Annual Report on Silvicultural Research in Madras State.

1955-56.

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ANNUAL REPORT ON SILVICULTURAL RESEARCH IN THE MADRAS STATE

FOR THE YEAR 1955-56

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PART I—General
PART II—Experimental Silviculture
PART III—Working Plans and Statistics
PART IV—Miscellaneous

APPENDICES A TO I

CHARTS I TO XXVII

BY
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State Silviculturist, Ootacamund

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PART I

GENERAL.

1. *The Silvicultural Research Programme.*—The Silvicultural esearch Programme was prepared by the State Silviculturist consultation with other officers.

2. *Research Gardens and Stations.*—The Statement of Research ardens at the commencement and close of the year is furnished. uring the year, a new Research Station was opened at Tanjore r research on the introduction of *Tectona grandis* in the canal anks, padugai lands and waste lands in the Tanjore district.

3. *Climate and rainfall.*—The climatic factors of all Research entres are furnished in the form of charts and tables.

4. *Records.*—Detailed statements on the open experimental ot and experimental garden files at the commencement and of ie year are furnished.

5. *Computation and analysis of annual measurements.*—The esent position is analysed and described.

6. *Sample plots.*—Detailed statement of sample plots is furnished. our sample plots were closed during the year.

7. *Tree increment plots and permanent preservation plots.*—etailed statement of all plots is furnished.

8. *Library.*—Particulars of new books added to the Library are rnished. Some volumes in which there was more than one copy e proposed to be transferred to the Office of the State Silviculturist, ndhra State.

9. *Documentation*—Reference is made to the additions made to o specific and general ledger files. A statement showing the imber of the files at the end of the year is given.

10. *Photographi collection.*—Reference in made to the additions the specific photographs and general photographs. The number photographs at the end of the year is given in a table.

11. *Administration.*—Shri P. Venkataramany, I.F.S., continued State Silviculturist, throughout the year.

12. *Staff under the State Silviculturist.*— A statement of staff at the beginning and at the close of the year is furnished. The post of Assistant Silviculturist was vacant for over six months. Appendix H furnishes a list of officers engaged exclusively on research.

13. *Tours.*—The State Silviculturist toured for 146 days during the year.

14. *Office inspections.*—All subordinate officers were inspected during the year.

15. *Discipline of staff.*—Satisfactory.

16. *Vanamahotsava.*— Seeds and seedlings were supplied.

17. *Technical advice, contributions and publications.*— The following technical contributions were prepared during the year :—

(1) A note on spike disease in sandal with suggestions for future research (offered for publication in the " Indian Forester ")

(2) The following articles were prepared for the Vanamahotsava Symposium held in Agra in January 1956:—

(i) The role of Forest in Water and Soil Conseravtion ;

(ii) The role of Forest in Flood Control ;

(iii) The significance of Vanamahotsava in Town Planning ;

(iv) Proper choice of species for Vanamahotsava ;

(v) Vanamahotsava in the production of Food, Fuel and Fodder ;

(vi) Vanamahotsava for Forestry.

(3) Underplanting in teak plantations in Madras State——Article published in the " Indian Forestry ".

(4) Is there deterioration of site quality in second rotation pure teak plantations—Article offered for publication in the " Indian Forester ".

(5) Notes on various species were compiled during the year with the iedea that these may be published together in book form for the general guidance of District Forest Officers and others.

(6) Notes on exotic trees introduced in the reserved forests of the Madras State. This was prepared with reference to a proforma supplied by the VI British Commonwealth Conference. The information is intended for submission to the President, Forest Research Institute, Dehra Dun, for submission to the VII British Commonwealth Conference.

18. *Acknowledgements.*—Valuable advice, help and suggestions received, are duly acknowledged.

PART II.

EXPERIMENTAL SILVICULTURE.

(i) General.

19. Experiments on teak continued to take a dominant place ; but several new expriments of importance were initiated during the year.

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

(a) *Natural regeneration by seed.*

20. *Acacia mollissima.*—Passing a light ground fire increases the quantity of natural regenartion on the ground.

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

22. *Dysoxyam malabaricum.*—Clearing weed growth and raking up the soil under mother trees in evergreen forests induces natural regeneration.

23. *Mesua ferrea.*—Clearing undergrowth and three weedings and clearing undergrowth with soil working, both induce significantly natural regeneration more than control where nothing was done.

24. *Hopea parviflora—Natural regeneration by seed.*—Weed cutting under mother trees in evergreen forest gives the largest number of seedlings to come in.

25. *Hopea parviflora—Canopy manipulation over established natural regeneration.*—Clearfelling over established regeneration promotes growth better than (i) felling and removal of middle storey only and (ii) control.

26. *Hopea parviflora—Canopy manipulation to regulate development of established seedlings.*— Clearfelling over established natural regenaration of 3 feet to 8 feet in height benefits it appreciably.

27. *Mesua ferrea—Effect of tending natural regeneration.*— Tending of natural regenartion is distinctly beneficial.

28. *Palaquium ellipticum—Canopy manipulation.*— Clearfelling an area over established natural regeneration promotes rapid height growth.

29. *Teak—Natural regenaration by seed.*— Preliminary indications are that a light ground fire in a teak plantation induces and accelerates natural regeneration.

(b) Natural regeneration by coppice.

30. *Teak coppice—Mortality of stools.*—There is no difference between (i) high cutting and (ii) low cutting of stems during coppicing or between (i) trimming stools or (ii) not trimming stools.

31. *Teak—Reduction of coppices shoots to* 4, 3, 2, 1 *per stool.*—Reduction to one shoot gives the best diameter and height growth Data on volume production not yet available.

(iii) SEEDS (COLLECTION, WEIGHMENT, GERMINATON PER CENT, PLANT PER CENT, ETC.).

32. *Supplies of seeds seedlings and stumps.*—During the year. 175 indents comprising 60 species and 17,722 lb. of seeds were supplied. Teak seeds from Madras State, as also seeds of *Eucalyptus. globulus* and *Acacia mollissima* were specially in great demand. Statement of seeds supplied is given as Appendix C. 12,831 lb. of teak seeds and 68, 300 teak stumps were supplied during the year.. List of Exotic seeds received for trials is furnished in Appendix D

33. *Germination tests and seed wweighments.*—A tabular statement showing seed weight, germinative capacity, plant per cent, plants per lb. and best method of raising all speicies tested so far is furnished as Appendix E, which is brought up to date with reference to tests carried out during the year ; additional species are also included in Appendix E .

34. *Aids to germination—Pre-treatment of seed.*—Details are furnished of the best method of accelerating germination of various species. A tabular statement showing behaviour of seeds under the four standarad treatments, viz.—

(i) Soaking in cold water for 24 hours ;

(ii) Soaking in hot water for 24 hours ;

(iii) Soaking in boiling water for 24 hours ;

(iv) Contrpl—No treatment ;

is furnishd. Appendix F gives this information.

35. *Aids to germination—Behaviour of seeds to treatment.*—Lists of species arranged in alphabetical order are given with reference to–

(i) Germinative capacity not improved by any of the treatments.

(ii) Germinative capacity is best without treatment ;

(iii) Germinative capacity is best when soaked in water for 24 hours.

(iv) Germination is best when soaked in boiling water ;

(v) Germinative capacity decreases with the boiling water treatment.

36. *Seed treatment—Obdurate species.*—Tabular statement is furnished showing behaviour of seeds under several treatments.

37. *Special seed pre-treatment for certain species*—Information is given in alphabetical order in respect of ten species.

(iv) NURSERY WORK.

38. *Nurseries.*—These were maintained in all Research Centres.

(v) ARTIFICIAL REGENERATION.

39. Artificial regeneration will be described in the following paragraph separately for (i) teak ; (ii) softwoods, and (iii) exotics.

(a) Experiments on teak.

40. *All-India teak seed origin sample plots.*—In Nilambur, South Burma and South Bombay seed origins give the maximum volume production ; but in South Coimbatore, Mount Stuart and Nilambur seed origins give the maximum volume production. Hence the indications of these two sets of sample plots are contradictory. Further observations are necessary.

41. *Teak—Introduction in Rameswaram Island.*—Teak when introduced in the sandy waste lands of Rameswaram gave 25 per cent survival and 5 inch heigh growth. Further experiments are in progress.

42. *Teak—Experiments on espacement.*—Experiments started in 1938 and in 1940 in Nilambur I and II quality second rotation teak plantations, show that of the two espacements, viz.—

(i) $6' \times 6'$ espacement (1,210 plants per acre) ; and

(ii) $8\frac{1}{2}' \times 8\frac{1}{2}'$ espacement (605 plants per acre) ;

the wider espacement gives significantly better height growth and is also cheaper in planting and weeding costs by 22 per cent. Hence the wider espacement has been adopted as standard practice in Nilambur and Kannoth from 1951 onwards.

There is besides the added advantage of the elimination of the first mechanical thinning-an essential operation in teak plantations with $6' \times 6'$ espacement.

43. *Teak—Sorting of seed by size.*—There is no significant difference in the mean heights of trees raised from seeds of different sizes.

44. *Teak—Effect of age, size and condition of seed bearer.*—Seed from overmature trees is as good as seeds from mature trees. Seeds can be collected from all trees except obviously immature trees.

45. *Teak—Comparison of seeds from plantations and 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.

46. *Teak—Use of halved and quartered stumps.*—There is no significant difference between entire and halved stumps. In times of scarcity, halved stumps may be used.

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

48. *Teak—Preparation of stumps in nursery.*—There is no difference between the ordinary district practice and the method of cutting the stem of the seedlings in the nursery bed and uprooting the roots after an interval of a week and making teak stumps.

49. *Teak—Cutting back one year old plantation.*—When a teak plantation one year old is cut back, the coppice shoots show a better mean height than the uncut control plants; but the difference disappears in the fourth year. If a young teak plantation is accidentally burnt, or damaged by wild elephants, the stems may be cut back with advantage.

