whether it is possible to raise *Rawolfia serpentina* as an undergrowth in teak plantations. Shoot cuttings and shoot cuttings with ½″—1″ of root, will be planted individually randomised at 3′ × 3′ 30 replications per treatment.	Begur, Dhoni, Nilambur, Kannoth, Topslip.	

APPENDIX A—*cont.*

Statement showing plan of operations for the Rescareh Centres for the year 1954–55—cont.

Serial number.	Particulars of work.	Centres in which done.	Remarks.
(1)	(2)	(3)	(4)
6	To collect the Phenological data on the following species:— 1 *Teak.* 2 *Dalbergia latifolia.* 3 *Dalbergia sissodis.* 4 *Terminalia tomentosa.* 5 *Terminalia paniculata.* 6 *Lagerstroemia lanceolata.*	Begur, Nilambur.	
7	To study the growth, silvicultural characters and requirements of the following species in the locality:— 1 *Acacia monolifolius.* 2 *Affornosia elata.* 3 *Ailanthus excelsa.* 4 *Ailanthus grandis.* 5 *Ailanthus malabarica.* 6 *Albizzia falcata.* 7 *Albizzia lebbeck.* 8 *Azadirachta indica.* 9 *Banumia racemosa.* 10 *Bombax malabaricum.* 11 *Butea frondosa.* 12 *Casuarina connighami.* 13 *Casuarina euphyllum.* 14 *Cedrella toona.* 15 *Copernecia cerifera.* 16 *Dolichandrone crispa.* 17 *Eucalyptus citriodara.* 18 *Eucalyptus hybrid.* 19 *Eucalyptus rostrata.* 20 *Civotia rothleriforius.* 21 *Gmelina arbovea.* 22 *Grevillia robusta.* 23 *Mallatous philiphinensis.* 24 *Melia dubia.* 25 *Minisopos litteralis.* 26 *Phoebe goalpareusis.* 27 *Pithecolabium dulce.* 28 *Pithecolabium saman.* 29 *Pterocarpus santalinus.* 30 *Stephygyne parvifolia.* 31 *Sterculia companulate.* 32 *Terminalia chebula.* 33 *Terminalia myriocarpo*	Begur, Dhoni, Kannoth, Topslip, Bermari, Denkanikota.	

APPENDIX A—*cont.*

Statement showing plan of operations for the Research Center for the year 1954–55—cont.

rial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
8	To determine the number of pluckings and the yield of Camphor per acre, the *Ocimum* being raised in place of a Kumri crop. A half acre plot, planted with teak stumps at 6′ × 6′, will be divided into two sub-plots, in one sub-plot *Ocium* seeds will be broadcast after one or two showers and in the other, the seeds will be sown after raking the soil. The leaves will be plucked on the first week of August, November and March and sent to the Forest Research Institute for analysis. The tender and mature leaves will be collected separately.	Begur, Dhoni, Kannoth, Top-slip.	
9	To find out the best method of raising the following species:— 1 *Afformosia elata*—transplants and stumps. 2 *Mallotus philipinensis*—Transplants and stumps seeds. 3 *Eucalyptus citriodora*—Transplants and basket plants. 30 replications per treatment at 6′ × 6′.	Begur.	
10	To find out whether it is possible to raise canes (*Calamus* species) of both exotic and indigenous species in the locality, seeds, seedlings and rhizomes will be used. Thirty replications per treatment individually randomized.	Begur, Channagthode.	
11	To find out, if it is possible to fill up the blanks caused by selection fellings in the natural forests, with the following species:— 1 *Wild mango*—Seeds. 2 *Bombax*—Seedlings. 3 *Lophopetalum wightianum*—Seedlings. 4 *Mahogany*—Seedlings. 5 *Ailanthus malabarica.* 6 *Sterculia companulata.* A 9 acre plot will be chosen either in Olete Reserved Forest or near Begur and the above species will be planted at 12′ × 12′ in 1½ acre sub-plots.	Begur.	

APPENDIX A – *cont.*

Statement showing plan of operations for the Research Centres for the year 1954–55—cont

Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
12	To determine the yield of *Rauwolfia serpentina* roots after 1, 2, 3 and 4 years. The plants in the nursery will be divided into four groups and each group will be uprooted after 1, 2, 3 and 4 years and the weight of green and dry roots recorded. The design will be as follows:— A—1 year. B—2 years. A D B C C—3 years. D—4 years. The shoot cuttings thus obtained will be utilized for a nursery experiment to find out the best method of raising *Rauwolfia serpentina.* 30 replications per treatment.	Begur, Channagthode, Dhoni.	
13	To find out the quantity of organic material (leaves, twigs, etc.), returned to the soil by one acre of teak of various qualities and various ages (suggested by Central Silviculturist to decide whether the soil is depleted or not by a pure crop of teak). Half acre plots in I, II and III qualities will be opened in a 10 year, 20 year, 30 year, 40 year, 50 year, 60 year and 70 year teak plantations. The leaves twigs, etc., will be gathered and weighed. This year, plots will be opened in 10 year, 20 year and 30 year old plantations.	Begur, Nilambur.	
14	To find out the best and cheapest method of afforesting the grass lands. In a 5-acre plot, divided into 5 sub-plots, the following species will be tried in one foot cubo pits at an espacement of 12′ × 12′:— 1 *Vateria indica*—Seeds. 2 *Wild mango*—Seeds. 3 *Artocarpus hirsuta*—Seed and seedlings raised in bamboo baskets. 4 *Ailanthus malabarica*—Seedlings. 5 *Sterculia companulata.* In half of each plot, the grass round each pit will be scraped to a diameter of 3′, while no scraping will be done in the other half. The design will be as follows:— *V.* *Indica. Aini. Sterculia. Ailanthus. Mange* Scraped.	Chandanathode.	

APPENDIX A--*cont.*

Statement showing plan of operations for the Research Centres for the year 1954-55—cont.

Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
15	To study the growth and development of *Eucalyptus citriodara* in the locality in a half acre plot, in the grass lands, basket plants of *Eucalyptus citriodara* will be planted in one foot cube pits at an espacement of 9′ × 9′.	Chandanathode.	
16	To find out whether it is possible to introduce valuable hardwood and softwood species in the natural evergreen forest, without clearfelling. The following species will be tried :— 1 *Ailanthus malabarica*—100 seedlings. 2 *Sterculia companulata*—100 seedlings. 3 *Lophopetalum wightianum*—100 seedlings. 4 *Vateria indica*—Seeds and seedlings 100. 5 *Wild mango*—Seeds and seedlings, 100. 6 *Mahogany*—Seeds and seedlings. 7 *Pterocarpus dalberdes.* 8 *Mimusops littoralis*—100. The seeds and seedlings will be planted in one foot cube pits at an espacement of 12′ × 12′. Two treatments will be tried for each species in treatment A only the shrubby undergrowth will be cleared, while in B, besides the undergrowth, saplings and poles of useless species up to a girth of 3′ will be felled.	Do.	
17	To find out whether it is possible to raise *Sterculia companulata* from shoot cuttings under the top canopy cover in an evergreen forest. Three sizes of cuttings, viz., large (1½″—2″ diamter), medium (1″—1½″) and small (½″—1″) and 18 inches long will be used. There will be 50 replications per treatment individually randomized. The cuttings will be planted in crowbar holes at an espacement of 6′ × 6′.	Do.	
18	To study the best method of raising *Alizzia falcata* :— A.—Transplants. B.—Stumps.	Dhone, Topslip.	
19	To find out whether it is possible to introduce valuable hard and soft woods in the natural moist deciduous forests in Sappal valley.	Dhone.	

APPENDIX A—*cont.*

Statement showing plan of operations for the Research Centres for the year 1954-55—cont.

Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
	The following species will be tried :— 1 *Stercullia companulata*—Seedlings. 2 *Ailanthus malabarica*—Seedlings. 3 *Evodia roxhurghiana*—Seedlings. 4 *Bombax malabaricum*—Seedlings. 5 *Wild mango*—Seeds. 6 *Artocarpus hirsuita*—Seeds and seedlings. 7 *Zanthoxylum rhetsa*—Seedlings raised in baskets. A seven-acre plot will be taken and divided into seven sub-plots of one acre each. In each sub-plot, half the area will be cleared of all shurb growth, while in the other half, the shrubs, saplings and poles will be felled. The underplants will be planted in pits 1 foot cube at 12′ × 12′.		
20	To study the effect of manuring teak plants with superphosphate in a second rotation crop. The following treatment with four replications each will be done as follows in a randomized block :— A.—2 oz. of superphosphate per plant. B.—2 oz. of N.P.K. fertilizer. C.—1 oz. of superphosphate plus 1 oz. N.P.K. D.—Control. B D C A C A B D A C D C D B A B The experiment will be done in September just after the Ponam harvest) and also in one year old plants. Last year, the experiment was done in a one year old plantation on the suggestion of the Chief Conservator of Forests, and the results were significant. But the experiments started in a six months old plantation (just after the Ponam harvest in September) did not give significant results.	Nilambur.	

APPENDIX A—*cont.*

Statement showing plan of operations for the Research Centres for the year 1954–55—cont.

Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
21	To find out whether *Calicopteris floribunda* retards the growth of teak or not (suggested by Conservator of Forests, Ootacamund Circle). In a one acre plot, divided into two sub-plots in Aravallikkavu, one will be kept as control and in the other the creepers will be cut flush with the ground in May, August and November.	Nilambur.	
22	To study the effect of artificial manuring on *Bombax* seedlings raised after cutting and burning a secondary growth (Ponamed area—Matchwood coupe of Kannoth range). The experiment will be in a 4×4 latin square with four treatments and four replications. The treatment will be as follows :— A.—Control, B. 2 oz. of N.P.K. Fertilizer C.—1 oz. superphosphate 1 oz. of N.P.K. D.—2 oz. of superphosphate. The design is shown below :— C B A D D A B C B C D A A D C B Each sub-plot will be quarter of an acre. The usual ponam crops may be allowed. (This experiment was done last year with superphosphate only, but the results are not significant.)	Kannoth.	
23	To study the effect of pruning in a pure *Evodia* plantation. To start with the pruning will be done in a three-year old plantation as shown below :— A B B A A.—Control. B.—Treated. Each sub-plot will be P of an acre. The undergrowth will not be cut. If the results are encouraging the experiment will be repeated in 4-acre plots in three, four and five years old plantations.	Do.	

APPENDIX A—*cont.*

Statement showing plan of operations for the Research Centres for the year 1954–55—cont.

Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
24	To study the effect of thinning in a pure *Evodia* plantation and determine the age of the first thinning. In a three-year old plantation 2 acres will be chosen and divided into four sub-plots; two will be thinned removing 50 per cent of the plants and the other two sub-plots will be treated as control :— A B B A A.—Thinned. B.—Control. Height and diameter measurements will be recorded to check initial comparability.	Kannoth.	
25	To find out whether wattle (*Acacia mollissima* or *Acacia decurrens*) will grow at 2,500 feet. Treated seeds of both species will be sown in 50 stakes each at 10—20 seeds per stake at an espacement of 9′ × 9′ before 30th April 1954.	Topslip.	
26	To see the effect of underplanting the following species in a pure teak plantations:— 1 *Mahogany.* 2 *Ailanthus malabarica.* 3 *Wild mango.* 4 *Sterculia companulata.* The experiments will be started in a 14—18 year old plantation. To begin with two acre plots will be divided into two sub plots, one with underplants and the other control. The underplants will be planted in pits at 12′ × 12′ espacement. Initial comparability to be checked on the basis of height and diameter.	Do.	
27	To find out whether it is possible to introduce valuable hard and softwood in Karianshola without clearfelling. The following species will be used :— 1 *Veteria indica* (dibbling of seeds). 2 *Mahogany* (transplants 1½—2′). 3 *Ailanthus malabarica* (one-year old plants) 4 *Ailanthus grandis* (transplants). 5 *Sterculia companulata* (transplants). 6 *Cinnamomum zeylanicum* (50 stumps). (Ceylon variety seedlings and stumps). 7 *Pterocarpus dalbergiodes.*	Do.	

APPENDIX A—*cont.*

Statement showing plan of operations for the Research Centres for the year 1954-55—cont.

Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
	One hundred plants of each species will be tried at an espacement of 12′ × 12′. There will be two treatments, A and B. In treatment A, only the shrubby undergrowth will be cut while in treatment B, the shrubby growth and all saplings and poles of useless species up to 3 feet in girth forming the middle canopy will be cut.		
28	Regeneration of a dry fuel forest by the Thummalo, Emmanur and Saucer methods —using *Neem*, *Prosopis* and *Cassia Siamea* seeds (Demonstration for the sake of the Forest College).	Bennari.	
29	To find out the best method of planting *Eucalpytus citriodara* and *Eucalyptus rostrata* and *Eucalyptus* hybrid :—	Do.	
	A.—Naked transplants.		
	B.—Basket plants.		
	C.—Potted plants.		
	50 plants per treatment individually randomized at an espacement of 6′ × 6′ in pits, 1 foot cube.		
30	To find the best size of *Eucalyptus citriodara Rostrata* and hybrid transplants :—	Do.	
	A.—Four months old.		
	B.—Six months old.		
	C.—8—10 months old.		
	D.—10—12 months old.		
	30 plants per treatment individually randomized (abcdbcdacdbadcbacbad) in pits 1 foot cube. All seedlings to be potted plants.		
31	To determine the best method of raising Cashew nut in the locality (suggested by Conservator, Working Plans) :—	Do.	
	A.—Direct sowing in worked soil.		
	B.—Transplants—Six months old.		
	C.—Seedlings raised in baskets.		

APPENDIX A—*cont.*

Statement showing plan of operations for the Research Centres for the year 1954–55—cont.

Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
32	The following experiments will be done to find out the best and cheapest method of reafforesting a degraded fuel forest :—	Bennari	
	(*a*) In the clearfelled 10-acre plots along the main road, the following species will be tried, as direct sowing and basket plants in lines 22′ feet apart :—		
	1 *Dalbergia sissoo*—A.		
	2 *Azadirachta indica*—B.		
	3 *Cassia siamea*—C.		
	4 *Acacia arabica*—D.		
	5 *Terminalia chebula*—E.		
	6 *Prosopis juliflora*—F.		
	The design will be as follows :—		
	ACBFDE ABDECF AFDBCE		
	Plants will be at 18 feet apart in 1 foot cube pits and in the centre of two such pits, seeds of the same species will be sown in worked up soil as shown below :—		
	Plant. Plant. Plant. Seeds. Seeds.		
	A kumri crop of ragi, thenai, kollu or thuvarai may be grown.		
	(*b*) In the 30-acre plot adjoining the Bhavanisagar road and last year's plot, 15 acres will be clearfelled and basket plants of the following species will be planted in 1 foot cube pits at 9 feet apart in lines 22 feet apart :—		
	1 *Eucalyptus hybrid.*		
	2 *Eucalyptus rostrata.*		
	3 *Eucalyptus citriodara.*		
	4 *Dalbergia sissoo.*		
	5 *Azadirachta indica.*		
	6 *Cassia siamea.*		
	7 *Acacia arabica.*		
	8 *Anacardium occidentale* (cashew nut).		
	The actual design of the experiment will be decided after the land has been prepared. A kumri crop of ragi, thenai, kollu or thuvarai may be grown.		

APPENDIX A—*cont.*

Statement showing plan of operations for the Research Centres for the year 1954–55—cont.

Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
32	The following experiment will be done to find out the be t and cheapest method of reafforesting a degraged full forest—*cont.* (*c*) In the other 15 acres, strips 3 feet wide will be cleared every 22 feet apart and basket plants of the above 8 species will be planted in 1 foot cube pits, 9 feet apart. Actual cost data of the above three experiments will be maintained.		
33	To find out whether *Casuarina cunninghami* will grow in the locality :— A.—Transplants. B.—Basket plants. 50 seedlings per treatment, individually randomized.	Bennari.	
34	To determine the yield of oil from *Eucalyptus citriodara* and find out whether it varies with the age of the plants. 10—15 lb. of leaves will be collected every month beginning from August and sent to Forest Research Institute. Leaves from 1951, 1952. Plants will be collected separately.	Do.	
35	To find out the best and cheapest method of eradicating the dense growth of *lantana* and reafforesting the degraded fuel forests. The following methods will be tried :— (*a*) Cutting the *Lantana* and burning. (*b*) Cutting 3 feet wide strips 22 feet apart. (*c*) Spraying with sodium chlorate and then burning. A 9-acre plot will be chosen in Noganur reserve adjoining the 1947 *Dalbergia sissoo* plot. This area will be divided into three sub-plots for the three methods. The following species will then be planted in one foot cube pits 9 feet apart in strips 22 feet apart :— 1 *Eucalyptus hybrid*—All basket plants. 2 *Eucalyptus rostrata*—All basket plants. 3 *Eucalyptus citriodara*—All basket plants. 4 *Cedrella toona*—seedlings. 5 *Dalbergia sissoo*—seedlings. A kumri crop of thenai, ragi, kambu, kollu or thuvarai may be allowed. Complete cost data will be maintained.	Denkanikota.	

APPENDIX A—*cont.*

Statement showing plan of operations for the Research Centres for the year 1954–55—cont.

Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks*
(1)	(2)	(3)	(4)
36	To find out the best method of propagating *Burserra delpichiana*— (*a*) Six cutting (medium size—above ¼ inch and below ½ inch in diameter) will be taken on the 15th of every month from April, three will be treated with seradix and three without Seradix and planted in pots.	Denkanikotta.	
37	To find out the growth and development of Casuarina cominghani— Hundred basket plants will be planted in one foot cube pits at 7′ × 7′.	Do.	
38	To find out a cheapest method of reafforesting a degraded fuel forest, in which the growth of *lantana* is sparse. A 4-acre plot will be chosen ; half the area will be clearfelled and in the other half strips 3 feet wide will be cut at 22 feet apart. The following species will be planted in one foot cube pits, 11 feet apart in lines 22 feet apart :— 1 *Dalbergia sissoo.* 2 *Cedrella toona.* 3 *Eucalyptus rostrata*—Basket plants. 4 *Eucalyptus hybrid*—Basket plants. 5 *Eucalyptus citriodara*—Basket plants. 6 *Cassia siamea*—seeds. A kumri crop may be grown in the clear-felled sub-plot. Detailed cost data will be maintained.	Do.	
39	In the nursery, seedlings of *Santalum Jassi*, the Horseylykonda variety, and strains from Nilgri, North Coimbatore, Javadis (Vellore West), Shevroys, and the local origin will be grown and tested against spike by the patch grafting.	Do.	
40	To find out whether the failure of the lac crop is due to parasite or not. Ten *Zizyphus* trees in Noganur and ten *Schlichera* trees in the garden will be chosen. The trees will be infected with brood lac (obtained from Ranchi) enclosed in wire gauze cages.	Do.	

APPENDIX A—*cont*

Statement showing plan of operations for the Research Centres for the year 1954-55—cont.

Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
41	To find out the best method of regenerating *Schelichera* and *Zizyphus* trees— A—Seeds. B—Seedlings. C—Stumps. D—Cuttings. Thirty replications per treatment at 3′×3′.	Denkanikotta.	
42	To find out the number of pluckings and yield of camphor per acre, the *Ocimum* being grown in place of a kumri crop. The experiment will be done in a *Lantana* infected area. In a half acre plot, after clearing and burning all *Lantana*, Eucalyptus hybrid will be planted in pits at 9′×9′. In half the plot *Ocimum* seeds will be sown broadcast after one or two showers. In the other half, *Ocimum* seeds will be sown after raking the soil. The ocimum leaves will be plucked during the first week of October, December and March and sent to the Forest Research Institute for analysis. Tender and mature leaves will be collected separately. Besides, rate of growth, etc., detailed cost data will be maintained.	Do.	
43	To find out the cheapest best method of ensuring uniform natural regeneration in a second rotation wattle plantation, three treatments, viz., a light burn, forking of the ground leaving two feet wide untouched strips every 11 feet apart and control will be tried with three replications per treatment. (Suggested by Conservator, Ootacamund Circle.)	Nilgiris.	
44	To study the effect of applying chemical fertilisers on the growth and development of wattle in virgin grass lands with and without wider scraping, to see if it is possible to do away with frost covering. There will be four treatments with four replications in each as follows :— B D C A C A B D A C D B D B A C A—1 oz. of fertiliser with 3 feet wide scraping. B—2 oz. of fertiliser with 3 feet wide scraping. C—2 oz. of fertiliser without wider scraping. D—Seeds and 2 oz. fertiliser and 3 feet scraping.	Do.	

APPENDIX A—*cont.*

Statement showing plan of operations for the Research Centres for the year 1954-55—cont.

Serial number.	*Particulars of work.*	*Centres in which done*	*Remarks*
(1)	(2)	(3)	(4)
45	To determine the best data of thinning natural regeneration of wattle. Four treatments with four replications in a latine square design as in experiment No. 2. The tretment will be— A.—2—3 feet in height. B. 3—5 feet in height. C.—5—7 feet in height. D.—7—9 feet in height. The plants will first be thinned to an average espacement of 6 feet. This experiment will be repeated in two localities.	Nilgiries	
46	To find out whether it is possible to lop the leaves of Bluegum more than once during the rotation without affecting the volume increment. The design will be 4×4 latine square as in the previous experiment. The treatment are as follows :— A.—Control—no lopping till end of rotation. B.—Two loppings in the seventh and fifteenth year. C.—Three loppings in the fifth, tenth and fifteenth year. D.—Four loppings in fourth, eighth, twelfth and fifteenth year. One-third of the crown will be left untouched, and branches thicker than 3 inches in diameter will not be cut.	Do.	
47	To determine whether the yield of *Eucalyptus* oil varies with the age of the Plant. Leaves from one to fifteen year old trees will be collected in the beginning of January, April, August and November and sent to the Forest Research Institute for analysis. Tender and mature leaves will be collected separately and sent.	Do.	
48	To find out whether it is possible to induce natural regeneration in a bluegum coppice area (as suggested by Conservator, Otacamund Circle in his inspection note for Nilgiris). In a twelve-year old plantation, the following treatment will be tried. A.—Cutting the undergrowth before seed fall. B.—Cutting the undergrowth and raking the soil before seed fall. C.—Cutting the undergrowth and broadcast sowing of seeds early in June. This will be repeated in two localities.	Do.	

APPENDIX A—*cont.*

Statement showing plan of operations for the Research Centres for the year 1954–55—cont.

Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
49	To find out whether it is possible to plant wattle during the pre-monsoon showers in April so that they will grow above the frost level by the following October. Hundred basket plants 6 inches to 9 inches and hundred mossed seedlings will be planted in pits, individually randomised (ABBAABBABAAB) with 2 oz. of fertiliser per plant before 20th April. Three feet wide scraping will be done for all plants in June and again in September (as suggested by the Chief Conservator of Forests).	Nilgiris.	
50	To find out whether it is possible to induce advance growth in a wattle plantation. In a mature wattle plantation (8—10 years old) mother trees will be left 30—40 feet apart and the rest felled. The felling slash will be heaped along the contours. The shrubby undergrowth will be cut flush with ground early in June. If found necessary, a second weeding will be done in September. This experiment will be repeated in two localities.	Do.	
51	To find out the best method of raising— 1 *Eucalyptus citriodara.* 2 *Eucalyptus redunca baralata.* 3 *Eucalyptus maculata.* 4 *Alnus glutinosa.* Three treatments (viz., naked transplants, mossed seedlings and basket plants) with thirty replications in each will be tried in the Andy's Corner experimental garden.	Do.	
52	To study the growth and development of— 1 *Eucalyptus citrodara.* 2 *Eucalyptus redunca.* 3 *Alnus glutinosa.* 4 *Acacia pycantha.* Two hundread seedlings (basket plants) of each species will be planted in 1 foot cube pits at an espacement of 9′ × 9′ in Andy's Corner.	Do.	

APPENDIX A—*cont.*

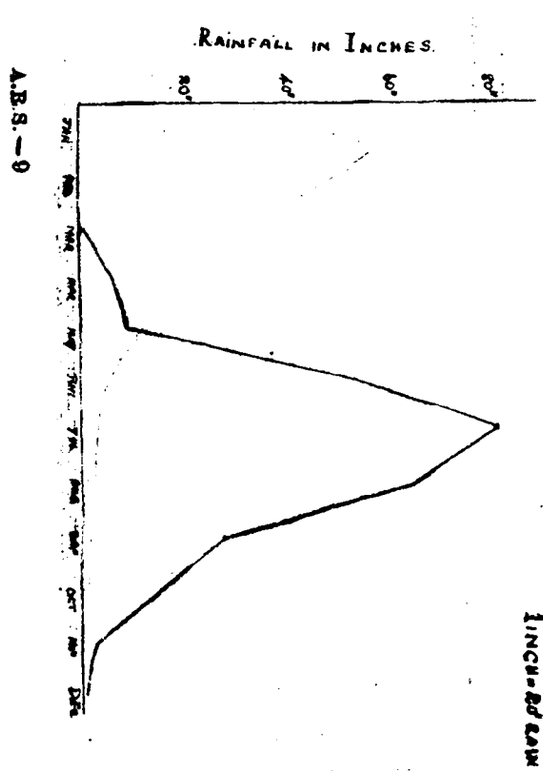
Statement showing plan of operations for the Research Centres for the year 1954-55—cont

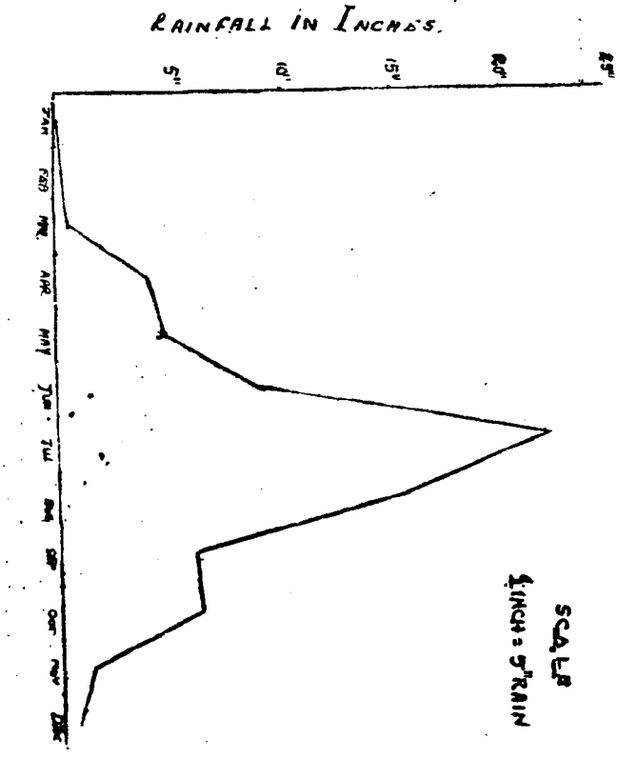
Serial number.	*Particulars of work.*	*Centres in which done.*	*Remarks.*
(1)	(2)	(3)	(4)
53	To find out whether it is advisable to reduce the number of coppice shoots in a one year old bluegum coppice plantation. There will be four treatments with 25 replications in each. A.—Control—All shoots left in tact. B.—Number of shoots reduced to two per stool. C.—Number of three shoots reduced to two per stool. D.—Number of four shoots reduced to two per stool. This will be done in two localities. (This experiment was suggested by Sri K. T. Matthew, I.F.S., as Conservator, Working Plan Circle, in May 1953.)	Nilgiris.	
54	To find out whether it is possible to grow two crops of lac in Mudumalai Range. Necessary brood lac will be obtained from Ranchi. The work will be done by the district staff under the supervision of the Silviculturist.	Do.	
55	To find out the best and cheapest method of eradicating the imperata grass and lantana and fill up the gaps created by selection fellings in Mudumalai Range. (Suggested by Conservator, Ootacamund and Sri K. T. Matthew, I.F.S., as Conservator, Working Plan Circle.) This experiment was done in 1950 and 1951, with teak, *Dalbergia sissoo*, *Mahogany*, *Aini*, and *Lencania glanca*, but all except *Mahogany* failed due to heavy browsing. This time, the following species will be tried, seedlings of *Mahogany* and teak (stumps) and seeds of *Terminalia tomentosa*, wild mango and *Cassia fistula.*	Do.	
	To study the effect of pruning in teak plantations and the earliest age at which pruning can be started. This experiment with one control and one treatment will be done in a 2, 3, 4 and 5. year old teak plantation. The work will be done by the district staff under the supervision of the Silviculturist	Do.	

APPENDIX B-I.

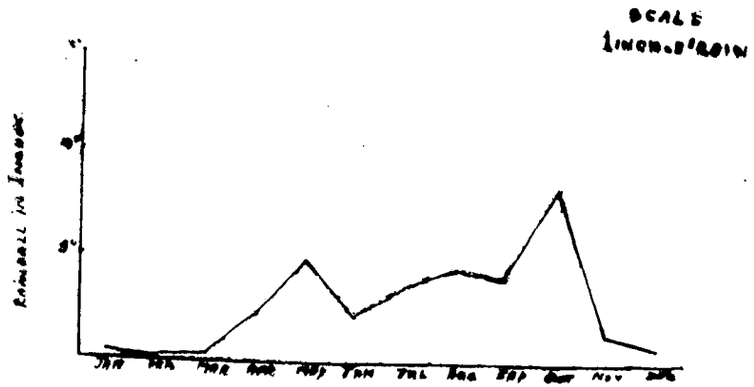
Statement showing the average monthly Rainfall with charts for Research Stations for the year 1954—55.

Months.	Evergreen Forests.						Mixed deciduous forests.										Dry deciduous forests.		High elevation forest	
	Topslip.		Chandanthode.		Nilambur.		Begur.		Kannoth.		Dhoni.		Walayar.		Eeumur.		Denkanikota.		Aramby.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
1954																				
April	4·86	6	4.10	4	3·31	9	1·74	7	3·71	4	2·82	9	1·90	2	4·72	10	1·95	6	3·80	13
May	1·30	1	6·70	12	4·50	11	5·33	11	2·15	9	6·00	9	3·20	6	4·57	9	9·40	11	2·71	12
June	9·60	14	75·30	30	28·03	26	11·66	23	41·11	26	28·44	26	10·10	13	0·44	2	3·44	4	4·82	61
July	12·60	15	82.40	31	24·46	29	22·26	28	51·90	30	46·21	30	16·40	13	1·01	4	5·00	8	9·58	24
August	7·20	12	86·50	26	18·48	25	12·82	22	36·80	25	27·13	23	10·60	14	5·29	10	3·89	7	8·85	23
September ..	8·60	9	35·30	23	4·46	18	5·11	18	15·81	28	7·66	16	5·04	12	0·18	1	1·50	4	1·36	8
October	3·40	5	13·50	17	10·73	15	6·81	12	12·33	22	12·96	20	6·00	14	14·74	15	11·05	14	9·17	20
November	..	..	..	..	1·97	3	0·25	1	1·80	3	1·76	4	..	..	1·63	2	..	..	0·51	3
December	5·10	7	0·70	3	1·10	2	0·76	3	1·50	3	0·16	2	1·50	5	1·04	2	3·11	7	3·03	7
1955																				
January	1·00	1	..	..	0·32	1	..	..	..	..	..	..	..	..	..	..	..	..	..	4
February	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
March	..	..	1·10	2	..	..	0·23	2	1·12	1	..	..	..	..	..	..	..	..	0·50	..
Total for 1954—55.	53·66	70	305·60	148	97·36	139	66·97	127	169·23	151	133·11	13	57·74	79	33·62	55	39·37	61	44·33	130
Total Rainfall for number of years.	1,815·68	2.732	7,206·52	5,371	8,603·93	9,276	2,495·26	3,583	6,132·10	5,279	2,885·53	3520	1,769·44	2,535	582·15	1,400	1,037·39	2,079	824·52	1,801
	(29)		(37)		(78)		(36)		(37)		(26)		(33)		(20)		(30)		(15)	
Average rainfall per year.	62·61	94	194·77	145	110·31	119	69·31	100	165·73	143	110·98	135	53·62	77	29·11	70	34·58	69	54·97	120