50. *Teak—Manurial experiments.*—Application of 2 oz. to 4 oz. of fertilizer per plant does have a beneficial effect and gives increased height growth. The composition of the fertilizer mixture seems of little account as both Super phosphate and N.P.K. mixture have given equally beneficial results. But the increase in height growth obtained by application of manure is only a few feet. With this limited increase in height growth, it is doubtful whether any saving can be effected in weeding costs. On the other hand the indication appears to be that manuring at a cost of Rs. 26 per acre will not be justified when the weeding and tending costs for there years up to establishment come only to Rs. 26 to Rs. 28 in Wynaad and Nilambur Forest divisions.

51. *Teak—Plantations with Kumri crop.*—There is no difference of teak raised with any of the common Kumri crops, viz.—

(1) Hill paddy.
(2) Chillies.
(3) Cotton.
(4) Ragi.
(5) Tapioca.
(6) Horsegram.

52. *No deterioration of Site quality in second rotation pure teak crops.*—Measurements of sample plots 17-A, 18-A and 19-A 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.

105. *Eucalyptus globulus—Experiment on reduction of coppice shoots.*—Blue gum coppices very well sending numerous coppice shoots. This experiment has four treatments, viz.—

A—Control—all coppice shoots left intact.
B—Number of coppice shoots reduced to 2 per stool.
C—Number of coppice shoots reduced to 3 per stool.
D—Number of coppice shoots reduced to 4 per stool.

The results of this experiments will be available only after a few years.

106. *Eucalyptus grandis.*—Experiments with the species are described. It attains a height of 1½ feet to 2½ feet in one year.

106-*a*. *Eucalyptus rostrata.*—The species is described briely. The experiments on the species are given.

106-*b*. *Eucalyptus rudis.*—The species is described briefly—the experiments on the species are given.

107. *Grevellia robusta.*—Growth data is furnished.

108. *Hyphaeni thebaica* (*Dum nut*).—The economic importance of the plant is described. Seedlings in Dhoni and Topslip research nurseries do not show promise.

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

110. *Ochroma lagopus.*—Experiments on growth and development are given. Growth and development are more rapid in an area of greater rainfall such as Nilambur and Dhoni than in areas of lesser rainfall such as Topslip and Begur.

Best method of raising is to sow seeds in containers (Bamboo tubes) and plant when seedlings are 4 inches to 9 inches high.

111. *Ocimum camphora* (*Syn. Ocimum kilimand Schancum*).—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.

Further experiments on improved methods of cultivation and harvesting are proposed for 1956–57.

112. *Pinus caribae* (Slash Pine).—Growth in Ootacamund is exceedingly slow.

113. *Pinus taeda* (Lablolly Pine).—Growth is poor.

113-*a*. *Prosopis julifeora.*—The importance of this species in the artificial regeneration of dry fuel forests is described.

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

114-*a*. *Stylosanthes gracils.*—The importance of this species as a green manure and cover crop is described. Experiments with the species are given.

114-*b*. *Terminalia myriocarpa* (Hollock).—The economic importance of the species is described. Experiments with the species are given.

115. *Salix babylonica.*—Growth data are given.

(*e*) *Bamboos and canes.*

116. *Dendrocalamus strictus.*—Details of three experiments are given.

117. *Bambusa arundinacea.*—Details of one experiment is given.

118. *Importance of research on canes.*—Data of import of canes is given and need for starting intensive research is emphasised.

119. *List of Madras canes.*—A detailed list is given.

120. *Calamus species—Seed weighments and germination tests.*—Data collected are given for 5 species.

121. *Calamus caesius.*—Information is furnished.

122. *Calamus gamblei.*—Information is furnished.

123. *Calamus pseudo-tenuis.*—Information is furnished.

124. *Calamus rheedii.*—Information is furnished.

125. *Calamus rotang.*—Information is furnished. In one experiment with direct sowings, natural transplants and planting natural rhizomes, planting natural seedlings gave the best results—43 per cent survival and 6·2 inches height growth in one year.

In another experiment on the period of viability of the seed, it was found that the seed loses viability quickly and so should be sown as quickly as possible after collection.

126. *Calamus scipionum.*—Information is furnished.

127. *Supplies of Plant materials of Calamus to Forest Research Institute, Dehra Dun.*—Information is given.

128. *Proposals for future research on canes.*—Details of experiments proposed for the future are furnished.

(*f*) *Medicinal plants.*

129. *Rauwolfia serpentina.*—The occurrence of the plant in Madras State is given and its use in medicine is referred to.

130. *Underplanting of Rauwolfia serpentina in teak plantations.*—Experiments in Kannoth, Begur, Nilambur and Dhoni are described. The results so far are not satisfactory.

131. *Best method of raising Rauwolfia serpentina.*—Details of experiments are given.

132. *Experiments on raising Rauwolfia serpentina in clearfelled and burnt natural forest and in natural forest under top canopy.*—Details are furnished. Growth is better in clearfelled and burnt area. Experiments show that at least two years are necessary for a seedling to produce exploitable roots.

133. *Rauwolfia canescens.*—Data about the growth and development of the plant are given.

(vi) Reclamation and afforestation including irrigated plantations.

134. *Afforestation of sandy wastelands in Rameshwaram Island.*—An experiment on the fixation of sand near Rameshwaram Road R.S., through baffle walls is described. The results are exceedingly encouraging.

135. *Afforestation of sandy wastelands and fixation of sand through artificial regeneration of various species.*—A list of species tried with results achieved at the close of the year is given.

136. *Vegetative propagation of species in Rameshwaram.*—Experiments with four species are given.

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

138. *Afforestation of grasslands in Chandanathode.*—Experiments with several species in 1953, 1954 are discussed.

(vii) Tending, Thinning, Cleaning, Climbers and Weeds.

139. *Pruning in teak plantations.*—Pruning is not beneficial from the point of view of diameter increment or height increment. Exhaustive data are furnished.

140. *Teak plantations in Wynaad—Best time for first thinning.*—First thinning at the age of five years is definitely superior to first thinning at the age of seven years or nine years in the Wynaad Division. Actually thinnings are being done with 6′ × 6′ espacement at the age of four or five years according to the quality of the crop.

141. *Teak plantations—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—selection of the final crop at 25 to 30 stems per acre and favouring these at all stages).

Detailed data are furnished and the following conclusions are drawn :—

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

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

(iii) The yield of useful basal area decreases as the intensity of thinning increases.

(iv) The yield of total volume (stem timber and stem small wood) is highest for "C" grade thinning and lowest for "X" grade thinning.

Hence heavier grades of thinning yield progressively greater diameter increment, but total volume production is greatest with a "C" grade thinning.

142. *Teak plantation—Best intensity of thinning—Nilambur.*—This is a repetition of the experiment given in paragraph 141 above, in sample plots 69 to 86 of Nilambur. Detailed measurements are given and analysed. The conclusions are identical to those given in paragraph 141 above.

143. *Teak plantations—Heavy and early thinnings to anticipate and not to follow likely suppression (advance thinning).*—On the lines of work done by Dr. Craib in South Africa, experiments were started in 1934 in Nilambur teak plantations in sample plots 120 to 125. Analysis of the latest measurements show that—

(i) The "advance thinning" has no appreciable effect on height growth.

(ii) The "advance thinning" produces accelerated rate of diameter increment; but the yield of total basal area and total volume production are significantly less than in ordinary thinning.

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

144. *Teak plantations—Thinning Research—Sample plots 136 to 141 of Nilambur.*—This is a repetition of the thinning experiment noted in paragraph 143 above. Owing to faulty execution of thinnings in the past, it is proposed to abandon these sample plots or utilize them for some other purpose.

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

146. *Eradication of Lantana through clearfelling, burning and planting forest crops with Kumri.*—Details of experiment in Salem North Division are furnished. Cutting and burning Lantana and planting in lines 22 feet apart with a Kumri crop of Ragi, is successful. *Eucalyptus rostrata. E. citriodora* and *E. hybrid* reach 5 feet, 5·7 feet and 3·6 feet respectively in two years.

147. *Eradication of Lantana through Weedicides.*— Experiments with 2-4-D, 2-4-5-T, Pentachlor-phenol, Extar-A (Sandoz product) and Shell Weed-Killer are discribed. Spraying with the above chemicals killed the plant above ground. Further observations are necessary to see whether any shoots will come from underground roots or fresh seedlings from dormant seeds lying on the ground.

148. *Eradication of Lantana through biological methods.*—Effect of attack by the Lantana scale insect *Orthezia insignis*— Browne is described.

149. *Occurrence of Loranthus in teak plantations.*—A description of the Loranthus plant is given.

150. *Loranthus infestation in teak plantations—Need for research.*—A description of *Loranthus longiflorus*—variety falcata KURZ—is given and the need for research on this subject is stated.

151. *Teak plantations—Eradication of Loranthus through chemicals.*—Experiments were started by injecting Copper sulphate and Fernoxone in augur holes made in the trunk of Loranthus infected teak trees. At the end of six to nine months there was no effect either in the teak trees or on the Loranthus. Further observations are being made.

152. *Salix babylonica—Pruning of branches.*—There is no difference between pruned and unpruned trees, as regards diameter increment.

(viii) MIXTURES.

153. *Nil.*

(ix) UNDERPLANTING.

154. *Teak plantations in Wynaad and Nilambur—Is underplanting necessary ?*—The problem is discussed and a case made out for "no underplanting".

155. *Origin of underplanting—Experiments in Madras State.*—The reasons which led to underplanting experiments are given.

156. *Teak plantations—Underplanting experiments in* 1930–40.—These are described separately for.—

(i) Underplanting with bamboos.

(ii) Underplanting with tree species.

(iii) Underplanting with shrubby plants.

157. *Teak plantations—Underplanting with Rauwolfia serpentina.*—Experiments are described.

158. *Teak plantations—Underplanting with Cinnamomum zeylanicum.*—Experiments are described.

159. *Lac cultivation in Denkanikota.*—Details of cultivation are given.

160. *Manufacture of lac products at Denkanikota.*—A Statement of lac products manufactured is given.

161. *Revenue and expenditure with profit on lac manufacture.*—Figures are furnished for 1955-56 and comparison is made with corresponding figures for 1954-55.

x. Silvicultural systems.

162. *Nil.*

(xi) Miscellaneous.