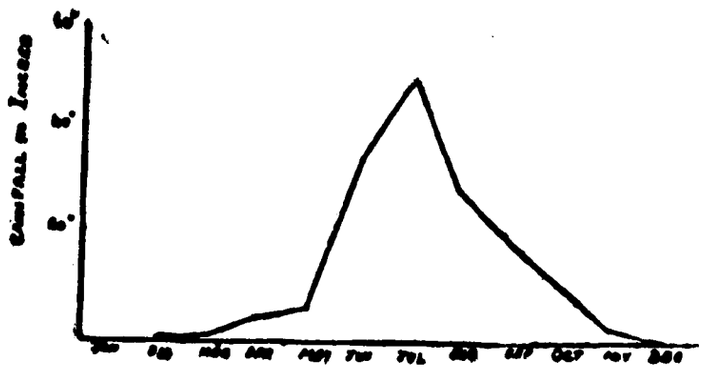




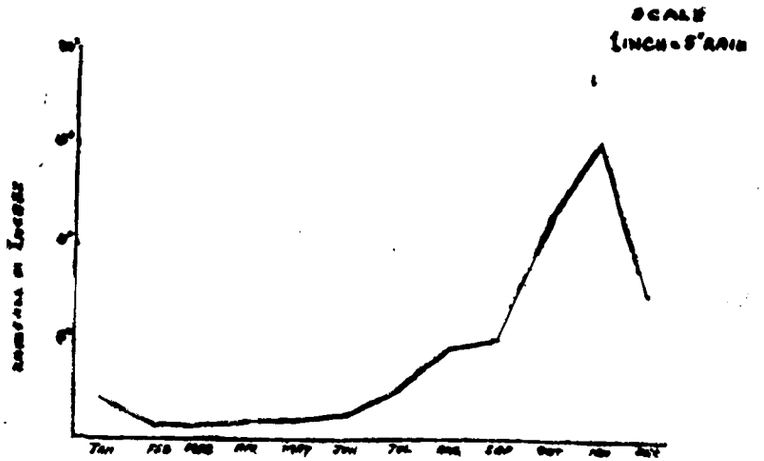
DENKANIKOTA



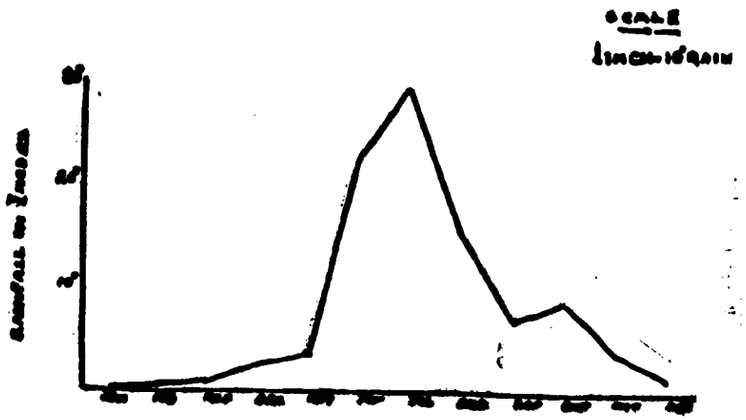
KANNOTH



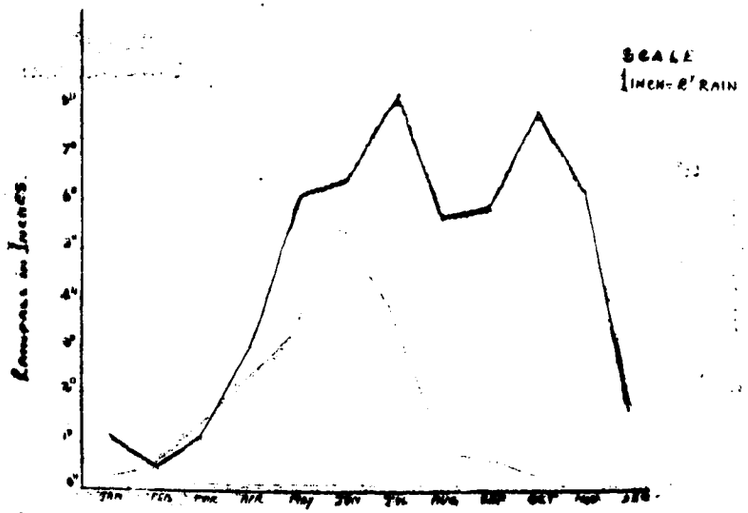
CUDDALORE



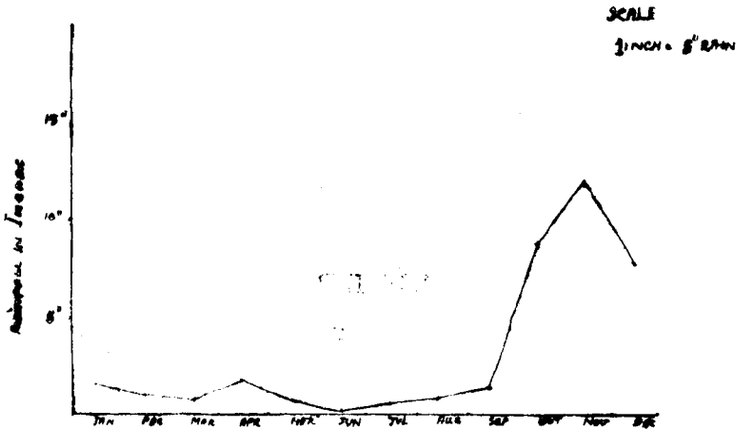
NILAMBUR



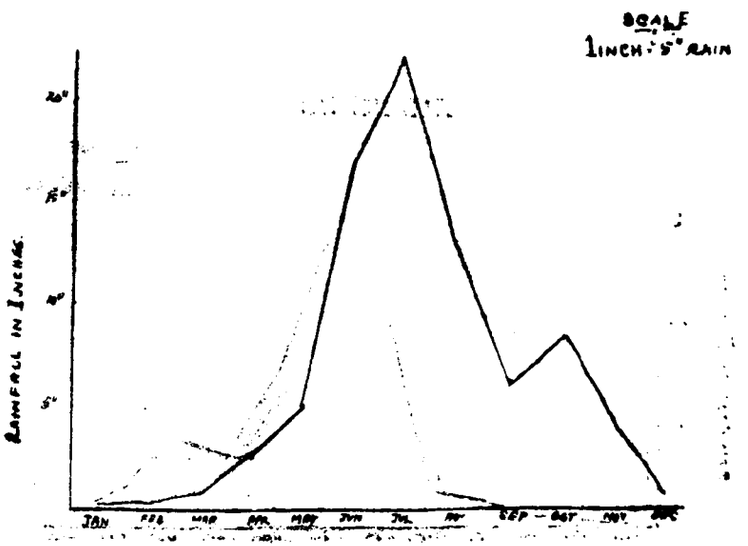
OOTACAMUND



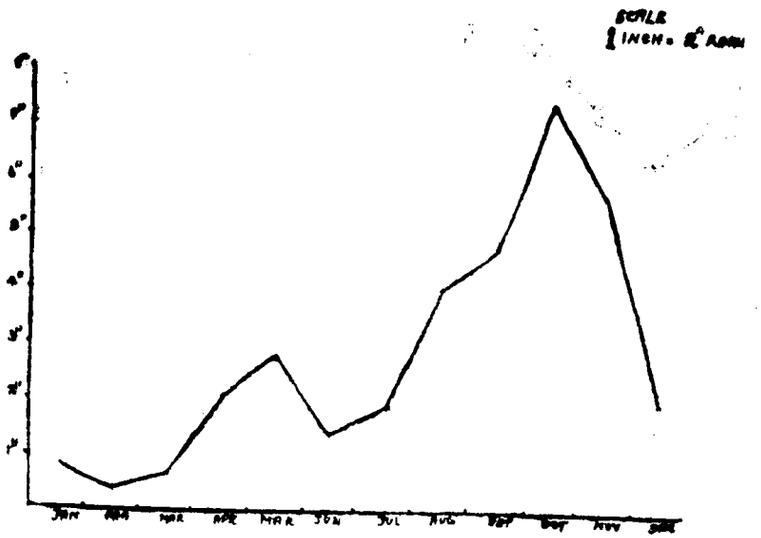
PAMBAN

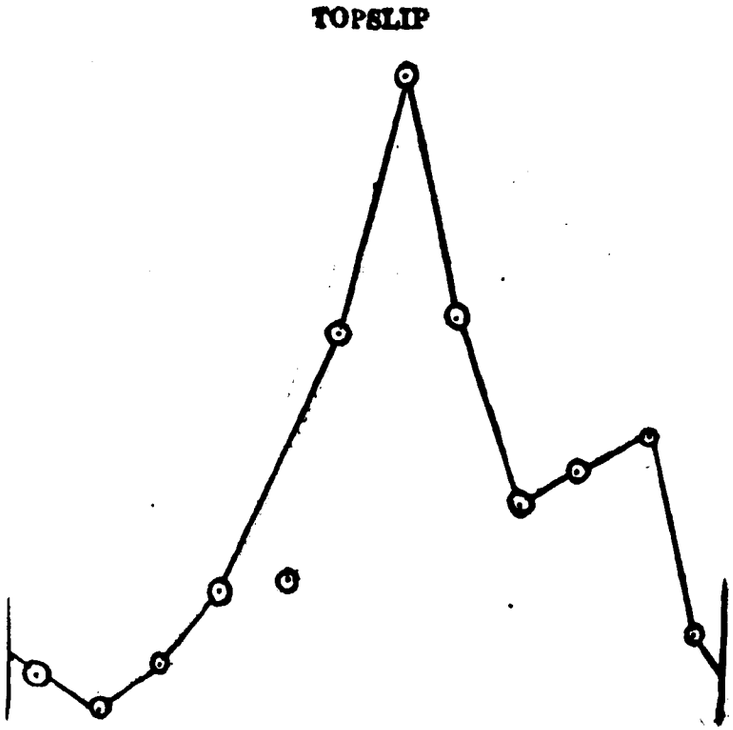


PALGHAT



VEMBURULI





APPENDIX C.

(Referred to in paragraph 6.)

Statement showing sample Plots, Permanent Preservation Plots and tree increment Plots in Madras State.

Division.	*Sample plot number.*	*Species.*	*Particulars.*
		I. SAMPLE PLOTS.	
Palghat	1	*Swietenia macrophylla* ..	Study height, diameter and volume increment.
	2	*Do.* ..	Do.
	3	*Tectona grandis*	Do.
	4	*Pterocarpus marsupium* ..	Do.
	5	*Terminalia crenulata* ..	Do.
Nilgiris	1	*Eucalyptus pillularis* ..	Study volume increment
	2	*Eucalyptus euginoides* ..	Do.
	3	*Eucalyptus propinoqua* ..	Do.
	4	*Eucalyptus acmenoides* ..	Do.
	5	*Eucalyptus paniculata* ..	Do.
	8	*Acacia mollissima*	Do.
	9	*Acacia decurrens*	Do.
	10	*Acacia mollissima*	To find out the yield of bark at different ages.
Coimbatore, South ..	1	*Tectona grandis*	To ascertain data for yield tables for Teak at Mount Stuart.
	2—17	*Do.*	Compare the height, diameter and volume increment of teak of different origins.
	18	*Do.*	To study height, diameter and volume increments.
	19	*Do.*	Do.
	20	*Do.*	Do.
	21	*Do.*	Do.
	22	*Do.*	Do.
	23	*Do.*	Do.
	24	*Do.*	Do.
Dharmbur	1	*Tectona grandis*	To study volume increment and development of plantation I quality severely thinned.
	2	*Do.*	To study volume increment and development of plantation I quality very severely thinned.
	3	*Do.*	To study volume increment and development of plantation II quality fairly thinned.
	4	*Do.*	To study volume increment and development of plantation II quality very severly thinned.
	7	*Do.*	To study volume increments and development of plantation I quality fairly severely thinned.
	8	*Do.*	To study volume increment and development of plantation I quality very severely thinned.
	17(a)	*Do.*	To determine whether there is any retardation in the development of teak crop indicating site quality deterioration from I and II rotation.
	18(a)	*Do.*	Do.
	18(d)	*Do.*	Do.
	26	*Do.*	To find out the girth increment.
	27	*Do.*	Do.

APPENDIX C—*cont.*

Statement showing Sample Plots, Permanent Preservation Plots and tree increment Plots in Madras State—cont.

Division.	*Sample plot number.*	*Species.*	*Particulars.*
		I. SAMPLE PLOTS—*cont.*	
Nilambur.—cont.	29 to 31	*Tectona grandis*	To field out the girth increment.
	35	*Do.*	Do.
	49	*Do.*	Do.
	51 and 52	*Xylia xylocarpa*	To find out the rate of growth of natural *Xylia*.
	54	*Lagerstroemia lanceolata* ..	To determine volume increment.
	55	*L. flos reginae*	Do.
	56	*Tectona grandis*	To study the volume increment of II rotation teak—II quality.
	57	*Do.*	To study the volume increment of II rotation teak—III quality.
	59	*Do.*	To study volume increment of II rotation teak.
	69to 77 and 80 to 86.	*Do.*	To find outthe best intensity of thinning.
	96 to 115	*Do.*	Comparison of growth from different origins.
	120 to 125	*Do.*	Comparing the effect on the height, diameter and volume increment in a II rotation teak plantation, heavy and early thinnings to anticipate suppression with normal District Practice.
	126	*Do.*	To determine the height diameter and volume increment of I quality teak plantation approaching the end of the rotation (when maintained beyond normal rotation age).
	127	*Do.*	Do.
	128	*Do.*	Do.
	129	*Do.*	Do.
	130	*Do.*	Do.
	131	*Swietenia macrophylla* ..	To determine height, diameter and volume increment.
	132	*Do.* ..	Do.
	133	*Do.* ..	To determine the best size of transplants and the best espacement for regeneration of Mahogany after clearfelling.
	134	*Do.* ..	Do.
	135	*Pericopsis mooniana* ..	Underplanting.
	136 to 141	*Tectona grandis*	Repetition of Dr. Craib's theory of thinning (similar to sample plots 120 to 125).
Wynaad	1 to 9	*Tectona grandis*	To find out volume increment.
	10 to 25	*Do.*	To find out the best intensity of thinning.
	26 to 34	*Do.*	To find out the best date for first thinning.
	35 to 39	*Do.*	To study height, diameter and volume increment of teak under normal District tanding.
	42 and 43	*Do.*	To determine whether Lantana has a retarding effect on the growth of teak.

APPENDIX C—*cont.*

Statement showing sample plots, permanent preservation plots and tree increment plots in Madras State—cont.

Division.	*Sample plot number.*	*Species.*	*Particulars.*
		I. SAMPLE PLOTS—*cont.*	
Wynad—cont.	44	*Pterocarpus marsupium* ..	To find out the effect of size and condition of seed bearers.
	45	*Tectona grandis*	Do.
	46	*Terminalia crenulata* ..	Do.
	47	*Sweitenia macrophylla* ..	To find out the height, diameter and volume increments.
	48	*Vitex peduncularis* ..	Do.
	49	*Lagerstroemia flos-reginae.*	Do.
	50	*Hopea parviflora*	Do.
	51	*Pterocarpus dalbergioides* ..	Do.
	52	*Chlorophora excelsa* ..	Do.
	53	*Hopea parviflora*	Do.
	54	*Ailanthes malabaricum* ..	Do.
	55	*Sterculia companulata* ..	Do.
South Kanara ..	1	*Hopea parviflora*	To study volume increment (light thinning).
	2	*Do.*	To study volume increment (moderate thinning).
	3	*Do.*	To study volume increment (heavy thinning).
Coimbatore North ..	1	*Tectona grandis*	To study the diameter and volume increment of irrigated teak.
	2	*Do.*	To observe growth and development of irrigated teak coppice.
	3	*Do.*	To compare the effect of irrigation of a teak plantation raised in an area of poor thorny scrub forest after the 4th, 5th and 6th monsoons after planting *Tectona grandis*.

II. PERMANENT PRESERVATION PLOTS.

Division.	*Permanent preservation plots number.*	*Species.*	*Particulars.*
Nilambur	1	*Swietenia macrophylla* ..	Demarcated area set aside in perpetuity for the preservation of the forest with no human interference beyond what is necessary for its protection and maintenance.
	2	*Do.* ..	Do.
	3	*Do.* ..	Do.
	4	*Tectona grandis*	Do.
Wynaad	1	(1) *Tectona grandis* ..	To preserve permanently and find out the normal development.
		(2) *Lagerstroemia lanceolata.*	Do.
		(3) *Grewia tiliafolia* ..	Do.
		(4) *Lagerstroemia lanceolata.*	Do.
		(5) *Dalbergia Latifolia* ..	Do.
		(6) *Pterocarpus marsupium.*	Do.
		(7) *Bombax malabaricum.*	Do.

APPENDIX C—*cont.*

Statement showing sample plots, permanent preservation plots and tree increment plots in Madras State—cont.

Division.	*Permanent preservation plot number.*	*Species.*	*Particulars.*
II. PERMANENT PRESERVATION PLOTS—*cont.*			
Palghat	1	*Dalbergia sissoides* ..	To prevent the groups of trees of the species from all forms of injury and to permit the normal development.
	2	*Swietenia macrophylla* ..	Do.
Coimbatore South ..	1	*Tectona grandis*	Preservation of a big tree near Tellikkal. To preserve the tree from all forms of injury and to permit the normal development of the tree.

III. TREE INCREMENT PLOTS.

Division.	*Tree increment plot number.*	*Species.*	*Particulars.*
Coimbatore South ..	1	*Mesua ferrea*	....
	2	*Hopea parviflora*	....
	3	*Calophyllum elatum* ..	....
Palghat	1	*Mesua ferrea*	....
	2	*Palaquium ellipticum* ..	....
South Kanara ..	1	*Hopea parviflora*	....
	2	*Acacia catechu*	....
	3	*Do.*	....
Nilgiris	1	*Eucalyptus globulus* ..	....
Salem North ..	1	*Santalum album*	....
Wynaad	1	*Mesua ferrea*	....
	2	*Palaquium ellipticum* ..	....
	3	*Dalbergia latifolia*	....
	4	*Pterocarpus marsupium* ..	....
	5	*Terminalia crenulata* ..	....
	6	*Lagerstroemia lanceolata* ..	....

APPENDIX D–1.

(Referred to in paragraph 34)

Statement showing the details of exotic species received and experimented upon in the Research Gardens in the division of State Silviculturist, Madras.

Serial number.	*Species.*	*Seeds received from country of origin.*	*Quantity received.*	*Tried in.*
(1)	(2)	(3)	(4)	(5)
1	*Albizzia stipulata* ..	Terramia Estate, Kullakamby.	18 lb.	Wynad, Salem South, Madura East, Kollegal, Tiruchirappalli, Madura West, Coimbatore North, Vellore East, Vellore West, Palghat, Salem North, Chingleput, Coimbatore South and Tirunelveli.
	Do.	District Forest Officer, Visakhapatnam South.	40 ,,	
	Do.	Silviculturist, Bombay ..	52 ,,	Palghat, Kollegal, Madura West, Tiruchirappalli, Tirunelveli, Coimbatore North, Salem North, Chingleput, Vellore East, Madura East and Coimbatore South.
		Silviculturist, Orissa ..	5 ,,	
2	*Bombax malabaricum* ..	Bombay, Poona ..	40 ,,	Salem North, Coimbatore North, Coimbatore South, Tirunelveli, Tiruchirappalli, Chingleput, Salem South, Madura East, Vellore East, Vellore West, Research Ranger, Nilambur, Research Foresters, Vemburuli, Markanam, Rameswaram, Topslip and Reserve Ranger, Wynad.
		Calcutta	203 ,,	
3	*Dalbergia sissoo* ..	Superintendent, Livestock Research Station, Hosur Cattle Farm.	3335 ,,	Tiruchirappalli, Madura West, Vellore West, Tirunelveli, Vellore East, Palghat, Coimbatore North, Kollegal, Chingleput, Salem South, Madura East, Markanam and Rameswaram.
4	*Eucalyptus robusta* ..	Conservator, Western Australia, Perth.	Small quantity.	Research Centres, Rameswaram, Markanam, Vemburuli, Ootacamund, Topslip, Nilambur, State Silviculturist—Andhra, Bombay, Central Silviculturist, Forest Research Institute, Debra Dun.
5	*Eucalyptus camaldulensis* ..			
6	*Eucalyptus gomphocephala* ..			
7	*Eucalyptus redunceaor alata* ..			
8	*Eucalyptus patens* ..			

APPENDIX D-1 —*cont.*

(Referred to in paragraph 34)

Statement showing the details of exotic species received and experimented upon in the Research Gardens in the division of State Silviculturist, Madras—cont.

Serial number.	Species.	Seeds received from country of origin.	Quantity received.	Tried in.
(1)	(2)	(3)	(4)	(5)
9	*Eucalyptus grandis*	Australia		Trivandrum, Kannan Devan Hills Research Centres, Ootacamund, Topslip, Vemburuli, Markanam, Wynad and The Nilgiris.
10	*Eucalyptus diversicolo*	Director-General, Forestry and Timber Bureau, Canberra, A.C.T., Australia.	Small quantity	Research Centres—Topslip, Wynad, Ootacamund, Botanical Garden, Ootacamund.
11	*Eucalyptus marginata*			
12	*Eucalyptus grandis*			
13	*Eucalyptus rudis*			
14	*Eucalyptus hybrid*	Silviculturist, Mysore	45 lb.	Kollegal, Salem North, Tirunelveli, Vellore West, Coimbatore North, Coimbatore South, Madurai West, Vellore East, Chingleput, Tiruchirappalli, Palghat, Madurai East, Research Centres—Markanam, Vemburuli, Salem South and Rameswaram.
15	*Calophyllum antillanum* ..	Conservator of Forest, Jamaica.	5 lb.	Research Centres–Palghat, Wynad, Topslip, Nilambur and South Kanara.
16	*Cedrela odorata*	Do.	2 ,,	Research Centres–Topslip, Nilambur, Kannoth, Chandanathode, Dhoni, South Kanara and Tirunelveli.

APPENDIX D-2

(Referred to in paragraph 34.)

Statement showing the details of indegenous seeds received and exverimented upon in the Research Gardens in the division of State Silviculturist, Madras.

Serial number.	Species.	Supplied to whom.	Seed origin.	Supplied by	Quantity.
(1)	(2)	(3)	(4)	(5)	(6)
1	*Acacia mollissima* ..	Forest Officer, Manipur	Purchased locally	Reserve Forester, Ootacamund.	100 lb.
2	*Do.* ..	Silva, Orissa	Do.	Do.	½ lb.
3	*Do.* ..	District Forest Officer, Coimbatore South.	Do.	Do.	30 ,,
4	*Do.* ..	Forest Officer, Berhampur	Do.	Do.	5 ,,
5	*Do.* ..	District Forest Officer, Godavari Upper.	Do.	Do.	1 ,,
6	*Do.* ..	Director of Cinchona	Do.	Do.	2 oz*
7	*Do.* ..	District Forest Officer, Visakhapatnam South.	Do.	Do.	5 lb.
8	*Do.* ..	Chief Forest Officer, North East Frontier Agency.	Do.	Do.	8 oz.
9	*Do.* ..	Silva, Darjeeling	Do.	Do.	2 ,,
10	*Do.* ..	Silvicultural Forest Ranger, Siliguri ..	Do.	Do.	8 ,,
11	*Do.* ..	District Forest Officer, Chamba	Do.	Do.	4 ,,
12	*Do.* ..	District Forest Officer, Visakhapatnam North.	Collected from Ootacamund Reserve Centre.	Do.	3 lb.
13	*Do.* ..	Range Officer, Poonachi Range	Do.	Do.	40 ,,
14	*Do.* ..	Director of Cinchona, Ootacamund ..	Do.	Do.	2 ,,
15	*Do.* ..	Conservator of Forests, Sikkim	Do.	Do.	1 ,,
16	*Do.* ..	Silva, Travancore-Cochin State	Do.	Do.	8 oz.
17	*Do.* ..	District Forest Officer, South Coorg ..	Do.	Do.	100 lb.
18	*Do.* ..	Director of Cinchona, Ootacamund ..	Do.	Do.	3 ,,
19	*Do.* ..	District Forest Officer, Coimbatore North.	Do.	Do.	10 ,,
20	*Do.* ..	District Forest Officer, Godavari Upper.	Do.	Do.	1½ ,,
21	*Do.* ..	District Forest Officer, Salem South ..	Do.	Do.	2½ ,,
22	*Do.* ..	Silva, Madhya Bharat	Do.	Do.	40 ,,
23	*Do.* ..	Silva, Assam	Do.	Do.	75 ,,
24	*Do.* ..	Chief Forest Officer, North-East Frontier Agency.	Do.	Do.	8 ,,

APPENDIX D-2—cont.

Statement showing the details of indegenous seeds received and experimented upon in the Research gardens in the division of State Silviculturist, Madras—cont.

Serial number.	Species.	Supplied to whom.	Seed origin.	Supplied by	Quantity.
(1)	(2)	(3)	(4)	(5)	(6)
25	*Acacia mollissima* ..	Silva, Assam	Collected from Ootacamund Reserve Centre.	Reserve Forester, Ootacamund.	62 lb.
26	*Do.* ..	Do.	Do.	Do.	108 ,,
27	*Do.* ..	Do.	Do.	Do.	5 ,,
					497½ ,, 32 oz.
1	*Acacia decurrens* ..	Forest Reserach Station Officer, Dharmyala.	Do.	Do.	½ lb.
2	*Do.* ..	Forest Research Station Officer, Mamali.	Do.	Do.	½ ,,
3	*Do.* ..	Silva, Orissa	Do.	Do.	½ ,,
4	Do. ..	Ceylon Produce Agency, Matala ..	Do.	Do.	10 ,,
5	*Do.* ..	Silva, Bombay	Do.	Do.	1/2 ,,
6	*Do.* ..	Chief Forest Officer, North-East Frontier Agency.	Do.	Do.	½ ,,
7	*Do.* ..	Silva, Darjeeling	Do.	Do.	2 oz.
8	*Do.* ..	District Forest Officer, Chamba ..	Do.	Do.	4 ,,
9	*Do.* ..	Conservator of Forests, Sikkim	Do.	Do.	1 lb.
10	*Do.* ..	Silva, Travancore-Cochin State	Do.	Do.	½ ,,
11	*Do.* ..	Silva, Madhya Bharat	Do.	Do.	20 ,,
12	*Do.* ..	Divisional Forest Officer, Satara Division	Do.	Do.	2½ oz.
13	*Do.* ..	Chief Forest Officer. Frontier Agency ..	Do.	Do.	1 lb.
					85 lb. 8½ oz.
1	*Acacia melanoxylon.*	Silva, Bombay	Purchased by Reserve Forester, Ootacamund.	Do.	½ lb.
2 to 7	*Acacia stipulata* ..	District Forest Officers, Coimbatore North, Palghat, Tiruchirappalli, Salem North and Chingleput, Coimbatore South at 3 lb. each.	Received from Visakhapatnam North.	Do.	18 ,,
8—18	*Do.* ..	District Forest Officers, Madurai West, Vellore East, Kollegal, Tirunelveli and Madurai East at 2 lb.	Do.	Do.	10 ,,
14	*Do.* ..	District Forest Officer, Vellore West ..	Do.	Do.	4 lb.
15	*Do.* ..	District Forest Officers, Wynad and Salem South.	Do.	Do.	2 ,,
16 to 22	*Albizzia stipulata* ..	District Forest Officers; Madura East, Madurai West, Vellore East, Vellore West, Palghat, Kollegal, Tirunelveli at 1 lb.	Received from Messrs. Tranis Estate.	Reserve Forester, Ootacamund.	7 ,,
23 to 24	*Do.* ..	District Forest Officers, Wynad and South Salem.	Do.	Do.	1 ,,
25 to 29	*Do.* ..	District Forest Officers, Coimbatore North, Tiruchirappalli, Salem North, Chingleput and Coimbatore South at 2 lb.	Do.	Do.	10 ,,
					52 ,,
1	*Dalbergia latifolia* ..	Divisional Forest Officer, Avadah, U.P.	Palghat	District Forest Officer, Palghat.	790 lb.
2	*Do.* ..	Do.	Nilambur	Reserve Ranger, Nilambur.	32 ,,
3	*Do.* ..	Divisional Forest Officer, Gonda ..	Palghat	District Forest Officer, Palghat.	82 ,,
4	*Do.* ..	Divisional Forest Officer, South Kheri ..	Do.	Do.	82 ,,
5	*Do.* ..	Do. Banaris ..	Do.	Do.	40 ,,
6	*Do.* ..	Do. North Kher ..	Do.	Do.	1,230 ,,
7	Do. ..	Do. Southern Do b ..	Do.	Do.	20 ,,
8	*Do.* ..	Do. Banda Division.	Do.	Do.	82 ,,
9	*Do.* ..	The Special Forest Officer, T. and B. ..	Do.	Do.	40 ,,
10	*Do.* ..	Divisional Forest Officer, Northern Doab.	Do.	Do.	410 ,,
11	*Do.* ..	Conservator of Forests, Ceylon	Do.	Do.	6 ,,
12	*Do.* ..	Range Officer, Dudwa Range	Nilambur	District Forest Officer, Nilambur.	2,460 ,,
13	*Do.* ..	Divisional Forest Officer, Dudhi ..	Palghat	District Forest Officer, Palghat.	40 ,,
14	*Do.* ..	Divisional Forest Officer, Mirzapur ..	Do.	Do.	10 ,,
15	*Do.* ..	Divisional Forest Officer, Ramnagar ..	Nilambur	Reserve Ranger, Nilambur	160 ,,
					5,484 ,,

APPENDIX D-2—*cont.*

Statement showing the details of indegenous seeds received and experimented upon in the Research gardens in the division of State Silviculturist, Madras—cont.

Serial number.	Species.	Supplied to whom.	Seed Origin.	Supplied by	Quantity.
(1)	(2)	(3)	(4)	(5)	(6)
1	*Cassia siamea* ..	Executive Officer, Community Development Project, Midnapur.	Denkanikota ..	Reserve Ranger, Denkanikota.	2 lb.
2	*Do.* ..	Divisional Forest Officer. Birbhum Suri.	Palghat	District Forest Officer, Palghat.	40 ,,
3	*Do.* ..	Divisional Forest Officer, Hardwar.	Do.	Do.	80 ,,
4	*Do.* ..	Divisional Forest Officer, Southern Doab.	Denkanikota	Reserve Ranger, Denkanikota.	30 ,,
5	*Do.* ..	Divisional Forest Officer, Rohilkhi ..	Do.	Reserve Ranger, Denkanikota.	30 ,,
6	*Do.* ..	Divisional Forest Officer, Virajbhumi ..	Do.	Do.	30 ,,
7	*Do.* ..	Divisional Forest Officer, South Kheri ..	Do.	Do.	1 ,,
8	*Do.* ..	Divisional Forest Officer, Gomati, Rapli.	Andhra	Reserve Forester, Ootacamund.	30 ,,
9	*Do.* ..	Divisional Forest Officer, Doab	Palghat	District Forest Officer, Palghat.	30 ,,
					273 ,,
1	*Balnocarpus utlis.*	Reserve Ranger, Wynad	Tirunelveli	Range Officer, Ambasamudram.	8 ,,
2	*Do.* ..	Research Forester, Nilambur	Do.	Do.	4½ ,,
3	*Do.* ..	Research Forester, Topslip	Do.	Do.	5 ,,
					17½ ,,
1	*Balsa seeds* ..	Manager, Colso Tea Estate	Ootacamund	Reserve Forester, Ootacamund.	1 ,,
		Manager, Dholai Estate	Do.	Do.	1 ,,
2	*Do.* ..	Silva, Bombay	Do.	Do.	4 oz.
3	*Do.* ..	Director, Research Station, Highways.	Do.	Do.	1 ,,
4	*Do.* ..	Divisional Forest Officer, Kolhapur ..	Do.	Do.	½ ,,
5	*Do.* ..	Conservator of Forests, Bophal	Do.	Do.	1 ,,
6	*Do.* ..	Manager, Tile Factory, Kozhicode ..	Wynad	Do.	8 ,,
7	Do.	District Forest Officer, Nagargali ..	Do.	Do.	¼ oz.
	Do.	District Forest Officer, North Andaman.	Do.	Do.	8 ,,
	Do.	Silva, Assam	Do.	Do.	2 ,,
10	Do.	Silva, Bombay	Do.	Do.	1 ,,
11	Do.	Silva, Darjeeling	Do.	Do.	4½ ,,
12	Do.	Conservator of Forests, Bophal	Do.	Do.	1 ,,
13	Do.	Conservator of Forests, Coorg	Do.	Do.	2 ,,
14	Do. ..	R.W. Gunson, Limited	Do.	Do. ..	1 ,,
15	Do.	Silva, Orissa	Do.	Do.	4 ,,
16	Do, ...	Director, M.P. Forests School, Balaghal.	Do.	Do.	1 ,,
17	Do.	Raghava Raja, Chingleput	Do.	Do.	1 ,,
18	Do.	Assistant Conservator of Forests, Coorg.	Do.	Do.	5 ,,
					5 lb.
1	*Eucalyptus Citriodora.*	Divisional Forest Officer, Palanpur, Ootacamund.	Ootacamund	Do.	4 oz.
2	Do.	Silva, Madhya Predesh	Do.	Do.	4 ,,
3	Do.	Instructor, F.G. School, Umaria ..	Do.	Do.	4 ,,
4	Do.	Silva, Travancore-Cochin State	Do.	Do.	4 ,,
5	Do.	Silva, Madhya Bharat	Do.	Do.	8 lbs
6	Do.	Divisional Forest Officer, Shahabad Sasaram, Bihar.	Do.	Do.	4 oz.
7	Do.	District Forest Officer, the Nilgiris ..	Do.	Do.	4 oz.
8	Do.	District Forest Officer, Salem South	Do.	Do.	2½ ,,
9	Do.	District Fotest Officer, Coimbatore North	Do.	Do.	4 ,,
10	Do.	District Forest Officer, Vellore East ..	Do.	Do.	3 ,,
					19 ,,
1	*Eucalyptus Globulus.*	A.S.W. Moor, Forest Range Officer, Koraput.	Do.	Do. ..	2 ,,
2	Do.	J. W. Procter, Assam	Do.	Do. ..	2 ,,
3	Do.	District Forest Officer, Coimbatore South.	Do.	Do. ..	8 ,,
4	Do.	District Forest Officer, Satara ..	Do.	Do. ..	6 ,,
5	Do.	Shree Gopal Paper Mills, Jamnagar ..	Do.	Do. ..	8 ,,

APPENDIX D-2—*cont.*

Statement showing the details of indegenous seeds received experimented upon in the Research gardens in the o... State Silviculturist, Madras—cont

Serial number.	*Species.*	*Supplied to whom.*	*Seed origin.*	*Supplied by.*	
(1)	(2)	(3)	(4)	(5)	(6)
6	*Eucalyptus Globulus.*	District Forest Officer, Garoth ..	Ootacamund	Ootacamund ..	4 oz.
7	Do.	Silva, Bombay	Do.	Do. ..	2 oz.
8	Do.	Instructor, F.H. School, Umaria	Do.	Do. ..	2 oz.
9	Do.	District Forest Officer, Soil Conservation Division, Jammu.	Do.	Do. ..	3 oz.
10	Do.	Silva, Madhya Bharat	Do.	Do. ..	4 oz.
11	Do.	Silva, Travancore-Cochin State	Do.	Do. ..	4 oz.
12	Do.	Divisional Forest Officer, Rajpipla ..	Do.	Do. ..	4 oz.
13	Do.	Sub-Divisional Forest Officer, Banasplank, Sub-division, Palanpur.	Do.	Do. ..	4 oz.
14	Do.	Divisional Forest Officer, Panchamahals Godhu.	Do.	Do. ..	2 oz.
15	Do	Range Officer, Dandeli	Do.	Do. ..	½ oz.
16	Do.	Divisional Forest Officer, Poona ..	Do.	Do. ..	3 oz.
17	Do.	District Forest Officer, Salem South ..	Do.	Do. ..	2½ oz.
					6 lbs. ½ oz.
1	*Eucalyptus tereticornis.*	Botanical Forest Officer, Assam	Do.	Do. ..	2 oz.
1	*Eucalyptus rostrata.*	Divisional Forest Officer, Kanav Western Division, N Kanara.	Do.	Do. ..	9 oz.
2	Do.	Divisional Forest Officer, Belgaum ..	Do.	Do. ..	8 oz.
3	Do.	Sub-Divisional Forest Officer, Banaskanthi.	Do.	Do. ..	4 oz.
4	Do.	Divisional Forest Officer, N. Khandesh.	Do.	Do. ..	½ oz.
					1·7½ oz.
1	Switenia macrophylla.	Divisional, Forest Officer Dang Division, Ahwa.	Nilambur	Reserve Ranger, Nilambur.	40 lb.