163. *Teak—Experiment on girdling mature trees one year before felling to see whether there is partial seasoning of wood.*—The trees have been felled and sold one year after girdling treatment. Results of sawing of the logs are awaited to see whether the girlded logs show signs of appreciable seasoning and better workability.

PART III.

WORKING PLANS AND STATISTICS.

(i) Working plans.

164. *Working plans.*—Information is furnished on working plans in progress and those which were completed or newly taken up.

(ii) Yield, Volume and Form Factor tables.

165. *Sample plots, permanent preservation plots and tree increment plots.*—Details of plots in existence are given. Appendix B gives complete lists.

(iii) Bark measurements.

166. *Nil.*

(iv) Miscellaneous formulae, etc.

167. An abstract of experiments conducted by District Forest Officers is furnished in Appendix G.

PART IV.

MISCELLANEOUS.

A. Forest Botany.

168. *Nil.*

B. Forest Entomology.

(a) *Systematic Entomology.*

169. *Nil.*

(b) *Economic Entomology.*

(i) Specific investigations.

170. *Teak defoliator attack in Madras—Investigations.*—Reference is made to the detailed note on subject prepared in 1954-55. The experiments suggested in the note will be taken up next year.

(ii) Miscellaneous investigations.

171. *Ailanthus excelsa and A. malabaricum—Defoliator attacks.*—Attacks of the Defoliator *Eligma narcissus* (Noctuidae) is described. Experiments on spraying and dusting of insecticides are proposed for trails

172. *Bombax malabaricum—Shoot borer.*—Attack of the shoot borer *Tonica neviferana* is described. Experiments on the spraying and dusting of insecticides are proposed for trails.

(iii) Unclassified and unidentified damage.

173. *Nil.*

C. Forest Zoology.

174. *Nil.*

D. Utilization.

175. *Forest utilization.*—There is a wholetime Forest Utilization Officer with headquarters at Madras. His report for the year is furnished as Appendix I.

———

(*b*) *Indigenous hardwood species.*

53. *Calophyllum elatum.*—Growth statistics are given.

53 A *Dipterocarpus indicus.*—Growth statistics are given.

54. *Gluta travancorica.*—Growth statistics are furnished. The species can be raised successfully but it suffers much from damage by wild elephants.

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

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

57. *Hopea parviflora—Frequency of weeding.*—Regular weeding three times a year till the seedlings reach the sapling stage, encourages rapid height increment.

58. *Hopea and Mahogany.*—These can be successfully introduced in a deciduous forest after clearfelling and burning.

59. *Raising evergreen species after clearfelling and burning deciduous forest which was originally evergreen.*—Evergreen species such as *Hopea parviflora, Mesua ferrea*, can be introduced in the retrograde evergreen forests using a nurse crop of *Tephrosia candida*, after clearfelling and burning.

60. *Mesua ferrea.*—Growth statistics are furnished.

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

(*c*) *Indigenous softwood species.*

62. *Artificial regeneration of gaps in evergreen forests.*—Of the six species tried, *Bombax malabaricum* has come up best.

63. *Introduction of softwoods in evergreen forests.*—Data furnished; further observations are required.

64. *Ailanthus excelsa.*—Grown statistics are furnished; defoliator attack by *Eligna narcissus* a Lepidopterous defoliator is referred to.

65. *Ailanthus malabarica.*—Growth statistics are given. This is also subject to damage by Eligna narcissus.

66. *Bombax malabaricum.*—Best method of raising is through one year old transplants.

67. *Bombax malabaricum—Shoot borer.*—The *Bombax* shoot borer *Tonica neviferana* is referred to.

68. *Bombax malabaricum—Manurial experiments.*—Application of manure has not shown any advantage.

69. *Evolia roxburghiana*.—Rate of growth is furnished. Thinning of the crops promotes diameter increment and reduces incidence of fungus attack. Pruning of branches has no beneficial effect on mean height growth.

70. *Gmelina arborea*.—Growth statistics are given.

71. *Melia dubia*.—Entire transplanting is the best method of raising the species. *Seradix harmone* is not efficacious in promoting root formation in Melia stem cuttings

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

73 *Sterculia alata*.—Growth statistics are given. Two months old transplants give better survival per cent; but two year old transplants give better height growth.

74. *Sterculia companulata*.—Nine months to one year old transplants give the best results. 9′ × 9′ espacement is better than 6′ × 6′ espacement. This species is very liable to damage by deer.

75. *Vitex peduncularis*.—Growth statistics are furnished.

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

(*d*) *Exotics*.

77. *Acacia mollissima* (*Black Wattle*).—Its economic importance is described and the need for research is emphasised.

78. *Acacia decurrens—Espacement experiment*.—The experiment is described. 9′ × 9′ espacement is better than 6′ × 6′ espacement both in height growth and survival per cent.

79. *Acacia mollissima and A. decurrens—Experimental Introduction in lower Altitudes of* 1,500 *feet*.—Experimental introduction of the plants in Topslip is described. The results show some promise.

80. *Acacia mollissima—Analysis of bark for tannin contents*.—The results of analysis of bark sent by the District Forest Officer, Nilgiris, to the Institute of Leather Technology, Madras, during the years 1942-43 to 1952-53 are furnished.

81. *Acacia mollissima—Pre-monsoon planting*.—The experimental planting of seedlings in April to compare it with planting during the south-west monsoon in June-July, was started. But due to severe frost damage no conclusions can be drawn.

82. *Acacia mollissima—Manurial experiment*.—Addition to 2 oz of N.P.K. fertilizer mixture with 3′ diameter scraping round the plants gave the best results. Addition of one oz. of fertilizer mixture gave slightly less height growth.

83. *Acacia mollissima—Experiment with different rotations*.—The experiment, with plots to be felled at rotation ages of 7, 10, 13 and 16 years, is described. Till now only sub-plots of rotation ages 7, 10, 13 have been felled. The M.A.I. of green bark culminates at about the 10th year; but the M.A.I. of dry bark increases steadily up to 13 years.

83-*a*. *Allanthus grandis—Prain*.—Experiments on the species are described and growth statistics are given.

84. *Albizzia falcata*.—Experiments on the species are described and growth statistics furnished.

85. *Aleurites fordii and A. montana*.—Experiments on the species are described and growth statistics furnished.

86. *Bursera delpechina*.—The plants in Denkanikota Research Garden are referred to. Attenpts to raise plants by vegetative propagation were unsuccessful.

87. *Broussenetia papyrifera*.—The species comes up well both by stumps and transplants and reaches a height of 28 feet in three years.

88. *Cassia javanica*.—The plant has importance on account of the tannin content of its bark, fruits and flowers. Analytical data furnished by the Institute of Leather Technology, Madras, are given. The tannin content in the bark, leaves and pods of this plant are greater than in the case of *Cassia siamea*. Seed weight 185 to the oz.; germinative capacity 12·5 per cent; plant per cent 12·5.

89. *Casuarina cunninghamiana*.—Growth data are furnished.

90. *Casuarina junghuhniana*.—Growth statistics are furnished.

90-A. *Cedrela odorata*—The usefulness and economic importance of the species are described; experiments on the species are also mentioned.

91. *Ceratonia siliqua*.—Results of nursery tests and experiments are given.

92. *Chlorophora excelsa*.—Growth statistics are furnished. The plant can grow to a height of 40 feet in fifteen years. In one locality it has grown faster in both diameter and in height than teak.

93. *Cinnamomum camphora* (*Japan or Formosa Camphor*).—Growth statistics are furnished.

94. *Cinnamomum zeylanicum*.—Growth statistics of both the sandy and laterite varieties are furnished. Comparison experiments showed that both transplants and stumps give 43 per cent survival and a height growth of 10 feet to 12 feet in six years.

95. *Cinnamomum zeylanicum—Underplanting in teak plantations.*—The underplanting experiments in four centres are described. The preliminary indications are that it is possible to raise a crop of *Cinnamomum zeylanicum* as an undercrop in teak plantations.

96. *Cinnamomum zeylanicum—Introduction as an underplanting in evergreen forests.*—The experiments are described.

97. *Copernicia cerifera* (*Carnuba wax palm*).—Experiments in three centres are given.

98. *Crocus kashmiriana* (Saffron).—Experimental introduction in Ootacamund and Topslip is described. Further observations are necessary.

99. *Dalbergia cochin-chinensis.*—Growth data are given.

100. *Dalbergia sissoo.*—Transplanting one year old seedlings, with or without a Kumri crop such as Ragi appears to be the best method of raising the species. Transplants two years old and stump planting of one and two years old plants, are also successful.

Growth data are given. It comes up well in burnt Lantana infested areas in Denkanikota.

101. *Eucalyptus species-- General.*—List of species tried is given.

101 *a*. *Eucalyptus species—Introduction in the plains districts in East Coast.*—Experiments with *Eucalyptus hybrid*, *E. citriodora* *E. patens*, *E. gomphocephala* are described.

102. *Eucalyptus citriodora.*—Investigations on the essential oil of the leaves are being started. It can be successfully raised through tubed plants. It has a rapid height growth of an average of 6 feet in one year (maximum up to 12 feet).

103. *Eucalyptus globulus* (Blue gum)- *Manurial experiments.*—Experiment is described. The addition of 2 oz. of N. P. K. manure mixture, per plant, is definitely beneficial in promoting height growth and increasing survival per cent.

104. *Eucalyptus globulus—Experiment on lopping of leaves more than once during the rotation.*—Experiment has been started with four treatments, viz.—

A—4 loppings at ages 4, 8, 12, 15 years.

B—3 loppings at ages 5, 10, 15 years.

C—2 loppings at ages 8 and 15 years.

D—1 lopping at age 15 years.

The results of this experiment will be available only after a few years.

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ANNUAL REPORT ON SILVICULTURAL RESEARCH IN THE MADRAS STATE FOR THE YEAR 1955—56.

PART I.

GENERAL.

1. *Silvicultural Research Programme.*—The Silvicultural Research Programme for the year 1955-56 was prepared by the State Silviculturist in consultation with the District Forest Officers and submitted to Conservator of Forests, Development Circle, for approval.