1	*Artocarpus hirsuta.*	Conservator of Forests, Ceylon	Wynad	Reserve Ranger, Wynad.	56lb.
2	Do.	Do.	Dhoni	Reserve Forest, Dhoni ..	9 ,,
					65 ,,
1	Teak seeds	District Forest Officer, Palghat	Nilambur	District Forest Officer, Nilambur.	1,000 lb.
2	Do.	District Forest Officer, Wynad	Do.	Do.	200 ,,
3	Do.	District Forest Officer, Tirunelveli ..	Do.	Do.	1,500 ,,
4	Do.	District Forest Officer, Madura West ..	Do.	Do.	500 ,,
5	Do.	District Forest Officer, Tiruchirappalli ..	Do.	Do.	300 ,,
6	Do.	District Forest Officer, Salem North ..	Do.	Do.	400 ,,
7	Do.	District Forest Officer, Kollegal ..	Do.	Do.	150 ,,
8	Do.	Chief Conservator of Forests Andamans.	Do.	Do.	800 ,,
9	Do.	Silva, West Bengal	Do.	Do.	800 ,,
10	Do.	Silva, U.P.	Do.	Do.	800 ,,
11	Do.	Silva, Bombay	Do.	Do.	400 ,,
12	Do.	Silva, Hyderabad	Do.	Do.	200 ,,
13	Do.	Range Officer, Bihar	Do.	Do.	100 ,,
14	Do.	Divisional Forest Officer, Vindhya Pradesh.	Do.	Do.	100 ,,
15	Do.	District Forest Officer, Rajastan ..	Do.	Do.	100 ,,
16	Do.	Central Silva, Dehra Dun	Do.	Do.	5 ,,
17	Do.	District Forest Officer, Sowrastra ..	Palghat	District Forest Officer, Palghat.	200 ,,
18	Do.	Conservator of Forests, Bhopal	Do.	Do.	200 ,,
19	Do.	Divisional Forest Officer, Jaipur ..	Do.	Do.	40 ,,
20	Do.	Special Forest Officer, Haldwani ..	Nilambur	District Forest Officer, Nilambur.	53 ,,
21	Do.	Divisional Forest Officer, Sahranpur ..	Do.	Do.	32 ,,
22	Do.	Divisional Forest Officer, Ramnagar ..	Do.	Do.	106 ,,
23	Do.	Divisional Forest Officer, Kalagarh	Do.	Do.	22 ,,
24	Do.	Lansdor. Divisional Forest Officer, North Kheri Division.	Do.	Do.	212 ,,
	Do.	Divisional Forest Officer, Balraich ..	Do.	Do.	160 ,,
	Do.	Divisional Forest Officer, Haldwani ..	Do.	Do.	54 ,,

APPENDIX D-2—*cont.*

***Statement showing the details of indegenous seeds received and experimented upon in the Research gardens in the division of State Silviculturist, Madras*—cont.**

Serial number.	*Species.*	*Supplied to whom.*	*Seed origin.*	*Supplied by.*	*Quantity.*
(1)	(2)	(3)	(4)	(5)	(6)
27	Teak seeds.. ..	District Forest Officer, South Kanara ..	Nilambur	District Forest Officer, Nilambur.	1,200 lb.
28	Do.	Divisional Forest Officer, North Andamans.	Do.	Reserve Forester, Nilambur.	300 ,,
					9,935 ,,
1	*Santalum album* ..	Divisional Forest Officer, Ramanagar.	Satyamangalam	Reserve Forester, Ootacamund.	40 lb.
2	Do. ..	Divisional Forest Officer, Saharanpur ..	Do.	Do.	20 ,,
3	Do. ..	Dudhi Forest Division	Do.	Do.	10 ,
4	Do.	Divisional Forest Officer, Lansdon ..	Do.	Do.	5 ,,
5	Do. ..	Divisional Forest Officer, Bundelkand ..	Denkanikota	Reserve Rangera Denkanikota.	40 ,,
6	Do. ..	Divisional Forest Officer, South Kheri ..	Do.	Do.	10 ,,
7	Do. ..	Divisional Forest Officer, Gorakpur ..	Do.	Do.	2 ,,
8	Do. ..	Divisional Forest Officer, Gonda Forest Division.	Do.	Do.	5 ,,
9	Do. ..	Divisional Forest Officer, Band Forest Division.	The Nilgiris	District Forest Officer, The Nilgiris.	10 ,,
10	Do. ..	Divisional Forest Officer, North Daab ..	Do.	Do.	5 ,,
11	Do. ..	Divisional Forest Officer, Bijanan ..	Do.	Do.	20 ,,
12	Do. ..	Divisional Forest Officer, Banaris ..	Salem	District Forest Officer, Salem North.	10 ,,
13	Do. ..	Divisional Forest Officer, Haldwax ..	Do.	Do.	10 ,,
14	Do. ..	Divisional Forest Officer, Bahria ..	Do.	Do.	10 ,,
15	Do. ..	Special Forest Officer, T. & B.	Do.	Do.	10 ,,
16	Do. ..	Divisional Forest Officer, Pilhibit ..	Do.	Do.	2 ,,
17	Do. ..	Divisional Forest Officer, North Kheri ..	Do.	Do.	40 ,,
					249 lb.

1	Teak stumps ..	District Forest Officer, Coimbatore North.	Nilambur	District Forest Officer, Nilambur.	2,000 *
		District Forest Officer, Salem North ..	Do.	Do.	10,000
		District Forest Officer, Palghat ..	Do.	Do.	20,000
		District Forest Officer, Tiruchirappalli ..	Do.	Do.	7,000
		District Forest Officer, Salem South ..	Do.	Do.	6,500
		District Forest Officer, Tirunelveli ..	Do.	Do.	36,500
					82,000
	Do.	Research Forester, Markanam	Do.	Do.	600
		Research Forester, Rameswaram ..	Do.	Do.	150
		District Forest Officer, Tiruchirappalli ..	Do.	Do.	2,400
		District Forest Officer, Vellore East ..	Do.	Do.	2,400
		District Forest Officer, Chingleput ..	Do.	Do.	2,400
					7,950
	Do.	District Forest Officer, Salem South ..	Do.	Do.	8,000
	Do.	District Forest Officer, Kozhikode ..	Kozhikode	District Forest Officer, Kozhikode.	5,000
					13,000
				Total stumps supplied..	102,950

*Arranged through this division.

APPENDIX D-2—*cont.*

Total quantity of various seeds supplied to the Divisional Forest Officers and other indentors in and outside the State.

Serial number.	*Name of species.*	*Quanity supplied.*	
1	*Artocarpus hirsuta*	75 lb.	
2	*Acacia mollissima*	498 „	
3	*Acacia decurrens*	35 „	8 oz.
4	*Acacia melanoxlyn*	½ „	
5	*Albizzia stipulata*	52 „	
6	*Balsa* seeds	5 „	
7	*Balnocarpus utilis*	171½ „	
8	*Cassia siamea*	273 „	
9	*Dalbergia latifolia*	5,484 „	
10	*Eucalyptus citriodora*	19 „	
11	*Eucalyptus globulus*	6 „	½ oz.
12	*Eucalyptus teriticornis*		2 oz.
13	*Eucalyptus rostrata*	1 „	7½ oz.
14	Tlak Seed	9,935 „	
15	*Swietenia marcrophylla*	40 „	
16	*Santalum album*	249 „	
	Total ..	16,689 lb.	
		13½ or, oz.	
		16,690 lb.	

APPENDIX E-I.

(Referred to in paragraph 35.)

Statement showing seed weighments with Germinative Capacity, plant per cent and Best method of Raising.

Species.	*Number.*				*Germination capacity.*	*Plant per cent.*	*Plants per lb.*	*Best method of Raising.*					*Month to collect seeds.*
	Seeds.		*Fruits.*					*Artificially seed.*	*Vegetative propagation.*				
	Per oz.	*Per lb.*	*Per oz.*	*Per lb.*				*Direct showing.*	*Entire Transplanting.*	*Stump planting.*	*Stem cutting.*	*Air layering.*	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Acacia arabica	155	2,480	..	..	75	75	1,860	1	..	..	..	..	XII–III
Acacia aureculiformis ..	1,213	19,408	..	..	80	65	12,615	..	1	..	..	..	III–IV
Acacia baileyana	966	15,456	..	..	53	14	2,164	..	1	..	..	..	VIII
Acacia cyarophylla	2,010	32,160	..	..	94	93	29,909		1	2			IV
Acacia cyclopsis	735	11,760	..	..	47	46	5,410	..	..	..	..	..	XII–I
Accia dealbata	2,340	37,440	..	..	45	33	12,335	..	1	2	..	..	XII–IV
Acacia decurrens	1,740	27,840	..	..	53	19	5,290	..	1	..	..	..	XII–I
Acacia ferruginea	167	2,672	..	..	90	80	2,138	1	..	..	..	..	XII–IV
Acacia leucophloea	1,076	17,216	..	..	42	30	5,165	1	..	..	..	..	XII–IV
Acacia melanoxylon	2,034	32,544	..	..	83	78	25,384	..	1	..	..	..	IV
Acacia mollissima	1,785	28,560	..	..	57	15	4,284	..	1	..	..	..	XII–II
Acacia planifronis	722	11,552	..	..	42	35	4,043	..	..	..	..	..	VI–VIII
Acacia saligna	1,364	21,824	..	..	9	8	1,746	..	..	..	..	..	XII–I
Acacia sundra	750	12,000	..	..	90	90	10,800	1	..	..	..	..	XI–V
Acrocarpus fraxinifolius ..	876	14,016	..	..	49	38	5,326	2	1	..	..	..	III–IV
Adenanthera pavonina ..	99	1,584	..	..	83	82	1,299	..	1	..	..	..	VII
Aglaia roxburghiana	51	816	..	..	57	56	457	..	1	..	..	..	IX
Ailanthus excelsa	291	4,656	..	..	5	4	186	..	..	..	..	..	I–III
Ailanthus grandis	40	..	..	..	51	34	215	..	..	..	..	..	
Ailanthus malabaricam (Begur).	266	..	..	..	14	5	221	..	..	..	..	..	..
Ailanthus malabaricam (Kannoth).	204	..	..	..	18	18	601	..	..	..	..	..	..
Alangium lamarckii	49	784	..	..	47	47	368	..	..	..	..	..	V & VII

APPENDIX E-I—*cont.*

Statement showing seed weights with Germinative Capacity, plant per cent and Best method of Raisings—cont.

(Referred to in paragraph 18.)

Species	Number. Seeds: Per oz.	Number. Seeds: Per lb.	Number. Fruits: Ber oz.	Number. Fruits: Per lb.	Germination capacity.	Plants per cents	Plants per lb.	Best method of Raising. Artificially seed. Direct showing.	Vegetative propagation. Entire Transplanting.	Stump planting.	Stem cultivating.	Air layering.	Month to collect seeds.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Albizzia amara	400	6,400	..	..	83	74	4,736	..	..	..	..	..	XII–I & VI
Albizzia lebbek	314	5,024	..	..	65	49	2,462	2	..	1	..	..	XII–II & V.
Albizzia stipulata	1,997	31,952	..	..	8	1	320	..	1	..	1	..	II–IV
Alnus nepalensis	66,308	1,060,928	..	..	2	1	10,609	..	..	..	..	..	I & II
Alstonia scholaris	3,501	56,016	..	..	30	28	15,684	..	..	..	..	..	I & IV
Anacardium occidentale	5·3	85	..	..	98	98	83	1	2	..	..	..	III–V
Anogeissus latifolia	2,265	36,240	..	..	2	1	362	..	..	..	..	..	III & IV
Antiaris toxicaria	18	288	..	..	39	35	101		..	..	..	..	
Araucaria excelsa	16	256	..	..	..	..	..	..	..	..	..	..	..
Artocarpus hirsuta	61	976	..	..	97	81	791	2	1	..	..	..	IV–V
Artocarpus integrifolia	5	82	..	..	59	59	48	..	..	..	..	..	VI–VII
Azadirachta indica	130	2,080	..	..	90	89	1,851	2	1	..	..	..	V–X
Balnocarpus utilis	7	110	..	..	72	69	76	..	1	..	..	..	XX
Bambusa arundinacea	2,277	36,432	..	..	38	37	13,480	..	..	..	..	..	II–IV
Bambusagiantea	3,475	..	..	..	2	1	555	..	..	..	..	..	..
Bambussa polymorpha	1,396	22,336	..	..	40	32	7,148	..	..	..	..	..	III
Bambusa tulda	455	7,280	..	..	2	1	73	..	..	..	..	..	..
Bauhinia purpurea	55	880	..	..	98	95	836	2	..	1	..	..	II–III
Bauhinia racemosa	224	3,584	..	..	27	23	824	2		1	..	..	II–IV
Bauhinia variegata	44	704	..	..	50	45	317	1	..	..	..	..	IV
Berberis tinctoria	2,880	46,080	..	..	56	23	10,598	..	..	..	..	..	V
Bischofia javanica	1,694	27,104	..	..	79	75	20,328	..	1	..	..	..	X–II
Bombax insigne	332	5,312	..	..	0·4	0·4	21	..	..	..	..	..	IV
Bombax malabaricum	778	12,448	..	..	22	16	1,992	..	1	2	..	..	III–V
Broussonetia papyrifera	17,455	279,280	..	..	47	28	78,198	..	1	2	..	..	VI
Callitris rhomboidea	4,855	77,680	..	..	45	18	13,982	..	..	..	..	..	IV–VI
Calophyllum elatum	4	64	..	..	89	67	43	..	1	..	..	..	V–IX
Calamus pseudotenuis	70	1,120	..	..	6	6	..	..	..	..	..	..	..
Calamus Scipionum	96	1,536	..	..	..	..	..	..	..	..	..	..	..
Calamus rotang	37	592	..	..	50	50	..	..	..	..	..	..	..
Canarium euphyllum	14	224	..	..	1·6	1·6	..	..	1	..	..	..	Germination period 46–72 days
Canthium didymum	303	4,848	..	..	42	12	582	..	..	..	..	..	III–VII
Cassia auriculata	908	14,528	..	..	68	53	7,700	1	..	..	..	..	I–III
Cassia fistula	177	2,832	..	..	55	47	1,331	1	..	..	..	..	II–IV
Cassia marginata	128	2,048	..	..	65	47	1,331	1	..	..	..	..	II–IV
Cassia siamea	1,033	16,528	..	..	98	87	14,379	1	..	..	..	..	II–IV
Cassia tomentosa	1,033	16,528	..	..	13	8	1,322	1	..	..	..	..	II–IV
Castenospermum australe	1	16	..	..	56	53	8	1	..	..	..	..	IV
Casuarina equisetifolia	32,778	524,448	..	..	15	5	26,222	..	..	..	..	..	I
Casuarina montana	9,600	..	..	..	27	27	..	..	1	..	..	..	IXI
Cedrela odorata	3,192	51,072	..	..	25	15	7,661	..	1	..	..	..	III
Cedrela odorata (Jamaica).	1,626	..	..	..	..	..	..	..	..	..	..	..	..
Cadrela toona	4,466	71,456	..	..	82	62	44,303	..	2	1	1	..	IV–VIII
Celtis tetrandra	420	6,720	..	..	5	5	336	..	..	..	..	..	VI
Ceratonia siliqua (Cypress)	155	..	..	..	24·5	19·7	488	..	..	..	..		Germination period 10–40 days.
Chickrassia tabularis	2,296	36,736	..	..	38	34	12,490	2	1	..	..	..	XII
Chlorophora excelsa	1,283	196,528	..	..	33	29	56,993	..	2	1	..	.	III–VIII
Chloroxylon swietenia	2,283	35,648	..	..	95	69	24,597	..	1	..	..	..	..
Chloroxylon swietenia (Ceylon)	1,406	22,496	..	..	73	58	13,048	..	..	..	..	..	III–X
Cinnamomum camphora	249	3,884	..	..	69	47	1,872	..	1	2	..	..	IX
Cinnamomum zeylanicum	105	1,680	..	..	1	1	17	..	..	1	..	..	..
Cinnamomum zeylanicum (Begur 1955).	116	..	..	..	0·4	6·4 to 6	..	..	..	1	..	..	..
Cyrissus scoparius	3,188	51,008	..	..	30	24	12,242	..	..	..	..	..	III–IV
Commiphora caudata	386	6,176	..	..	18	11	679	..	..		..	..	I
Cryptmeria japonica	9,691	155,056	..	..	0·2	..	..	..	..	..	..	..	IV

APPENDIX E—*cont.*

(Referred to in paragraph 18)

Statement showing seed weighments with Germinative Capacity, plant per cent and Best method of Raising.

Species.	Number. Seeds. Per oz.	Seeds. Per lb.	Fruits. Per oz.	Fruits. Per lb.	Germination capacity.	Plant per cent.	Plants per lb.	Best method of Raising. Artificially seeds. Direct showing.	Vegetative propagation. Entire Transplanting.	Stump planting.	Stem cultivating.	Air layering.	Month to collect seeds.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Cupressus macrocarpa ..	4,384	70,144	..	..	13	12	8,417		1	..	..	..	IV—VI
Cupressus torulosa	4,693	75,088	..	..	9	5	3,754	..	..	..	..	..	V–VI
Dalbergia latifolia	..	.	525	8,400	65	55	4,620	..	2	1	..	..	I–VI
Dalbergia sissoides	..	..	454	7,264	70	51	3,705	..	..	..	..	..	XII–III
Daphniphyllum glaucescehs ..	137	2,192	..	..	10	5	110	..	..	..	..	..	V–VI
Dendrocalamus brandisii ..	3,475	55,600	..	..	2	1	556	..	1	..	..	..	II
Dendrocalamus longispathus..	2,367	37,872	..	..	2	1	379	..	..	..	..	..	III–IV
Denarocalamus strictus ..	1,245	19,920	..	.	48	64	12,749	..	1	..	..	.	III–IV
Dipterocarpus bourdillonii ..	..	..	..	..	41	20	16	..	1	2	..		I
Dipterocarpus indicus ..	..	..	..	..	41	26	20	..	1 (basket).	..	..	..	III–VIII
Dodonea viscosa	3220	51,520	..	..	12	12	6182	..	..	..	..	..	I–IV
Dolichandrone crispa ..	852	13,632	..	..	54	48	6,543	1	..	..	..	..	I–IV
Dolichandrone falcata ..	725	11,600	..	..	13	1	116	..	..	..	..	..	III–V
Dysoxylum malabaricum ..	6	65	..	..	85	85	55	..	1	..	..	..	VII–VII
Elaeocarpus oblongus	10	160	..	..	7	6	10	..	..	..	..	..	II–V
Erythroxylon monogynum ..	922	14,752	..	..	59	46	6,786	..	..	..	..	..	IX–III
Eucalyptus astringens ..	30,240	..	..	..	40·4	..	..	..	..	..	..	..	X Germination period 12 to 116 days.
Eucalyptus Citriodora (Nilgri seed)	4,670	..	..	..	6·9	6·2	4,530	..	..	..	..	..	
Eucalyptus eugenioides ..	76,800	12,28,800	..	..	..	..	..	..	..	..	..	..	
Eucalyptus ficifolia	2,170	34,720	..	..	53	4	1,389	..	..	..	..	..	IV
Eucalyptus globus	8,676	1,38,816	..	..	32	20	27,763	..	1 (mos-seed)	..	..	..	II
Eucalyptus maculata ..	6,112	97,792	..	..	13	12	11 735	..	1 (mos-sed.	..	..	..	..
Eucalyptus pilluaris	35,200	5,63,200	..	..	0·1	0·1	563	..	..	..	..	..	
Eucalyptus propinqua ..	26,176	4,18,816	..	..	0·7	0·6	2,513	..	..	..	..	..	..
Eucalyptus rostrata	22,500	..	..	..	13·5	13·5	..	..	..	..	..	..	..
Eugenia arnottiana	105	1,680	..	..	73	71	1,193	..	..	..	..	..	V–VII
Eugenia calophyllifolia ..	146	2,336	..	..	20	16	374	..	..	..	..	..	V
Eurya japonica	25,600	4,09,600	..	..	..	..	..	..	..	..	..	..	IV
Evodia roxburgiana.	3,570	57,120	..	..	66	21	11,995	..	1	2	..	..	IV, V, XI, XII.
Feronia elephantum	1,395	22,320	..	..	66	63	14,062	..	1	..	..	..	X–IV
Givotia rottleriformis ..	11	176	..	..	43	40	70	..	1	2	..	..	X–IV
Glochidion neilgherrense ..	1,298	20,768	..	..	29	4	831	..	..	..	..	..	III–IV
Gluta travancorica	2	32	..	..	96	90	29	..	1	..	..	..	IV–VIII
Gluta travancorica (*Wynad* 1954).	4	64	..	..	70	70	45	..	..	..	..	..	..
Gmelina arborea	42	672	..	..	64	56	376	..	1	2	..	..	III–IV
Gmelina arborea (*Wynad* 1954.)	48	..	..	..	49	44	338	..	..	..	..	..	..
Grewia tiliaefolia	281	4,496	..	..	84	76	3,417	..	2	1	..	..	V–VI
Hakea saligna	2,276	36,416	..	..	78	68	24,763	..	..	..	..	..	IX–XII
Hardwickia binata	..	..	141	2,256	38	32	722	..	1	..	..	..	III–VII
Hardwickia pinnata	7	116	..	..	85	80	93	2	1	3	..	..	V–VI
Harrisonia bennettii	269	4,304	..	..	12	8	344	..	..	..	..	..	I
Holoptelia integrifolia ..	1,276	20,416	..	..	17	15	3,062	..	..	1	..	..	III–IV
Hopea parviflora	..	..	82	13.12	68	54	708	2	1	..	..	..	V–VII
Hyphaenithebaica (*Dum* nut) (from Cairo).	..	5	..	..	50	50	2·5	..	..	..	..	..	Period of germination 6 months.
Hymenodictyon excelsum ..	8,506	1,36,096	..	..	13	12	16,331	..	..	..	..	..	..
Indigofera endacaphylla ..	4,674	..	..	..	56	52	39,187	..	..	..	..	..	..
Indigofera teysmanii ..	4,002	..	..	..	27	16	10,501	..	..	..	..	..	..
Jacaranda mimosifolia ..	3,745	59,920	..	..	53	39	23,369	..	..	..	..	..	V
Juniperus procera	1,346	21,536	..	..	12	5	1,077	..	..	..	..	..	XII–I

APPENDIX E.

(Referred to in paragraph 35.)

Statement showing seed weighments with Germinative Capacity, plant per cent and Best method of Raising.

Species.	Number. Seeds. Per oz.	Seeds. Per lb.	Fruits. Per oz.	Fruits. Per lb.	Germination capacity.	Plant per cent.	Plants per lb.	Best method of Raising. Artificially seed. Direct showing.	Artificially seed. Entire Transplanting.	Vegetative propagation. Stump planting.	Vegetative propagation. Stem cutting.	Vegetative propagation. Air layering.	Month to collect seeds.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Khaya grandifoliala ..	..	..	..	..	35	30	..	..	..	..	..	..	..
Khyapenegalensis	..	..	..	..	10	10	..	..	..	..	..	..	..
Lagerstroemia flos reginae ..	3,877	62,192	..	..	60	55	34,205	..	2	1	..	..	XII–II
Lagerstroemia lanceolata ..	5,173	82,768	..	..	20	13	10,760	..	1	2	..	..	XIII–II
Lantana Camara	1,302	20,832	..	..	3	2	417	..	..	..	..	..	VIII
Leucaena glauca	873	13,968	..	..	38	33	4,609	..	1	..	..	..	I
Ligustrum neilgherrense ..	852	13,632	..	..	74	66	8,997	..	..	..	..	..	XII–III
Litsea wightiana	157	2,512	..	..	26	23	578	..	..	..	..	..	IV–VI
Lophopehalum wightianum ..	421	6,736	..	..	10	10	606	..	..	..	..	..	IV
Maba buxifolia	286	4,576	..	..	92	88	4,027	..	..	..	..	..	XI–I
Machilus macrantha	108	1,728	..	..	0·4	0·4	7	..	..	..	..	..	III
Mahonia leschenaultii ..	1,781	28,496	..	..	58	50	14,248	..	..	..	..	..	II–IV
Mangifera indica	3	44	..	..	83	79	35	2	1	..	..	..	V–VI
Markhamia platycalyx ..	1,140	18,240	..	..	1	1	182	..	1	..	..	..	..
Melia dubia	..	..	7	112	1·5	1·5	1	..	..	..	..	..	I& II X–XI
Meliosma wightii	140	2,240	..	..	14	10	224	..	..	..	..	..	III–V
Melocanna bambusoides ..	2	32	..	..	56	5	2	..	..	..	..	..	..
Memecylon umbellatum ..	216	3,456	..	..	94	90	3,110	..	..	..	..	..	XI–XII
Mesua ferrea	28	448	..	..	80	68	305	..	1	..	..	..	XI–III
Michelia nilagirica	363	5,808	..	..	24	23	1,336	..	..	..	..	..	IV–VI
Morus alba	26,015	4,16,240	..	..	13	5	20,812	..	..	..	1	..	..
Morus Alba (Meerut) ..	15,100	..	..	..	6	5	12,080	..	..	..	..	..	Period of Germination 8–25 days.
Mundulea suberosa	958	15,328	..	..	54	35	5,365	..	..	..	..	..	IV
Rapanea wightiana ..	1,296	20,736	..	..	20	20	4,147	..	..	..	..	..	IV–VI
Neolitsea zeylanica	190	3,040	..	..	53	53	1,671	..	..	..	..	..	V–VII
Ochroma lagopus	4,240	67,840	..	..	0·7	0·1	68	..	1	..	..	..	..
Palaquium ellipticum ..	7	112	..	..	69	68	76	..	1	..	..	..	V–VIII
Phoebe goalparensis	28	448	..	..	9	9	40	..	..	..	..	..	XI
Phoebe goalparensis (Wynad).	28	448	..	..	15	14	60	..	..	..	..	..	..
Photinia notoniana	10,830	1,73,280	..	..	21	..	..	..	..	..	..	..	V–VII
Pinus caribaea (Honduras) (Begur 1954).	1,804	..	..	..	34	23	6,569	..	..	..	..	..	..
Pinus caribaea (Honduras) (Chandanthode—54).	1,804	..	..	..	63	63	18,184	..	..	..	..	..	..
Pinus insignis	1,807	28,912	..	..	8	4	1,156	..	..	..	..	..	V–VI
Pinus insularis	3,680	58,880	..	..	3	1	589	..	..	..	..	..	II
Pinus longifolia	234	3,744	..	..	80	46	1,722	1	..	..	..	..	IV
Pithecolobium dulce	183	2,928	..	..	79	50	1,464	1	..	..	..	..	II–V
Pleurostylia withtii	1,213	19,408	..	..	20	12	2,329	..	..	..	..	..	XI
Poecileneuron indicum ..	1	15	..	..	31	29	4	..	1	..	..	..	V
Poinciana elata	241	3,856	..	..	65	14	540	..	..	1	..	..	XII
Poinciana regia	62	992	..	..	68	19	188	..	..	..	..	..	IV
Polyalthia fragranas	9	140	..	..	17	16	22	..	..	..	..	..	V
Polyalthia longifolia	21	336	..	..	3	2	7	..	..	..	..	..	IV–IX
Pongamia glabra	..	..	17	272	15	12	33	..	..	..	..	..	III–V & X
Premna tomentosa	1,759	28,144	..	..	1	1	281	..	..	..	..	..	IV
Prinsepia utilis	171	2,763	..	..	..	..	..	..	..	..	..	..	IV
Prosopis juliflora	924	14,784	..	..	89	78	10,792	1	..	..	..	..	V
Prosopis spicigera	753	12,048	..	..	88	88	10,602	..	..	..	..	..	II–VII
Pterocarpus dalbergiodes ..	..	..	52	832	49	29	241	..	1	..	..	..	II–VII
Pterocarpus marsupium ..	..	..	60	960	97	90	864	3	2	1	..	..	I–VI
Pterocarpus santalinus ..	..	..	29	467	88	65	303	..	..	1	..	..	II–VII
Pterospermum rubiginosum ..	1,911	30,576	..	..	14	8	2,446	..	..	..	..	..	I

APPENDIX E —*cont.*

(Referred to in paragraph 35)

Statement showing seed weightment with Germative Capacity, plant per cent and Best method of Raising.

Species.	Number. Seeds. Per oz	Number. Seeds. Per lb.	Number. Fruits. Per oz.	Number. Fruits. Per lb.	Germination capacity.	Plant per cent.	Plants per lb.	Best method of Raisings. Artificially seed. Direct showing.	Best method of Raisings. Artificially seed. Entire Transplanting.	Best method of Raisings. Vegetative propagation. Stump planting.	Best method of Raisings. Vegetative propagation. Stem cutting.	Best method of Raisings. Vegetative propagation. Air layering.	Month to collect seeds.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Pueraria phaseoloides	1,650	..	..	..	45	38	10,138	..	..	..	..	..	..
Pyrethrum	21,445	3,43,120	..	..	..	..	..	..	..	..	..	..	..
Quercus incana	14	228	..	..	80	51	116	..	..	..	..	..	II
Rhodomyrtus tomentosa	3,686	58,976	..	..	9	1	590	..	..	..	..	..	IV
Samadara indica	11	176	..	..	33	32	56	..	..	..	..	..	II, IV, VI, VII.
Sapindus emarginatus	75	1,200	..	..	67	62	744	..	..	..	..	..	II–IV
Sapindus trifoliatus	55	880	..	..	72	60	528	..	..	..	..	..	IV–VI
Santalum album	147	2,352	..	..	85	58	1,364	..	1	2	..	..	X–XI and III–IV
Schleichera trijuga	62	992	..	..	76	72	714	..	..	1	..	..	II–VIII
Semecarpus anacardium	13	208	..	..	57	53	110	..	..	..	..	..	II–IV
Shorea talura	..	..	29	464	68	60	278	1	..	..	..	..	V
Sideroxylon tomentosum	85	1,360	..	..	18	16	218	..	..	..	..	..	VI
Soymida febifuga	378	6,048	..	..	28	25	1,512	..	1	..	..	..	II–VII
Sterculia companulata	110	..	..	..	51	44	767	..	..	..	..	..	..
Sterculia urens	179	2,864	..	..	32	18	515	..	2	1	..	..	V
Stipa tenassima	13,200	2,11,200	..	..	3	2	4,224	..	..	..	..	..	..
Strychnos nux vomica	17	272	..	..	52	52	141	..	..	..	..	..	XIIV
Strychnos potatorum	46	736	..	..	62	62	456	..	..	..	..	..	III–VII
Stylosanthes gracilis	8,890	1,42,240	..	..	38	32	47,000	..	..	..	..	..	Soaing in hot water gives better germination
***Stylosanthes gracilis* (Nilambur Centre).**	8,520	..	..	..	15·7	15·2	19,130	..	..	..	..	..	Period of germination 25 days.
Stylosanthes gracilis (Begur)	9,530	..	..	..	6	4	6,100	..	..	..	..	..	..
Swietenia macrophylla	65	1,040	..	..	78	78	759	2	1	..	..	..	XII–III
Swietenia mahogoni	95	1,520	..	..	74	73	1,110	..	..	..	..	..	..
Symplocos foliosa	80	1,280	..	..	..	..	..	..	..	..	..	..	III–VII
Tamarindus indica	41	656	..	..	95	80	525	1	..	..	..	..	II–V
Tectona grandis	..	..	50	800	68	58	464	..	..	1	..	..	XI–V
Tephrosia candida	1,300	20,800	..	..	53	45	9,360	1	..	..	..	..	XI–I
Terminalia arjuna	..	..	22	352	19	17	60	..	..	..	..	..	XI–XII IV–VII
Terminalia belerica	..	..	6	96	62	53	51	..	1	..	..	..	II
Terminalia chebula	..	..	18	294	60	50	147	..	1	..	..	..	XI–IV
Terminalia crenulata	..	..	22	352	72	58	204	..	..	1	..	..	I–VI
Terminalia myriocarpa (Dhoni)	..	..	16,000	..	10	7	17,920	..	..	..	..	..	Germination period 12–30 days.
Terminalia myriocarpa (*Topsalip*).	..	..	16,000	..	1·1	1·0	2.560	..	..	..	..	..	..
Terminalia paniculata	..	..	1,014	16.224	16	9	1,460	..	..	1	..	..	XI–IV
Terminalia tomentosa	..	..	30	480	5	2	9	..	..	..	..	..	II
Ternstromia japonica	200	3,200	..	..	4	..	..	..	..	..	..	..	II–VII
Tetrameles nudiflora	12,284	1,96,544	..	..	0·9	0·2	393	..	..	..	..	..	III–V
Thyrostachys oliveri	1.890	30,240	..	..	25	22	6,653	..	..	..	..	..	V
Trema orientalis	5,515	88,240	..	..	11	9	7.942	2	1	..	..	..	I–VI
Tsuga brunoniana	10,000	1,60,000	..	..	4	4	6,400	..	..	..	..	..	..
Vateria indica	..	..	1.6	26	80	76	20	..	1	..	..	..	VII–VIII

APPENDIX E.—*cont.*

(Referred to in paragraph 35)

Statement showing seed weighments with Germinative Capacity, plant per cent and Best method of Raising.

Species.	Number. Seeds. Per oz.	Number. Seeds. Per lb.	Number. Fruits. Per oz.	Number. Fruits. Per lb.	Germination capacity.	Plant per cent.	Plants per lb.	Best method of Raising. Artificially seed. Direct showing.	Best method of Raising. Vegetative propagation. Entire Transplanting.	Best method of Raising. Vegetative propagation. Stump planting.	Best method of Raising. Vegetative propagation. Stem planting.	Best method of Raising. Vegetative propagation. Air layering.	Month to collect seeds.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Viburnum coriaceum	566	9,056	..	..	4	4	362	..	..	..	..	..	VII
Viburnum erubescens ..	1,005	16,080	..	..	7	7	1,126	..	..	..	..	..	VII
Vite altissima	353	5,648	..	..	8	3	169	..	..	..	..	..	XI–IV
Vite littoralis	88	1,408	..		30	..	..	..	..	..	..	..	V–VII
Vitex peduncularis	273	4,368	..	..	28	15	655	..	1	2	..	..	VII–VIII
Wrightia tinctoria	751	12,016	..	..	66	58	6,969	1	2	..	..	..	II–V
Xylia xylocarpa	95	1,520	..	..	99	80	1,216	1	..	2	..	..	I–V
Zizyphus glabrata	207	3,312	..	..	19	12	397	..	..	..	..	..	X–II
Zanthoylum Rhetsa	383	7,728	..	..	0·2	..	..	..	..	..	..	..	I–IV
Zizyphus incurva	114	1,824	..	..	69	38	693	..	..	..	..	..	I
Zizyphus jujuba	56	896	..	..	95	82	735	..	..	..	..	..	I–VII
Zizyphus spinachrista (Cypress).	..	..	..	..	100	62·5	..	..	..	..	..	..	Germination period 35 days.
Sizyphus xylopyrue	612	9,792	[illegible]	[illegible]	52	40	3,917	[illegible]	..	..	..	III	

APPENDIX E-2

***Statement, showing results of seed pre-treatment tests*—cont.**

(Referred to in paragraph 36-C.)