2. *Research gardens and stations.*—At the commencement of the year the following Research Centres were in existence. During the year in accordance with the orders of the Chief Conservator of Forests, Madras, a new Research Station was opened at Tanjore with effect from 13th January 1956. This station is in charge of a Forester. A separate post of Forester has not been sanctioned for this Centre and this station is therefore manned by a Forester taken from the existing sanctioned strength of the Silvicultural Research Division.

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

TABLE I.—*Statement of Research Cntres and Gardens.*

Research centres with staff at beginning of year on 1st April 1955.	*Research centres and staff at end of year on 31st March 1956.*	*Reasons for change.*
I Research Station, Wynaad, with sub-centres at Begur, Chandanathode and Kannoth. Staff— Ranger .. 1 Foresters .. 3 Forest Guard 1	Research Station, Wynaad, with sub-centres at Begur, Chandanathode and Kannoth. Staff— Ranger .. 1 Foresters .. 2 Forest Guard 1	One post of Forester temporarily vacant.
II Research Station, Nilambur with sub-centres at Topslip and Dhoni. Staff— Ranger .. 1 Foresters .. 3	Research Station, Nilambur with sub-centres at Topslip and Dhoni. Staff— Ranger .. 1 Foresters .. 3	
III Research Station, Nilambur. Staff— Forester .. 1	....	The station is under the Research Ranger, Nilambur. The Forester was transferred to the State Silviculturist's Office to attend special works.

Research centres with staff at beginning of year on 1st April 1955.	*Research centres and staff at end of year on 31st March 1956.*	*Reasons for changes.*
IV Research Station, Ootacamund. Staff— Foresters .. 2	Research Station, Ootacamund. Staff— Foresters .. 3 Forest Guard 1	One Forester has been transferred from Nilambur Research Centre to attend to computation work which was in arrears. One Forest Guard has been transferred from Denkanikota Research Centre, for assisting Research Forester, Ootacamund Centre—vide Chief Conservator's Ref. No. 24731/54-D3, dated 6th/9th November 1955.
V Research Station, Denkanikota. Staff— Ranger .. 1 Forester .. 1 Forest Guards 3	Research Station, Denkanikota. Staff— Ranger .. 1 Forester .. 1 Forest Guards 2	One Forest Guard was transferred to Ootacamund Research Centre to assist Research Forester, Ootacamund (Please see Item IV above.)
VI Research Station, Rameswaram. Staff— Forester .. 1 Res. Watcher 1	Research Station, Rameswaram. Staff— Forester .. 1 Res. Watcher 1	No change.
Temporary Stations.		
VII Research Station, Markanum. Staff— Forester .. 1 Mali .. 1	Research Station, Markanum Staff— Forester .. 1 Mali .. 1	No change.
VIII Research Station, Vemburili. Staff— Forester .. 1 Mali .. 1	Research Station, Vemburili. Staff— Forester .. 1 Mali .. 1	Do.
IX	Research station, Tanjore— Staff— .. 1 Forester	Tanjore station was newly opened in 1955-56 as per Conservator, Develoment Circle's Ref. No. 8058/55-M, dated 2nd December 1955, with effect from 13th January 1956.

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 temparatures

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 the year 1955-56 for all the research centres are also given in Appendix 'A'.

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 statements summarize the information on the open Experimental plot files and the open Experimental garden files at the commencement and at the close of the year :—

TABLE II.—*Statement of Experimental plot Files.*

Name of research range.	*Name of research centre.*	*Number at the beginning of the year.*	*Added during the year.*	*Closed during the year.*	*Number at the close of the year.*
(1)	(2)	(3)	(4)	(5)	(6)
Nilambur	Nilambur ..	39	1	3	37
	Topslip ..	24	..	6	18
	Dhoni	42	..	4	38
Wynaad	Begur	27	3	3	27
	Kannoth	30	1	1	30
	Chandanathode ..	14	..	7	7
Denkanikota	Denkanikota ..	5	..	..	5
Directly under State Silviculturist.	Benneri	84	..	..	84
	Ootacamund ..	8	4	..	12
	Total ..	273	9	24	258

TABLE III.—*Statement of Experimental Garden Files.*

Name of research range.	*Name of research centre.*	*Number at the beginning of the year.*	*Added during the year.*	*Closed during the year.*	*Number at the close of the year.*
(1)	(2)	(3)	(4)	(5)	(6)
Nilambur	Nilambur	2	11	..	13
	Topslip	57	28	1	84
	Dhoni ..	59	2	18	43
Wynaad ..	Begur	40	17	7	50
	Chandanathode ..	32	4	..	36
	Kannoth	56	4	..	60
Denkanikota	Denkanikota ..	46	1	..	47
Directly under State Silviculturist	Ootacamund ..	16	10	..	26
	Vemburili	..	9	..	9
	Markanum	..	46	..	46
	Rameswaram ..	..	33	..	33
	Total ..	308	165	26	447

TABLE IV.—*Abstract of E. P. files and E. G. files at the Commencement and close of the year.*

Description of files.	*At the beginning of the year.*	*Added during the year.*	*Closed during the year.*	*Number at the close of the year.*
Experimental plot files ..	273	9	24	258
Experimental Garden files ..	308	165	26	447

5. *Computation and analysis of annual measurements.*—Attention is invited to paragraph 5 of the Annual Report on Silvicultural Research for 1954–55.

At the close of the year, as noted in paragraph 4 above, there were as many as 258 Experimental Plot files and 447 Experimental Garden files or a total of 705 files in all.

The Special Duty Forester, who has deputed to the office of the State Silviculturist by the Chief Conservator of Forests in his No. 2473/54-D 3, dated 26th November 1954, continued to work on the computations of the annual measurements throughout the year.

Owing to pressure of work in other directions and shortage of technical staff, particularly the absence of an Assistant Silviculturist for more than six months during the year, the computation and analysis of the annual measurements, which was very much in arrears could not be brought quite up to date. The computation of the figures involves considerably 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.

The work of bringing the analysis of the measurement is in progress and this will be completed by the close of the next year.

6. *Sample plots.*—There were 188 sample plots under the control of the State Silviculturist at the beginning of the year. During the year, no sample plots were opened afresh. One sample plot in Coimbatore North Division and three Sample plots in Nilambur Division were felled during the year. Hence the number of Sample Plots at the close of the year was 184 as per statement below. Please see Appendix B for detailed List of sample plots.

TABLE V—*Statement of sample plots by species.*

Serial number and division.	*Species.*	*Number of Sample Plots.*
1 Palghat	*Pterocarpu marsupium*	1
2 Do.	*Swiet nia l n nt ni macrophylla* ..	2
3 Do.	*Tecton grandis*	1
4 Do.	*Terminali cre ulata*	1
5 Nilgiris	*Acacia decurrens*	1
6 Do.	*Acacia mollissima*	2
7 Do.	*Eucalptyptus acmenoides*	1
8 Do.	*Eucalyptus euginoides*	1
9 Do.	*Eucal ptus Pen c lat*	1
10 Do.	*Eucalyptus pilluluris*	1
11 Do.	*Eucalyptus propinque*	1
12 Coimbatore South ..	*Tectona grandis*	24
13 Nilambur	*Lagerstreemis flos reginae*	1
14 Do.	*Lagerstr emi lanceolata*	1
15 Do.	Peric psis moonians	1
16 Do.	*Swietenia macrophylla*	1
17 Do.	*Teetona grandis*	1
18 Do.	*Xylia xyloocarpa*	80
19 Wynaad	*Ailanthus malabarica*	1
20 Do.	*Chlorophora excelsa*	1
21 Do.	*Hope i parviflora*	1
22 Do.	*Lagerstreemia flos reginase*	1
23 Do.	*Pterocarpus dalbergicides*	1
24 Do.	*Pterocarpus marcunium*	
25 Do.	*Sterculia companulata*	2
26 Do.	*Swietenia macrophylla*	1
27 Do.	*Tectona grandis*	42
28 Do.	*Terminallis crenulate*	1
29 Do.	*Vitex peduncularis*	1
30 South Kanara	*Hopes parviflora*	3
31 Coimbatore North ..	*Tectona grandis*	2
	Total ..	184

NOTE.—Total—191 sample plots noted as closing balance in paragraph 6 of the Annual Report on Silvicultural Research for 1954–55 is an error for 188. The No. "86" against item (17) was an error for "83".

7. *Tree increment plots and permanent preservation plots.*—Appendix B furnishes a list of all Tree increment Plots and Permanent Preservation Plots in the Madras State. These are maintained during the year.

8. *Library.*—The Library in the office of the State Silviculturist was maintained. As the library served the needs of the Composite State of Madras prior to partition in October 1953 into separate States of Madras and Andhra, such books in which more than one copy was available, was ordered to be transferred to the Silviculturist, Andhra State, by the Chief Conservator of Forests, Madras. A list of 104 volumes available for transfer has been prepared and the books will be transferred in the coming year.

During the year 16 volumes at a total cost of Rs. 260-0-6 were added to the Library. These are in addition to 43 volumes which were publications of the Forest Research Institute, Dehra Dun, and the Madras Government chiefly dealing with—

Administration Reports ;

Silvicultural Notes of Forests Research Institute ;

Working Plans of Divisions.

The total number of volumes and reports in the Library at the beginning of the year and at the close of the year are furnished below —

Volumes at the beginning of the year	.. ..	1,489
Additions during the year	.. .. .	59
	Total ..	1,548

9. *Documentation.*—The Ledger files of the office of the 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 three additions to the General Ledger files and three 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 Howard's "A System of Filing Information on Forestry".

At the end of the year there were 842 Specific Ledger Files and 551 General Ledger files as shown below :—

TABLE VI – *Abstract of Ledger Files.*

Name of file.	*At the beginning of the year.*	*Added during the year.*	*At the end of the year.*
Specific Ledger files	839	3	842
General Ledger files	548	3	551

In addition 52 entries were made in the existing Specific Ledger files and 47 entries in the existing General Ledger files, making a total of 99 additional entries during the year.

10. *Photographic collection.*—During the year, certain accessories for the camera were purchased at a total cost of Rs. 308–4–0.