Species.	Number of tests made.	Average germinative capacity with Untreated.	Cold water.	Hot water.	Boiling water.
(1)	(2)	(3)	(4)	(5)	(6)
Acacia auriculiformis ..	8	14	14	16	17
Acacia bailejana	4	2	3	19	42
Acacia cyanophylla	9	11	14	17	35
Acacia cyclopsis	4	8	8	7	4
Acacia dealbata	6	45	68	60	67
Acacia decurrens	4	1	1	8	24
Acacia ferruginea	11	48	42	47	33
Acacia leucophloea	14	21	12	17	23
Acacia melanoxylon	1	83	81	91	90
Acacia mollissima	5	5	2	11	29
Acacia planifrons	6	18	16	18	13
Acacia saligna	4	6	5	3	5
Acacia sundra	10	34	28	30	25
Acrocarpus fraxinifolius ..	25	8	8	9	6
Adenanthera pavoniana ..	6	31	31	13	1
Ailanthus excelsa	1	..	1	..	Not done.
Albizzia lebbek	4	20	18	19	15
Alangium lamarckii	2	8	13	11	1
Albizzia amara	22	41	35	30	24
Albizzia lebbek	4	20	18	19	15
Alnus nepalensis	4	1	1	..	Not done.
Alstonia scholaris ..	1	1	1	1	Not done.
Anacardium occidentale ..	6	70	58	54	24
Anogeissus latifolia	2	1	1	1	..
Azadirachta indica	10	41	37	29	6
Balanocarpus utilis	2	42	35	39	20
Bauhinia pururea	11	29	25	27	18
Bauhinia racemosa	5	13	13	15	16
Bischofia javanica	3	14	17	1	Not done.
Berberis tinctoria	2	56	..	..	..
Bombax malabaricum	4	17	19	18	6
Calophyllum elatum	7	15	14	13	..
Canthium didymum	2	2	3	3	..
Cassia auriculata	14	12	9	11	5
Cassia fistula	17	11	11	8	7
Cassia marginata	12	17	22	13	6
Cassia siamea	16	60	37	47	5
Cedrela odorata	1	1	..	..	Not done.
Ceratonia siliqua (Carob tree) (Cypress) ..	1	49	49	Nil.	Nil.
Chickrassia tabularis	2	31	25	..	Not done.
Chlorophora excelsa	16	18	15	12	..
Chloroxylon swietenia	15	16	15	14	1
Choerisia speciosa	2	46	..	..	..
Cinnamomum camphora	1	1	1	..	Not done.
Commiphora caudata	1	3	1	2	..
Burpressus torulosa	2	7	..	..	..
Dalbergia latifolia	22	31	26	20	5
Dalbergia sissoides	30	26	26	32	5
Dendrocalamus strictus ..	7	28	19	18	..
Dolichandrone crispa	6	12	10	10	1
Dolichandrone falcata	5	6	5	4	1

APPENDIX E-2—*cont.*

Statement showing results of seed pre-treatment tests—cont.

(Referred to in paragraph 36-C.)

Species.	Number of tests made.	Average germinative capacity with			
		Untreated.	Cold water.	Hot water.	Boiling water.
(1)	(2)	(3)	(4)	(5)	(6)
Elaeocarpus oblongus ..	2	5	..	..	..
Erythroseylon mono gynum	3	13	14	11	1
Eugenia arnottiana ..	53	53	51	40	42
Evodia roxburghiana ..	9	6	6	1	..
Feronia elephanum ..	5	13	14	13	1
Gwotia rottleriformis ..	9	4	3	3	2
Glochidion neigherrenes ..	2	3	..	..	..
Gluta travancorica ..	10	44	48	42	21
Gmetina arbar	25	20	19	18	6
Grewia tiliaefolia	4	7	5	7	5
Hakea soligana	2	45	..	..	..
Hadwicia bianata ..	1	38	25	27	1
Hardwiokia pinnata ..	1	..	..	..	..
Holoptelia integrifolia ..	1	1	..	1	..
Hymenodictiyon excelsum	1	8	9	10	Not done
Juniperus procersa ..	4	2	4	5	1
Lagerstromia es regfloas	1	5	3	3	..
Lagerstroemia lance.lota ..	31	5	4	4	..
Leucaena glauca ..	12	24	26	31	32
Ligustrum neilgherrense ..	2	66	21	13	2
Liteea zlyanica ..	2	15	9	7	..
Lophopetalum winghtianum	1	1	1	..	Not done.
Machilus macrantha ..	1	..	..	..	Do.
Mahonia leschenaultu ..	4	51	6	2	..
Mangifera indica	3	34	43	42	3
Markhamia platycalyx ..	1	1	1	..	..
Melia dubia	2	1	..	..	..
Melioma wightii	1	14	8	..	..
Michelia neilgherrense ..	1	5	..	..	..
Morus alba	1	45	45	..	..
Myrsine wightiana (Rapanea)	2	10	14	11	20
Neolitsea zeylanica ..	2	16	18	..	..
Palaquium ellipticum ..	15	38	48	40	..
Phoel goalparensis ..	1	1	1	..	..
Pinus longifolia	4	34	54	27	49
Pinus insignis	3	4	9	2	..
Pithecolobium dulce ..	9	47	20	42	5
Pleurostylia wightii ..	1	13	20	2	5
Poinciana elata	3	17	21	19	21
Pinciana regia	1	28	28	26	68
Polyalthia fragrans ..	3	5	4	2	1
Premna tonnent ..	1	1	1	1	3
Prosopis juliflora ..	6	61	62	53	40
Prosopis specigera ..	1	10	12	8	3
Parocterpus dalbergwites	6	13	16	11	5
Pterocarpus santallinus ..	15	21	58	29	15
Pterocarpus santalinus ..	3	14	18	17	4
Pterocarpus marsupium ..	96	39	31	32	12
Pterospermum rubiginosum	1	11	11	..	Not done.
Quercus incana	2	81	..	..	...
Sapindus emarginata ..	5	17	7	11	10
Schleichera trijuga ..	22	27	25	23	..
Shorea talura	1	68	54	54	1

APPENDIX E—2—*cont.*

Statement showing results of seed pre-treatment tests—cont.

(Referred to in paragraph 36 C.)

Species.	Number of tests made.	Average germinative capacity with			
		Untreated.	Cold water.	Hot water.	Boiling water.
(1)	(2)	(3)	(4)	(5)	(6)
Soymida febrifuga ..	10	1	3	1	..
Sterculia urens	5	18	15	16	..
Strychnos nuxvomica ..	5	12	9	18	3
Strychno potatorum ..	3	5	6	4	..
Tamarindus indica ..	3	53	45	46	15
Tectona grandis	40	28	27	24	8
Terminalia chebula—					
(1) Whole fruit.. ..	15	20	16	22	8
(2) Fleshy covering removed	3	4	6	5	7
(3) Kernel	4	6	1	2	..
Termanalia crenulata—					
(1) Fresh seed ..	83	28	30	24	6
(2) Stored 14 months ..	10	9	8	7	8
Terminalia myriocarpa ..	1	10	..	..	..
Terminalia paniculata ..	29	10	8	8	..
Terminalia tomentosa ..	1	1	1	1	..
Tetrameles nudiflora ..	1	1	1	1	Not done.
Thysastachys oliveri ..	1	10	11	4	2
Trema orientalis	7	3	2	2	1
Vateria indica	3	58	57	58	..
Vitex altissima	2	3	3	4	..
Vitex littoralis	2	30	38	11	..
Vitex peduncularis ..	3	7	8	3	..
Wrightia tinctoria.. ..	4	21	30	24	2
Xylia xylocarpa	42	20	26	25	13
Zanthoxylon rhetsa ..	1	..	..	..	..
Zizyphus glabrata ..	3	6	4	4	4
Zizyphus incurva ..	5	31	24	24	22
Zizyphus jujuba	14	22	26	17	19
Zizyphus zylopyrus ..	3	11	13	13	13

APPENDIX F.

District Experiments, 1954–55.

1. In addition to experiments carried out by State Silviculturist and by research officers directly under him several interesting experiments were carried on by the District Forest Officers, on matters of particular interest to them. A brief resume of these experiments is furnished below. The information is arranged alphabetically according to the forest Divisions.

I Chingleput.

2. *Casuarina equisitefolia Planting 1 Seedling—Compared with planting two seedlings in the same pit.*—An interesting experiment was started during the year to compare the survival per cent and height growth of the following two treatments :—

(i) Planting one casuarina seedling at each planting site.

(ii) planting two casuarina seedlings simultaneously at each planting site.

The experiment is based on the promise that if two seedlings are planted simultaneously this may give higher survival per cent, the extra cost being only the cost of the extra seedlings which is generally negligible. Unfortunately owing to a severe attack of shoot borer, there were heavy casualities and the experiment was not proceeded with. This will be repeated in the following year.

II. Coimbatore South.

3. *Teak—Manurial experiment with Superphosphate.*—In the 1954 teak plantations, of Tunucadavu range; 2¾ oz. of Superphosphate was applied to each teak plant.

Subsequent observations showed that there was no difference as a result of application of manure.

4. *Acasia mollissima—Introduction in grass lands.*—There are extensive grass lands, similar to these of Nilgiris, in the Annamalai hills of Punachi Range. An attempt was made to afforest these lands with mossed seedlings of *Acacia mollissima* obtained from the Nilgiris Forest Division. In 1954, in an area of 5 acres, mossed seedlings were put in, one foot cube pits, at an espacement of 11′×11′

Subsequent observations shows that the plants are well established.

III. Nilambur.

5. *Underplanting in teak plantations.*—During the year, 61 acres of 1923 teak plantation were underplanted with *Mahogany* (*Sweietenia macrophylla*) natural seedlings obtained from the forest, at the time when the teak plantation was 31 years old, i.e., in the year follows the final thinning. The total cost of the operation was Rs. 109–12–0. The result of this work was finally good. Similarly 75 acres of the 1946 teak plantation of Amarampalam Range and 25 acres of National Forest in Nilambur Range were dibbled with *Hopea parviflora* seeds at a total cost of Rs. 250–10–0. The result of the experiment was poor in Amarampalam Range (75 acres teak plantation) and fairly satisfactory in Nilambur Range (25 acres Natural forest).

6. Attention is invited to paragraphs 152 to 159. Of this report wherein underplanting experiments carried on by the State Silviculturist have been described.

IV. Palghat.

7. *Introduction of Evodia roxburghiana.*—In June 1954, in Mukthikulam in Bolampatti Range one acre was planted at an espacement of 9′×9′ with one-year old seedlings of *Evodia roxburghiana* in one foot cube pits.

The expenditure incurred in planting was Rs. 69-8-0. The percentage of survivals at end of one year is 85 per cent and the plants are healthy and promising.

8. *Introduction of Eucalyptus (hybrid).*—During the year, in the Muthikulam forest of Bolampatty Range, 3 feet wide lines were cleared in two acres, 18 feet apart. Six hundred and one cube pits were dug along the cleared lines (at a distance of 8 feet apart along the lines espacement of planting '18′ × 8′) and one foot high seedlings of Eucalyptus hybrid were planted on 25th July 1954. Scraping round the plants was also done. The total cost for 2 acres was Rs. 67–8–0. Percentage of Survival at the end of the year was 30 per cent.

V. Tirunelveli.

9. *Cutting back teak plantation at age four years.*—In obedience to the directions of the Chief Conservator of Forests in his No. 15881/54-D-3, dated 28th June 1954, an experiment was started in the 1950 teak plantation of Kuttalam Beat. Over an acre of nine square chains, distributed at randum 9 sub-posts of 1 square chain, the teak saplings which were four years old and which were of an height of average height of were cut back. The object was to compare the coppice growth of coppice resulting from the cut stems, with that of the uncoppiced stems in the uncut area around. Subsequent observations show that the coppice stems are definitely inferior to that of the uncopped stems.

In this connexion attention is invited to paragraph 47-A whereas a comparison experiment was done with teak plants cut back when they were one-year old. (Vide E. P. No. 174 of 1953 of Nilambur.)

VI. Vellore East.

10. *New design of Pots for raising pot plants.*—In previous years burnt earthenware pots open at both ends with a separate square flat tile at the bottom were used for raising pot plants.

During the year, a different kind of pots was used. Pots open at both ends, 9 inches tall, 4 inches wide at the top and 6 inches wide at the bottom (made of burnt clay) were used. There had two sets of holes at right angles to each other, an inch above the bottom ; but not at the same level so that two sticks can be put through them before filling the pots with soil. These sticks are withdrawn at the time of planting to help the plant and the soil mass to descend from the pots into the planting pits, without disturbance to the root system of the plants. The pots are used again for raising more pot plants.

11. *Afforestation of dry fuel forests—Comparison of pot plants with direct sowings.*—In this division, afforestation of dry fuel forests is done by direct sowings in soil worked lines supplemented by planting pot plants at an espacement of 33′×33′ or 40 plants per acre. The species used, were *Acasia arabica, Albizzia amara, Zizphus jujuba, Tamarindus indica, Albizzia lebbeck, Neem, Pongamia glabra, Prosopis juliflora, and Dalbergia sissoo.*

The following table furnishes the results obtained by direct sowings and by pot plants in the different Ranges:—

Range.	Pot plants.		Direct sowings.	
	Survival per cent.	Mean height.	Survival per cent.	Mean height.
		INCHES.		INCHES.
Vellore	..	9 to 36	..	12 to 8
Polur	90	30	30	9
Tiruvannamalai	80	9 to 30	30	6
Santhavasal	75	9 to 18	45	12
Vellore	55	18 to 36	50	9
Odugathur	80	24	70	12

It is seen that pot plants give significantly higher survival per cent and mean height growth than direct sowings.

12. *Sowings on mounds* 8′×1′×1′ *compared with sowings on mounds* 5′×1′×½′.—Trenches 8′×1′×1′ were dug in a land with gentle slope and the excavated earth heaped as a mound on the lower side. Seeds of miscellaneous fuel species like *Albizzia amara, Albizzia lebbeck, Azadarachta indica, Pongamia glabra, Prosopis juliflora, Dalbergia, sissoo* were sown in the mounds. Similar seeds were sown in mounds obtained from trenches of size 5′×1′×½′. Observations in Ponnur, Tippakadu, Poosimalai and Karuthamalai Reserved Forests show the following comparative results.

Serial number and locality.	Trenches of 8′X1′ Survival	Trenches of 8′X1′ Mean	Trenches of 5′X1′X½. Survival	Trenches of 5′X1′X½. Mean
	Per cent.	Height.	Per cent.	Height.
		INCHES.		INCHES.
1 Ponnur Reserve Forest ..	30	18	30	9
2 Tippakadu Reserve Forest ..	35	6	20	6
3 Poodimalai Reserve Forest ..	55	18	35	10
4 Karuthamalai Reserve Forest ..	70	18	70	6
Average for all centres ..	47½	15	39	8

It is seen that bigger and deeper trenches give slightly better survival per cent and significantly greater height growth.

13. *Introduction of Albizzia stipulata.—Albizzia stipulata* transplants were planted on 6th October 1954 in an area of about 1½ acres in Thaniar rest-house compound at an espacement of 12′×12′. An enumeration in February 1955 showed that there were 90 per cent survivals.

14. *Introduction of Eucalyptus rostrata and Eucalyptus hybrid.*—In a clearfelled and burnt area of 15 acres in Santhavasal Range one foot cube pits were dug at espacement of 12′×12′ and basketed plants of *Eucalyptus rostrata* and *Eucalyptus hybrid* were plantd in August 1954 and October 1954, respectively. An enumeration in February 1955 showed 45 per cent survival with a mean height of 3½′ feet (the heights ranging from 1½ feet to 8 feet). The high percentage of casualities is reported to be due to white and attack, in spite of repeated dusting with Hexidol powder.

15. *Introduction of Eucalyptus citriodora.*—In ten acres of a clearfelled and burnt area in Komatiyeri Javadis, one foot cube pits were dug at an espacement of 12′×12′ and basketted seedlings of *Equacalyptus cirtriodora* were planted in October 1954, during the North-east monsoon rains. An enumeration in February 1955 revealed 15 per cent survival with a mean height of 3 feet and a maximum height of 7 feet. Here also casualities are due to white ant attack.