During the year, additions were made to the specific photographs and general photographs as shown below :—

TABLE VII.—*Abstract of Photographic Collections.*

Particulars.	*Number at the beginning of the year.*	*Added during the year.*	*Number at the end of the year*
Specific photographs	943	25	968
General	860	..	860

11. *Administration.*—The post of State Silviculturist was held by Shri P. Venkataramany, I.F.S., throughout the year.

12. *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 VIII.—*Statement of staff under the State Silviculturist.*

Serial number and staff at the beginning of the year on 1st April 1955.	*Staff at the end of the year on 31st March 1956.*	*Reasons for change.*
1 Assistant Siviculturit 1 ..	Assistant Sivicultusist 1	Post vacant during the periods—23rd April to 8th July 1955 6th November 1955 to 31st March 1956.,
2 Research Rangers— 3 ..	Research Rangers 3 ..	
3 Research Foresters—13 ..	Research Foresters 12..	One post of Forester in Chandanathode Centre is temporarily vacant.
4 Forest Guards—3 ..	Forest Guards .. 3	..
5 Reserve Watchers—2 ..	Reserve Watchers 2	..
6 Malis—2	Malis 2	.. ..

Serial number and staff at the beginning of the year on 1st April 1955	*Staff at the end of the year on 31st March 1956.*	*Reasons for changes*
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—57	One peon's post intended for the Assistant Silviculturist has been kept vacant from 5th November 1955 as the post of Assistant Silviculturist is also vacant.

NOTE.—Due to the lack of the services of the Assistant Silviculturist for over six months, several items of works in the office and in the field fell into arrears.

Appendix H furnishes a statement showing the rank, designation and address of Forest Officers employed exclusively on research work in Madras State during the year 1955–56.

13. *Tours.*—The State Silviculturist toured for a total of 146 days during the year under report.

14. *Office Inspections.*—The following Research Range Officers, 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—16th and 17th January 1956.

(2) Research Range Office, Nilambur—29th and 30th December 1955.

(3) Research Range Office, Wynaad—9th and 10th November 1955.

(4) Research Forester's Accounts, Ootcamund—25th July 1955.

(5 Research Forester's Accounts, Markanam—19th to 24th November 1955.

(6) Research Forester's Accounts, Vemburili—26th November 1955.

(7) Research Forester's Accounts, Rameswaram—30th November 1955.

(8) Inspection of Lac Depot at Denkanikota—19th and 20th January 1956.

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

The office of the State Silviculturist was inspected by the Conservator of Forests, Development Circle, Madras, on 4th June 1955 and the general condition of the office was found to be satisfactory.

15. *Discipline.*—The discipline of the staff both Ministerial and Executive was quite satisfactory. There was no case of punishments of the subordinates during the year.

16. *Vanamahotsava.*—As usual seeds and seedlings were distributed from the nurseries from the various centres for the celebration of Vanamahotsava, during the year.

17. *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 prepared during the year:—

(1) A Note on Spike Disease in Sandal with suggestions for future research (offered for publication in the 'Indian Forester').

(2) The following articles were prepared for the Vanamahotsava Symposium held in Agra in January 1956 :—

(i) The Role of Forests in Water and Soil Conservation ;

(ii) the Role of Forest in Flood Control ;

(iii) the Significance of Vanamhotsava in Town-Planning ;

(iv) proper choice of species for Vanamahotsava ;

(v) vanamahotsava in the production of food, fuel and Fodder ; and

(vi) vanamahotsava for Forestry.

(3) Underplanting in Teak Plantations in Madras State—Article published in the 'Indian Forester'.

(4) Is there deterioration of site quality in Second Rotation Pure Teak Plantations—Article offered for publication in the 'Indian Forester'.

(5) Notes on various species were compiled during the year with the idea that these may be published together in book form for the general guidance of District Forest Officers and others.

(6) Notes on exotic trees introduced in the reserved forests of the Madras State.—This was prepared with reference to a *proforma* supplied by the IV British Commonwealth Conference. The information is intended for submission to the President, Forest Research Institute, Dehra Dun for submission to the VII British Commonwealth Conference.

18. *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.

19. New experimental works were undertaken as per approved Plan of Operations for the year, besides maintaining all open experiments of previous years. Experiments on *Teak* continued to occupy a dominant place in the work for the year. Among notable new experiments started during the year were those on the lopping of *Eucalyptus globulus*, more than once during the rotation for distillation of oil, the reduction of coppice shoots in Blue gum coppice crops, the injection of chemicals in the stem of Teak trees with a view to eradicate the attacks of Loranthus bushes on the crowns of the Teak trees, experimental introduction of Saffron (*Crocus kashmiriana*) in the Nilgiris, trials fo various exotic species of Eucalyptus in the Nilgiris, the trial of plant harmones, and the eradication of Lantana through spraying and dusting of 2-4 D, 2-4-5-T and other weedicides.

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

(a) *Natural regeneration by seed.*

20. *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, E.P. 22/54 was started. There are three treatments with three replications as follows :-

A—Control.

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

C—Passi ng a light uniform fire over the area.

Inspection during the year shows that treatment ' C ' " passing a light uniform fire over the area" significantly increases the quantity of natural regeneration on the ground. The experiment is under further observation.

21. *Artocarpus hirsuta—E.Ps.* 43/1937 *and* 46/1937 *of Chandanathode Wynaad.—Growth and Development.*—These E.Ps. were formed in 1937 out of old Gard n 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 ;

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

The above two experiments were closed during the year with the conclusion that this species cannot be grown successfully in areas susceptible to damage by bison and wild elephants, such as Chandanathode and Topslip. E.P. 41/1937 of Kannoth further confirms this conclusion as the failure of the species was mainly due to damage by game. In Nilambur, damage by wild elephants is not appreciable, but browsing by spotted Deer and Sambhur is appreciably great and hence this species cannot be raised successfully here without a game proof fence.

22. *Dysoxylum malabaricum.—E.P.* 23/1934, *Wynaad.*—E.P. 23 of Wynaad Division was started in 1934 to find out the best method of indu ing 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 inches to 6 inches ;

C—Control—No weeding or soil working.

In the report for 1953–54, the conclusion was already drawn that treatment ' B ' gave the best results. Latest measurements recorded in December 1954 confirmed the above conclusion, viz., that clearing the weed growth and raking the soil just before the seedfall is the best treatment to induce natural regeneration of the species. This experiment was closed during the year with the above conclusion.

23. *Mesua ferrea.—E.P.* 23/1934 *of Wynaad*—In the same experiment, therel are n w l 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.

The experiment has been under observation for a long time. The result has been the same every year. The conclusion can therefore be drawn that :

(i) clearing undergrowth and three weedings ;

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

Both induce significantly natural regeneration more than control where nothing was done. With this conclusion the experiment was closed during the year.

24. *Natural regeneration by seed.*—E.Ps. 54, 55, 56 of South Coimbatore Division were 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.

E.P. 54/1933 *Hopea parviflora* :—Treatment 'A' (weeding) gives significantly the largest number of seedlings above 9 inches in height. As a definite conclusion has been arrived at this plot will be closed during the coming year.

Experimental Plot 55/1933—*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 in earlier years treated plots had better stocking than control plots. From 1951 onwards there was no new recruitment of seedlings below 9 inches 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.

As these plots were kept open for over 20 years and no definite conclusions can be arrived at on account of monkey damage it is proposed to close this experiment during coming year.

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 overmature and no seedfall is reported from 1943 onwards. Out of 15 trees under observation 8 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 plot 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, i.e., 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 3 inches.

In treatment 'A', the number of unestablished regenerations is nearly eight times that of established regeneration. In treatment 'B' the proportion was $4\frac{1}{2}$ times and in treatment 'C' there were only six established and 23 unestablished plants.

It may therefore be concluded that clearfelling after obtaining natural regeneration significantly promotes height increment. As all plants have reached the sapling stage, 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 *Palaquium ellipticum*. Hence this conclusion may be taken as confirmed.

26. *Hopea parviflora—Canopy manipulation to regulate development of established seedlings.*—Experimental plots 75 and 76 of South Coimbatore were started in 1937 to observe development of established natural regeneration of *Hopea parviflora* 3 feet to 8 feet in height asfollows :—

Experimental plot 75—under evergreen top canopy shade ;

Experimental plot 76—after clearfelling the overwood.

Latest measurements indicate that the number of survivals and mean height are distinctly greater in the clearfelled plot. The indications are, that at the stage when the regeneration is established clearfelling the overwood benifits the natural regeneration appreciably.

27. *Mesua ferrea—Effect of tending natural regeneration—Experimental plots 3, 4, 5, 6 of 1932, Chandanathode.*—These were started in 1932 to study the effect of tending natural regeneration of *Mesua ferrea* seedlings and sapling stages by reducing competition by other species in the under wood. 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 5 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 benificial for the establishment of natural regeneration.

These experiments were closed during the year with the conclusion that tending of natural regeneration in the seedling and sapling stages is distinctly beneficial for the establishment of natural regeneration of *Mesua ferrea*.

28. *Palaquium 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 *Palaquium 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 *Palaquium ellipticum* is significantly beneficial to the establishment of the species and promoted rapid height growth. A similar conclusion has already been drawn in experimental plot 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. The plot files will be summarized and closed during the year.

29. *Teak—Natural regeneration by seed—Experimental grounds* 447 *and* 448 *of Wynad.*—These 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 the 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.

30. *Teak—Natural Regeneration by seed—Experimental grounds* 468, 469 *of Wynaad.*—The above experiment was repeated during the year 1955 in experimental grounds 468, 469 formed in the 1901 and 1902 Teak Plantations respectively in Begur. The observations are furnished below :—

Table IX. Teak Natural Regeneration by seed.

	E.G. No.	A.	B.	C.	D.
1 Maximum number of natural regeneration that appeared in the sub-plots.	468/55	2	228	6	152
2 Do.	469.55	6	146	5	185
3 Survivals in March 1956 ..	468/55	..	..	..	..
4 Do. ..	469/55	..	..	..	..

The above results confirm the indication of last year that burning induces and accelerated natural regeneration. The seedlings that appeared all died subsequently due to the stems being covered with earth due to drips during the rains. Hence establishment of teak advance growth may not be possible in a teak plantation with a complete canopy owing to drip from the canopy.

(*b*) *Natural Regeneration by Coppice.*

31. *Teak coppice—Mortality of stools.—Experimental plot* 162 of 1937 *of Palghat Division*—has been maintained. The object is to study the effect of coppicing at 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 30·07 acres to 16·07 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.

32. *Teak Coppice—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 shoot : 21 shoots : 4 shoots and control. But we are interested in total volume production per acre and the size of the individual coppice shoots. We will have to wait till the rotation to ascertain which treaotment gives the maximum volume production.

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

33. *Supplies of seeds, seedlings and stumps.*—As usual, the State Silviculturist was incharge of supplies of seeds, dseedlings 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, arragements were made for the supply of 175 indents comprising 60 species and an aggregate quantity of 17,722 lb. of seeds. The corresponding figures for the previous year were 213 indents comprising 35 species with an aggregate quantity of 20,485 lb.

A large proportion of the seeds supplied was collected by the research staff in addition to their other duties. Seeds of Madras origin are particularly popular with various officers of other States in India, particularly seeds of *Tectona grandis, Eucalyptus globulus, Acacai mollissima, A. decurrens Anacardium occidentale, Dalbergia latifolia, Swietnia mahoganii, S. macrophylla.*

The gross revenue realized by seeds supplied during the year was Rs. 3,882-11-6 against Rs. 7,324-11-5 during the previous year.

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 statementi n Appendix 'C'.

TABLE IX-A.—*Results of germination tests in* 1955–56.

Species.	*Number of seeds* PER OZ.	*Number of seeds* PER LB.	*Germinative capacity.*	*Plant per cent.*	*Plants per lb.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Acacia farnosiana	290	4,640	22	7	305	Soaking in boilinig water good.
Albizzia stipulata (Bombay).	532	8,512	25	19	1,693	Do.
A. stipulata (Orissa).	422	6,752	44	39	2,655	No treatment good.
Cassia javanica.	182	2,912	12.5	12.5	364	Soaking in cold water good.
Pueraria phaseoloides.	1,508	24,128	18	18	4,343	All four treatments good.
P. thumbergiana.	2,012	32,192	27	25	8,048	Soaking in hot water good.
P. javanica ..	1,025	16,400	37	36	5,904	No treatment good
Termainalia catappa.	5	80	25	25	20	Soaking in hot water good.
T. chebula ..	28	448	17	17	76	Do.
Eaucalyptus grandis.	3,00,960	48,15,360	10	8.3	3,996,748	....
E. marginata ..	12,760	204,160	0.6	0.2	41	....
Termaninalia myriocarpa. (Begur).	1,106	17,700	6.2	4.9	867	....
Do. (Kannoth).	..	..	12.6	4.0	708	
Do. (Chandanathode).	..	..	2.8	..	..	....
Bombax malabaricum (Calcutta), (Begur).	878	14,048	6.4	6	843	...
Do. (Bangalore), (Begur).	..	..	61.6	59.6	..	....

During the year 12,831 lb. of teak seeds and 68,300 teak stumps were sypplied to indentors in and outside Madras State. The corresponding figures for the previous year were 9,935 lb. of teak seeds and 102,950 teak stumps. This is particularly brought to notice as teak seeds of Madras origin are deservedly held in high regard by everyone in India and abroad.

A considerable variety of seeds of exotic species were received for trials in this Division. A list of these seeds is furnished in Appendix D and results of trials of these species are furnished in the body of the report under appropriate headings.

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

The results of germination tests carried out during the year 1955–56 are furnished below for ready reference. These are also included in the alphabetical order in the table in Appendix E.

35. *Aids to germination : pre-treatment of seed—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. The *germinative capacity* of the seed of the following species was not apparently improved by any of the treatments used :—

Acacia auriculiformis.	*Eugenia arnottiana.*
A. cyclopis.	*Givotia rottleriformis.*
A. feruganae.	*Grewia tilioefolia.*
A. leucophloea.	*Holoptelia integrifolia.*
A. melanoxylon.	*Leucaena glauca.*
A. planifrons.	*Markhamia platycalyx.*
A. saligna.	*Poinciana.elata.*
A. sundra.	*Premna tomentosa.*
Acrocarpus fraxinifolius.	*Prosopis juliflora.*
Albizzia amara.	*P. specijera.*
A. lebbek.	*Zizypus glabrata.*
Bauhinia racemosa.	*Z. incurva.*
Bischofia javanica.	*Z. jujuba.*
Commiphora caudata.	*Z. xylopyrus.*

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

Anarcardium occidentale.	*Hakea saligna.*
Azadirachta indica.	*Ligustraum neligherrense.*
Berberis tinctoria.	*Litsea zeylanica.*
Cassia siamea.	*Mahonia leschenaultii.*
Chorisia speciosa.	*Meliosma wightii.*
Cupressus torulosa.	*Michelia nilagirica.*
Dendrocalamus strictus.	*Quercus inicana.*
Eloeocarpus oblongus.	*Sapindus emarginatus.*
neilgherrense.	*Tamarindus indica.*

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

Alangium lamarckii.	*Ochroma lagopus.*
Ailanthes excelsa.	*Pinus longifolia.*
Bombax malabaricum.	*P. insignis.*
Cassia marginata.	*Pongamia glabra.*
Chickrassia tabularis.	*Soymida febrifuga.*
Harrisonia benetti.	*Thyrostachys oliveri.*
Magnifera indica.	*Pterocarpus santalinus.*

when sown without removing the seed coat.

39. 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 decurrens.*
A. cyanophylla.	*A. mollissima.*
A. dealbata.	*Myrsine wightiana.*

40. Treatment with boiling water as descripbed in the revious paragraph appears to decrease appreciably the germination of—

Adenanthera pavoniana.	*Erythroxylon monogynum.*
Alangium lamarckii.	*Evodia roxburghiana.*
Azadirechta indica.	*Feronia elephantum.*
Balanocarpus utilis.	*Gluta travancorica.*
Bauhinuia purpurea.	*Gmelina arborea.*
Bombax malabaricum.	*Juniperus procera.*
Calophyllm elatum.	*Lagerstroemia flosreginae.*
Canthium didymum.	*L. laneolata.*
Cassia auriculata.	*Ligustrum neilgherrense.*
C. fistula.	*Litsea zeylanica.*
C. marginata.	*Mahonia leschenualitii.*
C. siamea.	*Mangifera indica.*
Chickrassia tabularis.	*Neolitsea zeylanica.*
Chlorophora excelsa.	*Palaquium ellipticum.*
Chlorxylon swietenia.	*Pinus insignis.*
Dalbergia latifolia.	*Pithecolobium dulce.*
D. sissoides.	*Pterocarpus dalbergioides.*
Dendrocalamus strictus.	*P. marsupium.*
Dolichandrone crispa.	*Schleichera trijuga.*
D. falcata.	*Sterculia urens.*

Strychnos nux vomica.
S. potatorum.
Tectona grandis.
Terminalia chebula.
T. crenulata.
T. paniculata.
Thyrostachys oliveri.
Vateria indiac.
Vitex altissima.
V. littoralis.
V. peduncularis.

41. The results of pre-treatment tests are summarised in Appendix F. Generaly 100 seeds were used for each treatment in each test. The results of the tests in previous years are also included.

42. *Seed pre-treatment—Obdudate species.*—The following specie which usually give a very lower 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*) scorching over a fire;

(*e*) soaking in concentrated sulphuric acid;

(*f*) exposing to Sun and watering on allternate dates.

43. Results idoluding those of previous years are seen in the tabl› below :—

Table X —*Percentage of germination of seeds of obdudate species.*

Species.	*Number of tests.*	*Percentage of germination of seeds treated with*						
		Control,	*Lime water,*	*Fermenting,*	*Scorching,*	*Sul pluric acid,*	*Weathering,*	*Other remarks.*
Acacia arabica ..	1	12·6	X	13·4	X	21·5	X	Seed passed through goats gave 21·9 per cent.
A. auriculifermis.	21	9	X	9	X	6	9	
A. leucophloea ..	43	13	X	13	X	11	8	
Alangiumlamarckii.	1	2	X	3	X	3	6	
Acrocarpus fraxinifolius.	30	9	6	13	4	X	6½	
Calophyllum elatum.	3	9	X	X	X	2	X	
Canthium didymum.	2	0·3	X	0·4	X	1·2	0·3	
Cassia auriculata ..	10	7	X	8	X	25	7	
C. fistula	43	12	9	10	0	28	8	
C. marginate	12	20	13	9	0	35	1	
Erthoxylon monogynum.	13	6	X	2	X	7	6	
Givotia rottleriformis.	9	3	8	3	X	0·2	0·3	
Pterocarpus santalinus.	43	24	X	21	2	10	13	
Terminalia chebula ..	43	19	9	29	16	9	16	
Trema orientalis ..	24	13	X	X	6	X	X	

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

45. *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 test is very hard and without pre-treatment the seeds give a low ermination 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 d:um; 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 twelve hours. Finally the seeds are washed four or five 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 anda 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) *Albizzia 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 bird 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 to 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) *Cassia fistula.*—Soaking in concentrated sulphuric acid increases germinative capacity.

(vii) *Chrysanthemum cinerarialfolium* (*Pyrethrum*).—Seeds are soaked in cold 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 3 to 4 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, after collection, are pounded in a wooden mortar 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 inches—4 inches layer of earth and watered liberrally.

(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 sowing in the open or in nursery beds.

(iv) Nursery Work.

46. Nurseries were maintained in all the Research Centres, viz., Begur, Chandanattode, Kannotte, Nilambur, Dhoni, Topslip, Denkanikota, Ootacamund, Rameshwaram, Vemburili and Markanum. Seedlings raised were generally used for experimental purposes. During the year, a new nursery was opened in the Padugai land, below the Vennar Vettar Regulator in the Tanjore District for supplying teak stumps during the next year for atrificial regeneration operations in the Tanjore district.