16. *Introduction of Dalbergia sissoo—with Kumri.*—In an area of 20 acres of worked fuel coupe in Ambur Reserved Forest one foot cube pits were dug in lines 22 feet apart, the pits being 11 feet apart in the lines (i.e. spacement 22 feet×11 feet or 180 plants per acre). *Dalbergia sissoo* transplants were planted in August 1954 during rains. A kumari crop of brinjals and tomatoes was raised by the Kumaridars between rows of Sissoo plants. Enumeration in February 1955 showed that there were 90 per cent survivals with a mean height of 3 feet and an average height of 6 feet. These results are extremely good and wherever there is demand for Kumri, such Kumri plantations can be raised successfully at little or no cost.

17. *Introduction of Anacardium occidentale.*—In 2 acres, Cashew was shown in situ, at an espacement of 22′×22′ on 22nd July 1954 and in another 2 acres nursery raised plants were planted out on 7th August 1954. Enumeration in February 1955 showed that direct sowings gave 84 per cent survival as against 58 per cent survival for transplants. For this species, direct sowing is better than entire transplanting.

18. *Afforestation of denuded Hill slips through contour trenching and bunding.*—One hundred acres of Ammur Reserve forest in a Hill adjoining Walajah Road R.S. was taken up for afforestation. The growth initially consisted of throny bushes of *Carissa spinarum, Randia duometorum, Flacourtia* species with a few scattered seedlings of *Morinda tinctoria* and coppice shoots of *Acasia leucophloea.*

19. Contour trenches 11 feet long, 1½ feet broad at top, one foot broad at bottom and one foot deep were dug at an espacement of 22 feet, centre to centre along the contours. The contour lines were 22 feet apart and the trenches were staggered to prevent run off of water. There were 90 trenches per acre. The earth excavated from the trenches was heaped on the down hill side close to the trench so as to form a mound.

20. A mixure of seeds of *Azadirachta indica, Albizzia amara, Albizzia lebbeck, Dalbergia sissoo, Prosopis juliflora, Tamarindus indica, Cassia siamea, Pithecolobium dulce, Hardwickia benata, Sapindus emarginatus Acacia sundra* were sown in the mounds in July, August 1954.

In addition, six months old pot plants and seven months old nursery plants of the above species were also planted on the mounds to supplement seedlings coming from direct sowings. Observations by end of February 1955 showed that—

Fifty per cent of the mounds are well stocked with 10 to 15 seedlings per mound (or one seedling on every foot of the mound).

Twenty-five per cent of the mounds have 5 to 10 plants per mound (or one seedling on every 2 feet of the mound).

Ten per cent of the mounds have less than five plants per mound.

Fifteen per cent of the mounds were without seedlings. These are situated near hill tops in rocky areas.

21. The mean heights of seedlings in the eastern slope, was 2½ feet, in the western slope 2 feet and in the southern slope was one foot. The maximum heights attained by the different species were—

	FT.
Prosopis juliflora	4
Albizzia lebbeck	3
Albizzia amara	3
Dalbergia sissoo	2
Azadirachta indica.	2½
Tamarindus indica	1½

22. The indications are that afforestation of barren and denuded hill slopes can be successfully achieved by a system of contour trenches and contour bunds. It is difficult to identify the post plants from the plants raised by sowings, and in some cases, plants raised by sowings appear to be better than pot plants or transplants. The tentative conclusion is therefore that direct sowings in July—August on mounds give better results than pot plants or transplants.

VII. Vellore West.

23. *Regeneration of Neem through Root suckers.*—As per the orders of the present Chief Conservator of Forests (Sri S. K. Basu, I.F.S., when he was Conservator of Forests, Salem Circle), an experiment was conducted to find out whether Neem (*Azadiracta indica*) can be raised artificially by root suckers.

Three neam trees were selected in an ex-panchayat Reserved Forest in Harur Range, Vellore West Division. Trenches at a radius of 10 feet around the trees were dug to a depth of 1½ feet in June 1954. In January 1955, the three trees were having thirteen roots suckers with a mean height of 3 feet. When again they were observed in August 1955 after 14 months of the application of the treatment, the mean height was 4·7 feet.

The District Forest Officer, Vellore West Division, had noticed seventeen healthy root suckers with a maximum height of eight feet when a trench was dug at a distance of 60 feet from a mature Neem tree.

Indications.—Natural regeneration of neem (*Azadirachta india*) can be obtained, through root suckers if trenches are dug at a distance of 30 feet from mother trees. Trenches closer to the mather tree or farther away than 30 feet did not produce equally good results.

During 1955-56 experiments will be conducted in these lines in Denkanikota, Marakanam and Vemburuli centres by the State Silviculturist for the following species :—

(1) Neem (*Azadiracta indica*).

(2) Borasu (*Chloroxylon swietenia*).

(3) Oonjal (*Albizzia amara*).

(4) Velvelan (*Acacia leucophloea*).

APPENDIX G.

NOTE ON THE PROBLEMS OF TEAK DEFOLIATORS IN MADRAS STATE.

1. A conference was held on 17th February 1955 between the Conservator of Forests, Ootacamund Circle, Ootacamund, and the Forest Entomologist, Forest Research Institute, Dehra Dun, on the above subject. The Statistician, Forest Research Institute, the State Silviculturist, Ootacamund, the District Forest Officer, Nilambur Division and the Working Plan Officer, Nilambur, were also present.

2. This problem will be discussed under the following two heads :—

(i) Loss of increment of teak due to attack of defoliators ;

(ii) Work so far done on defoliators and their control and results achieved. Work proposed for the future will also be indicated.

3. *Loss of increment of teak due to defoliation.*—Teak defoliation is caused by *Hyblal Purea* and *Hapalia machœralis* and a variety of other insects. For the purpose of this note the defoliation caused by only these two insects will be considered. Champion's research in Dehra Dun had shown that three defoliations artificially carried out resulted in a loss of increment of 60 per cent. We may therefore assume that the average loss per defoliation is 20 per cent. In actual practice in Nilambur an area might experience defoliation only about once in a year. It is therefore considered that in actual practice in Nilambur the loss of increment due to defoliation may not be more than 20 per cent. Dr. Beeson's experiments have shown that the average defoliation is about 8·2 per cent. We may therefore conclude that the loss of increment is somewhere between 8 per cent and 20 per cent.

In a III quality teak plantation of rotation age 70 years, the volume from stem timber per acre is 2,340 c.ft. Assuming that 10 per cent of this is lost through defoliation, the loss of increment during the rotation per acre is 234 c.ft. At Rs. 5 per c.ft. standing, this works out to a monetary loss of Rs. 1,170 per acre during a rotation.

In the past no accurate experiment has been devised or carried out to determine the exact loss of increment due to defoliator attack. The experiment by Champion in Forest Research Institute was done in young pole crop of size 12 feet high and 2 inches diameter breast height while actually in Nilambur the defoliation intensity is very great in the age group of 20 to 30 years where the average height is 66 feet and average diameter 8·1 inches. It is therefore desirable to devise and carry out new experiments to determine the loss of increment. Unless exact figures are available regarding the loss of increment and the consequent financial loss due to defoliation we might not be able to undertake expensive measures like artificial dusting for eradicating the defoliators. As per tentative calculation given above, chemical remedial measures involving an expenditure in excess of Rs. 1,170 per acre would not be justified.

4. The following experiment is proposed to determine more exactly the loss of increment due to defoliation :—

Age group of the plantation—20 to 30 years, because this age group is believed to be most vulnerable to defoliation.

Number of treatments.—There will be four treatments as shown below :—

(i) Complete hand-defoliation of all leaves once in March April after the new flush of leaves has appeared.

(ii) Complete immunity from defoliation by intense spraying or dusting of chemicals to protect the foliage ; once in March-April and again in September since these are two months in which heavy defoliation generally occurs.

(iii) Complete hand-defoliation of all leaves once in September to be carried out when defoliator attack is greatest in adjoining areas.

(iv) Control.—No action—allowing the leaves to natural de-foliation by insects. The degree of defoliation will be observed and recorded.

5. *Characters to be observed for comparison.*—(i) Diameter at 4½ feet high and basel area.

(ii) Total heights to be measured by Abne's level, as the trees would be of an average height of 66 feet at age 25 years and exact measurement with tape is impracticable.

(iii) Height of exploitable bole up to 8 inches diameter, for computing timber volume up to 8 inches diameter.

(iv) The exact degree of defoliation in treatment (iv) in paragraph 5 above will be observed and recorded.

6. *Location of experiment.*—The experiment will be done in three centres, viz., Wynaad and Nilambur and Topslip in Coimbatore South.

7. *Details of experiment.*—Eighty trees distributed at random in a plantation of an area of 2 or 3 acres will be selected and numbered with intervening unnumbered trees to act as surround. Eighty trees after initial measurements of height diameter at breast height and height of exploitable bole will be allocated to the four treatments, so that the tree allotted to the four treatments are initially comparable. The four treatments will then be applied. Intermediate measurements will be taken at the end of five years and final measurement at the end of 10 years.

8. *Work done so far on teak defoliators and their control.*—The two chief insects responsible for defoliation are *Hybalaca puera* and *Hapalia macharlis*. The life histories of these two insects have been studied in detail already and are given in Forest Insects by Dr. Beeson. No further work is necessary.

9. *Study of parasites and predators.*—The most promising parasite for the control of the teak defoliators are *Cedria paradoxa* and *Trichogramma minutim*. The life histories of these two insects have also been studied in datail. The life histories of other insects which act as predators and parasites on defoliators have also been studied in "Indian Forest Record", Volume 7, No. 6. No further laboratory work on the life histories of the parasites and predators are therefore necessary.

10. In 1942–43, 42,000 adults of *Cedria paradoxa* bred at Dehra Dun were liberated in teak plantations in Coorg. It is not known exactly what results were achieved. This may be investigated by reference to Coorg.

About 1,000 individuals of *Cedria paradoxa* were released in August 1937 in Nilambur and again 24,000 specimens of *Cedria paradoxa* were released in September 1937. No definite results were obtained. About 9,000 individuals of *Trichogramma minutum* were also released in Nilambur. Here again no definite results were obtained. Efforts to introduce *Apantalis* and *Tachinid* parasites were not successful owing to the prevelance of wilt disease in the host Caterpillars.

It is considered necessary now to open an insectary in Nilambur and release both the above parasites and study the result on a five-year period. Close and continuous observation for at least five years is necessary before we can assess the suitability of this methods. Details for this experiment are to be looked into by the Forest Entomologist.

The Forest Entomologist stated that proposals for the study of insect Institute under the Second Five-Year Plans are now before the Government epidemics by the Entomology Branch of the Forest Research of India. It was felt that as the teak defoliator problem is of an All-India nature the Madras Forest Department might address the President of the Forest Research Institute to include this in the Second Five-Year Plan.

11. *Control of defoliators through a suitable under-growth.*—An exhaustive study of the under-growth of teak plantation has been carried out by Forest Entomologist of Forest Research Institute and recommendations made in Forest publications from 1934 onwards. The recommendations were also incorporated in the Working Plan for Nilambur by A. R. Brand in 1941 pages 212 to 217. Lists are furnished of plants which are desirable in teak plantations as they are the host plants of insects which are alternative hosts to *Codria paradoxa* and *Trichogramma*. Also lists of undesirable plants have also been prepared as these are alternative food plants to the defoliators *Hyblsa purea* and *Hapalia machaerablis*. The question of how far the prescriptions in the Working Plan, viz. removal of undesirable plants from the plantations was carried out, was discussed. It appears that the removal of the undesirable plants was carried out at the time of thinnings for a few years from 1927 to 1935 and then this operation was given up as not practicable. When done, it was observed that on account of heavy rainfall, the copice shoots from the cutstumps came up vigorously and in actual practice this operation was found to be of no avail.

12. The question whether eradication of the undesirable plants can be done by cutting the plants and painting the cut stumps with Atlas solution or some other chemical poison, was considered. This was given up as being impracticabale and dangerous.

13. *Under-planting with Swietenia macrophylla.*—The question of under-planting teak with *Swietenia macrophylla* is already under the active consideration of the Madras Forest Department. It is to be noted that *Swietenia macrophylla* is a desirable species to encourage in teak plantations as it is the food plant of the defoliators *Hispsiphlyla robusta* and *Lamidi* species which are alternative hosts of four parasites of *Machaeralis* and *Puera* (Dr. Beeson's article in 'Indian Forester', page 485 August 1938). The teak plant is most vulnerable to defoliator attack between the years 20 and 30. Owing to the damage by elephants and alsodamage to the under-plants during thinning it is desirable to

introduce the under-plant at age 26 after the penultimate thinning at age 25, is carried out. Final thinning is due at age 25, and so *Sweitenia macrophylla* plants under-planted at age 26 will at least have 10 years to grow so as to resist incidental damage during final thinnings at age 36 years. It is expected that this under-plant will be beneficial from the point of view of defoliator control.

14. *Chemical control.*—In 1940 the State Silviculturist (Madras) carried out an experiment with Lead arsenate. This is described in paragraphs 3 and 9 of the Note of State Silviculturist, dated 7th February 1955. It was found that spraying was possible but that the insecticide scorched the leaves.

15. The most important insecticides for the present purpose are D.D.T. (Geigys) and Benzene Hexa Chloride. For the purpose of this investigation, it is enough if our attention is focussed on these two chemicals. The cost of these chemicals will be about Re. 1 per lb. or less. The most suitable agency for carrying out the dusting with the D.D.T. or B.H.C. will be through a helicopter chartered from the Indian Air Force or Plant Protection Directorate. The Forest Entomologist will explore the subject in detail. Also the quantity of chemical required per acre for dusting, the cost of the same and the cost of application through a helicopter will be investigated by the Forest Entomologist. It has to be remembered that this total cost cannot exceed Rs. 1,170 per acre, the upper limit of monetary loss through defoliation per acre, the upper limit of monetary loss through defoliation.

16. Small scale experiments are necessary for determining the concentration of the two insecticides necessary for application and also which of the two insecticides, D.D.T. or B.H.C. is more effective. This experiment will be done by State Silviculturist, Ootacamund, on a laboratory scale on the following lines at Nilambur.

Wire gauge cages will be prepared. Fresh leaves collected from the forest will be put in cages and the well developed caterpillars of ***Hapalia machaeralis*** and ***Hyblaea puera*** collected from the forests and starved for above six hours will be put on the leaves in the cages. One hundred Caterpillars will be put in each cage. The fresh leaves put in the cages will be dusted with various concentrations of D.D.T. and B.H.C. The number of Caterpillars dead after 12 hours and after 24 hours will be observed. There will be a control cage without dusting. Separate cage will be kept for experiments with ***Machaeralis*** and with ***Puera***.

In another experiment ***pupae*** of the defoliators collected from the forests will be put in cages and dusted with D.D.T. and B.H.C. The number of adult moths which emerge from the ***pupae*** will be counted (i) for treatment with insecticide; (ii) control no insecticide.

Also the dates of emergence of the moths from the *pupae* should be recorded as the chemical is likely to delay emergence. Daily observations should be made until no more emergence occurs. Dusting powder and Spraying with a watery solution, will both be tried to find out which is more efficatious.

Different concentrations of D.D.T. and B.H.C. should be used as different treatments.

In the case of experiment on Caterpillars the concentration of dust will be 5 per cent and 10 per cent D.D.T., B.H.C. 0·5 per cent, 1 per cent and 2 per cent. For dusting the *pupae* the concentrations will be the same as above.

In the experiment regarding dusting of pupæ the moths which emerging should be killed in a killing bottle and preserved for being identified by the Forest Entomologist.

17. *Wilt desease of Caterpillars.*—It has been found that at certain times probably to a virus attack, Caterpillars wilt and die in large numbers in Nilambur. It is felt that this is a promising line of approach and should be investigated. At present no data are available. If successful this may provide a cheap method of control during epidemics. The Forest Entomologist will kindly take this up.

18. *Resistant strain of teak.*—Is there a strain of teak which resists defoliation at all times and in all circumstances? Several observators have reported the possibility of the existence of a resistant strain. The question whether research is necessary to ascertain whether such a resistant strain exists, was discussed. The matter was dropped as not practicable.

19. The teak plantations in Nilambur are rigidly protected from fire by a system of fire-lines. It is a controversial point whether burning decreases the defoliator attack, or whether it increases the defoliator attack. Also it is a controversial point whether bruning increase the increment of teak or whether it decreases the increment of teak. It is therefore proposed to start an experiment in teak plantations at ages 5, 10, 15, 20, 30, 40, 50 and 60 years to find out whether a ground fire in the teak plantation early in summer season will be beneficial, or will be detrimental from the point of view of defoliators and the teak increment. A design for such an experiment will be evolved by the State Silviculturist in consultation with the Statistician, Forest Research Institute.

20. It is considered, that if teak plantations are surrounded by a belt of natural forests with growth of miscellaneous species this will be advantageous in that it will act as a reserve for predators and parasites of teak defoliators and this will be beneficial and controlling the intensity of defoliators. It has therefore been decided that in all the future teak plantations a belt of one chain allround will be clear-felled, but not burnt and planted. To prevent fire in this one chain belt and undisposed of slash should be dragged from the one chain belt to the area to be planted so that the one chain belt will not get burnt. This one chain belt will get filled up with coppice shoots of old trees and seedling regeneration coming up naturally. It is expected that this belt of miscellaneous vegetation will be beneficial from the point of view of defoliator control.

17th February 1925. (Signed) M. L. ROONWAL,
Forest Entomologist F.R.I. Dehadun.