(v) Artificial Regeneration.

47. 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 *Evoda roxburghiana, Melia dubia, Spondias mangifera, Sterculia alata, Sterculia campanulata, 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.*

48. *Teak—All India teak seed origin experiments.—S. Ps. 96 to 119 of Nilambur and S. Ps. 2 to 17 of South Coimbatore.*—Experiments started in Nilambur (S.P. Nos. 96 to 119 of Aravallikava) and in South Coimbatore (S.P. Nos. 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) Anamalis,
(5) South Bombay,
(6) Nilambur.

and there are four S.Ps. 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 S.Ps. 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 :-

	C.FT.
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 : —

	C.FT.
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 origin in the last place. The indications afforded by these two sets of sample plots are herefore controdictory for the present and hence further observations are necessary before we can draw any definite conclusions.

The sample plots numbers 96 to 119 at Nilambur and numbers 2 to 17 in South Coimbatore were thinned during 1955–56 and measurements were taken. The measurements have been sent to the Central Silviculturist for computation. An analysis of the measurements will be furnished in the coming year.

49. *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 the Nilgiris. 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, Niligiris 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.

50. *Introduction of teak in Rameshwaram Island*—One hundred and twenty six teak stumps were planted on 3rd June 1955 in crow bar holes at an espacement of $8\frac{1}{2}' \times 8\frac{1}{2}'$. They were watered as follows:–

One gallon per plant per day for the first seven days; thereafter once in two days for the next 10 watering days; thereafter watering once a week till the break of the North East Monsoon.

The sprouting was good; but due to heavy scroching winds, survivals were only 25 per cent and the average height growth was only 5 inches. The experiment will be repeated next year with wind protection for the plants.

50-A. *Introduction of teak in Markanum.*—During the year, teak was introduced in Markanum through planting teak stumps obtained from Nilambur in the months of June, July 1955. In one case (E.G. 14/55) the stumps were watered for 15 days with 1/3 pot of water equivalent to one gallon of water. In the other case (E.G. 15/55) the plants were watered with one gallon of water

for 15 days; thereafter they were watered with one gallon of water on alternate days if there was no rain. In March 1956, the survivals and height growth were as below:—

TABLE X-A.—*Growth of teak in Markanum.*

Experimental Ground. Number.	*Date of planting.*	*Survival*	*Mean height.*	*Remarks.*
		PER CENT.	INCHES.	
14/55 ..	3rd June 1955 ..	133/500	5	Watered for 15 days only. Height 3—10
15/55 ..	10th July 1955 ..	403/500	12	Watered for as Casuarina. Height 5—21 inches.

In general, the indications are that teak can be introduced; but the growth is slow and watering of the plants is required on the same lines as for Casuarina.

51. *Teak—Experiments on espacement,*—Experimental plot 149/38 is an espacement experiment in first quality second rotation teak area to campare $6' \times 6'$ 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 150/38 of Nilambur is a repetition of the above experiment in second quality teak area. Here also the wider espacement gave better mean height but the increment in height was not significant.

Experimental plots 159/40 and 160/40 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 A.I.Q. II and A.I.Q. III) second rotation teak plantation. Here also the wider espacemeht gives significantly better mean height growth in both the plots. The measurements are furnished below for reference :-

TABLE XI.—*Measurement of mean height growth of teak with two of espacements* $6' \times 6'$ *and* $8\frac{1}{2}' \times 8\frac{1}{2}'$ *in experimental plote number* 159/40 *in I quality teak plantation.*

Year	*Mean height of teak* $6' \times 6'$	*Mean height of teak* $8\frac{1}{2}' \times 8\frac{1}{2}'$	*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.
1955 ..	44·9	47·7	Not significant.

TABLE XII.—*Measurements of mean height growth of teak with two espacements of 6′ x 6′ and 8½′ x 8½′ in experimental plot number 160/40 in II quality teak plantation.*

Year.	Mean height of teak in feet.		Remarks.
	6′ x 8′.	8½′ x 8½′.	
(1)	(2)	(3)	(4)
1942	8·3	9·9	
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.
1955	44·0	46·4	Not significant.

The general conclusions are identical for both Experimental plots Nos. 159/40 and 160/40, indicating that the results can be applied to both first and second quality teak plantations of the second rotation. These are—

(i) Judged by mean height growth $8\frac{1}{2}' \times 8\frac{1}{2}'$ espacement is significantly better than $6' \times 6'$ espacement from the sixth year right up to the fifteenth year. In the sixteenth year, though the wider espacement gives better hight growth, the difference is not significant. There is therefore justification for the suspicion that with the lapse of years, the difference will disappear altogether.

(ii) In Nilambur Division, weedings in teak plantations are carried out only up to the third year. In Experimental plot No. 159/40 the cost up to third year was Rs. 23–7–3 for $6' \times 6'$ espacement and Rs. 18–5–6 for $8\frac{1}{2}' \times 8\frac{1}{2}'$ espacement. The corresponding figures of costs for Experimental plot No. 160/40 were Rs. 23–14–0 for $6' \times 6'$ espacement and Rs. 18–10–0 for $8\frac{1}{2}' \times 8\frac{1}{2}'$ espacement. Hence the cost of artificial regeneration is about $2\frac{1}{2}$ per cent less with the wider espacement of $8\frac{1}{2}' \times 8\frac{1}{2}'$. This dispels the traditional fear that the eider espacement will induce a more rapid and thicker growth of weeds and climbers which will involve increased cost of weeding and tending.

Apart from cutting down nursery and planting costs, as only half the original number of stumps are now required per acre of planting, the under espacement allows for a longer period of Ponam cultivation, resulting in better aeration of the soil, greater control over weeds and consequently an accelerated start for the young teak. There is more over the added advantage of the complete elimination of the first mechanical thinning - an essential operation in teak plantations with $6' \times 6'$ espacement.

52. *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 fo any particular size of teak.

Experimental plots Nos. 55/1938 of Begur and Experimental plots Nos. 166/1938 of Plaghat were formed with the above object of comparing the growth of trees raised from seeds of 4 different sizes as shown below:—

A—District sample seed containing all sizes mixed together ;

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

C—Medium seed, 0·3″ to 05″ in diameter ;

D—Small seed, below 0·3″ in diameter.

Height measurement in 1946 showed 26′ 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 signifiance 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).

53. *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 paragrap 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 gereral, seed from over-mature and under-mature 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 three centres, the species being raised by stump planting. Mesurements were last taken in 1955 and the following shows the analysis of the data collected up to-date. 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—E.P. 36/37—*Dalbergia latifolia.*—No significant difference in height or survival per cent.

Coimbatore South—E P. 78/38—*Dalbergia latifolia*—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—E P. 79/38—*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.

A similar conclusion that the difference in age, size, or condition of seed bearer does not cause any difference in the height growth of the progeny during seven or eight years was reached in closed E.P. No. 158/36 of Plaghat (now converted into S.P. 5), in respect of *Terminalia crenulata.*

Palghat E.P. No. 157/37.—*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.

54. *Teak.—Comparison of trees raised from plantation seed with those raised from seeds from natural forests.*—E.Ps. Nos. 66/40, 79/41, 85/42 of Wynaad (Begur Centre), E.P. 83/40 of Coimbatore South and 171/40 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 E.P. 85/42 of Wynaad where plantation seed gave better mean height growth). It is not however known whether any desirable or undiserable 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.

55. *Splitting of teak stumps—E.G.* 334/49 *of Begur and E.G.* 384/49 *of Topslip.*—These are comparison experiments to study the effect of planting of entire teak stumps, halved stumps and quartered stumps on the growth and development of plants raised from the stumps.

Latest measurements are furnished below :—

TABLE XIII.—*Abstract of measurements in E.G.* 334/49, *Begur and* 384/49, *Topslip.*

	Begur E.G. 334/49.		*Topslip E. G.* 384/49.	
	Survival per cent.	*Height growth.*	*Survival per cent.*	*Height growth.*
A Entire stumps	82·3	15·3	70	22·6
B Halved stumps	82·0	14·8	40	20·1
C Quartered stumps	44·0	14 6	23·3	25·6
D Two quartered stumps	34·0	13·5	..	..

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' and '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 loss similar results were obtained in E.G. 234/50 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 stumps 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 result was obtained by the Central Silviculturist (vide Experiment 26-A of 1950—reported in " Forest Research in India—1950–51 ").

56. *Teak— Comparison of Good and Malformed stumps.—E.G.* 335/49, *Begur and closed E.G.* 359/49, *Dhoni.*—These experiments were started in 1949 to compare the growth of trees raised from good stumps with those from malformed stumps. Latest measurements are as follows :—

TABLE XIV.—*Abstract of E.G.* 335/49, *Begur and closed E.G.* 359/49, *Dhoni.*

	E. G. 335/49, *Begur.*		*E. G.* 359/49, *Dhoni.*	
	Survival per cent.	*Mean height.*	*Survival per cent.*	*Mean height.*
Good stumps	74	13·7′	63·3	16·0
Malformed stumps	78	16·0′	50·0	16·4

There is no significant difference in the mean height or survival per cent of plants obtained from good and malformed stumps. Therefore malformed teak stumps can be used as freely as stumps of good form in the artificial regeneration of teak.

57. *Teak—Preparation of Stumps in Nursery.—Stumping teak* in nursery bed and pulling out the plants from nursery bed after a week or ten days *versus* District Practice—

E.Gs. 375/51, 396/52 *of Begur*, 265/51, 274/52 *and* 288/53 *of Kannoth, and E.G.* 399/51 *of Dhoni.*—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.

58. *Teak—Cutting one year old plantation—E.P.* 174/1953 *of Nilambur.*—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 plants had 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 the significance disappears in the fourth year (1956) when measurements showed a mean height of 21·9 inches in the treated plot and of 19·4 inches in the control plot. Further observations have to be continued. If however, a one-year old teak plantation happens to be accidentally burnt, one need not be sorry and the charred and damaged plants can be cut back.

Reference is invited to paragraph V, sub-paragraph 9 of Appendix 'F' of the Annual Report on Silvicultural Research in Madras State for 1954–55 wherein an experiment on the cutting back of teak stems in a four year old teak plantation in the Kuttalam Beat in Tirunelveli Division is described. In this experiment it was found that the coppice shoots arising from the cut from four year old plants were definitely inferior to the uncut plants.

59. *Teak—Manurial experiments—E.P.* 173/1953 *of Nilambur.*—E.P. 173/1953 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—12 inches round each plant during the third week of April when the teak plants were one year old. The 1956 measurement shows that the application of 2¾ oz. of Superphosphate is distinctly beneficial in the case of Panangode Bit I and application of 4 oz. of Superphosphate is beneficial in the case of Walluvaseri Bits, II and III. The measurements of 1954 had shown that the application of 4 oz. of manure was distinctly beneficial in both the plots. The experiment however is vitiated by the fact that the manured plants had a soil working along with the application of the manure while the control plots did not have the benefit of the soil working. There was also no initial comparability in the mean heights of the plants in the sub-plots allotted to the different treatments.

The following tables compare the increase in height growth between the measurements taken on 1st May 1953 and those taken on 12th March 1954 and in march 1956 in the Panangode and Walluvaseri 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 mean heights of the plants in the sub-plots allotted to different treatments.

TABLE XV.—*Panangode E.P.* 173/1953.

	A Control.	*B* 2¾ oz. of Superphosphate.	*C* 4 oz. of Superphosphate.	*D* 5½ oz. of Superphosphate.
1 Initial measurements in May 1953	16·38″	16·65″	18·56″	15·25″
2 Measurements of March 1954.	56·8″	62·3″	65·9″	56·3″
Measurements of March 1955.	13·2″	14·6′	14·9′	12·5′
3 Measurements of March 1956.	21·6′	25·4′	23·8′	21·0′
4 Difference between 1954 and 1953	40·42″	45·65″	47·34″	41·05″
5 Difference between 1956 and 1953	20·2′	24·0′	22·3′	19·7′

TABLE XVI.—*Walluvaseri* E.P. 173/1953

1 Initial measurements in May 1953	18·49″	14·5″	13·27″	21·26″
2 Measurements of March 1954.	43·75″	41·0″	41·5′	39·0″
Measurements of March 1955.	8·0′	7·6′	8·3′	7·2′
3 Measurements of March 1956.	15·1′	15·7′	16·5′	14·5′
4 Difference between 1954 and 1953	25·26″	26·5′	41·5″	39·0″
5 Difference between 1956 and 1953	13·6′	14·5′	15·4′	13·5′

Combining the results of both the plots for measurements of both 1954 and 1956, it is seen that the application of manure does have a beneficial effect on height growth and that the optimum dosage appears to be between 2¾ oz. and 4 oz. per plant.

60. *Teak—Manurial Experiments—E.Ps.* 173/53 *and* 175/53.—*Cost of application of manure.*—. The cost of application of manure at 4 oz. per plant at an espacement of 8½′×8½′ comes to 150 lb. per acre, or Rs. 18 ; labour charges for working the soil to a radius of 1½ feet to 2 feet and to a depth of 9″ and mixing the manure will be about Rs. 8. The total cost will therefore be Rs. 18 plus 8×Rs. 26 per acre.

For raising teak plantation under Kumri method in Nilambur Division three departmental weedings will be done after the Kumridar harvest the crop in October, in the first year and again three weedings in the second year. One tending is done in the third year also. The total cost per acre will be Rs. 13–8–0 plus Rs. 10–8–0 plus Rs. 4–2–0= Rs. 28–2–0 per acre. It is believed that the use of fertilisers will result in savings under weeding. This will have to be examined by further replications of this experiment. Owing to heavy monsoon rains of nearly 110 inches in Nilambur it is possible that a part of the manure applied may be leached away during rains as the manure was applied in this experiment in the top soil. This experiment is being repeated in 1956–57 by mixing the manure in soil at a depth of 9 inches and covering the top 3 inches of the ground with soil without manure. Another way of putting the manure mixed with soil, in a lump in the crowbar hole prior to planting of teak stumps is also being tried in 1956–57. In this method of application of manure, there is no expenditure at all as it is only necessary that the crowbar holes should be slightly deeper than is necessary to take the teak stump. In the Wynaad teak plantations, weeding is done once in January, after Kumridar harvests the crop at a cost of Rs. 7–8–0 in the first year. In the second year three weedings are done costing Rs. 5 plus Rs. 3–12–0 plus Rs. 2–8–0. In the third year, two weedings are done at a cost of Rs. 5 plus Rs. 2–8–0. Total cost of three years weedings comes to Rs. 26–4–0 as against Rs. 28–2–0 per acre in Nilambur. The question to be considered is therefore whether the increased height growth resulting from the application of manure will be counter-balanced by the savings in weeding cost, during the first three years.

61. *Teak—Manurial experiments—E.P.* 175/1953 *of Nilambur.*—This manuring experiment was formed on 13th September 1953 in two 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 when the plants were six months old.

C—3 oz. Do. Do.

D—4 oz Do. Do.

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″ C—11·8″
B—12·09″ D—11·9″

As there was no initial comparability between the sub-plots allotted to the four treatments, the measurements of 1954 and 1956 were analysed taking into account only the differences in height during the intervals between 21st October 1953 and 19th February 1954 and between 21st October 1953 and March 1956. The analysis is as shown below:—

TABLE XVII.—*Manurial experiment—E.P. No.* 175/1953, *Nilambur.*

	A Con'rol.	*B* 2 oz. of Superphos-phate.	*C* 3 oz. of Superphos-phate.	*D* 4 oz. of Superphos-phate.
1 Initial measurements on 21st October 1953	13·05″	12·09″	11·8′	11·09″
2 Measurements on 19th February 1954	15·8″	15·6″	17·7″	17·5″
Measurements on 20th March 1955	17·8″	8·9″	11·1′	10·7′
3 Measurements of March 1956.	16·3′	14·6′	18·6′	18·4′
4 Difference between 1954 and 1953	2·75″	3·51″	5·9″	6·41″
5 Difference between 1956 and 1953 measurements ..	15·2′	13·7′	17·6′	17·5′

It is therfore seen that the application of manure has a beneficial effect on height growth and that 3 to 4 oz. of manure per plant gives the maximum height growth.

62. *Teak—Manurial experiments—E.P. No.* 193/54 *of Nilambur.*—This experiment was started in a six months old teak plantation of 1954 in Nilambur. There were four treatments as below :—

A—2 oz. of Superphosphate.
B—2 oz. of N.P.K. fertilizer mixture.
C—1 oz. of Superphosphate and 1 oz. of N.P.K. fertilizer.
D—Control.

It will be noted that the quantity of fertilizer applied is the same in treatments 'A', 'B', 'C' above ; but only the composition varies. The measurements of 1956 are analysed below :—

TABLE XVIII.—*E.P.No.* 193/54, *Nilambur—Teak—Manurial Experiment.*

	A 2 oz. of super.	*B* 2 oz. of N.P.K.	*C* 1 oz. of super plus 1. oz. of N.P.K.	*D* control.
	IN FEET.	IN FEET.	IN FEET.	IN FEET.
1 Height measurements in 1954.	5·1	4·9	5·0	4·4
2 Height measurements in 1956	18·3	17·9	18·7	16·2
3 Increase in height	13·2	13·0	13·7	11·8

The results indicate that there is no difference in height growth due to different composition of the fertilizer mixture but that application of manure does give increased height growth.

63. *Teak Manurial experiment—E.P. No. 194/55 of Nilambur.*—The experiment in E.P. No. 193/54 was repeated during 1955 in the 1955 Teak Plantation. Initial comparability between the different treatments was secured by planting stumps of a uniform collar diameter of 0·8 inches. Manure was applied after soil working to a depth of 9 inches, manure was mixed 6 inches below ground level and the top 6 inches was covered with soil only. This method of application was devised in order to ensure that there is no surface wash of the manure during heavy rains. The control plot was also given a similar soil working. Manure was applied in November 1955 when the plants were about one foot in height. Measurements in April 1956 are furnished below:—

TABLE XIX.—*Teak Manurial experiment—E.P. No. 194/1955, Nilambur.*

Treatment.	*Number put in.*	*Number of survivals.*	*Mean height in inches.*
A—2 oz. of N.P.K.	125	99	16·2
B—3 oz. of N.P.K.	125	104	16·8
C—4 oz. of N.P.K.	125	103	20·3.
D—Control	125	97	17 3

Although treatment 'C', with 4 oz. of N.P.K. mixture has given the best height growth, the results cannot be relied upon as Control without manure has given better mean height than treatments 'A' and 'B'.

64. *Teak—Manurial experiments—General discussion.*—From the exper iments in E.P. Nos. 173/53, 175/53, 193/54 and 194/55, it is possible to deduce some general conclusions. Application of 2 oz. to 4 oz. of manure does have a beneficial effect and gives increased height growth as already indicated in last year's report. The composition of the manure seems of little account as both Superphosphate and N.P.K. mixture have given equally beneficial results.

But the increase in height growth obtained by application of manure is only a few feet. With this limited increase in height growth, it is doubtful whether any saving can be effected in weeding costs as furnished in paragraph 60 above. On the other hand, the indication appears to be that manuring at a cost of Rs. 26 per acre will not be justified when the weeding and tending costs for three years up to establishment is only about Rs. 26 to Rs. 28 in the Wynaad and Nilambur Forest Divisions.

However, observations in the above experiments will be continued.

65. *Teak—Plantation raised with Kumri—E.Ps. Nos.* 176, 177, 3, 179 *of Palghat.*—At the present time, teak plantations are sed in conjunction with Kumri (i.e., Taungya) in the majority the teak planting areas. It was therefore considered necessary start experiments to find out which Kumri crop did the least rm to the growth of the teak. Accordingly Experimental Plot os. 176, 177, 178, 179 of Palghat were started in the years 1943 1945 to determine the best field crop for raising teak under mri. In each of the experiments there were seven treatments, mely, six kumri crops and one control without a kumri crop. ie six Kumari crops were—

(1) Hill paddy; (2) Chillies; (3) Cotton; (4) Ragi; (5) pioca; and (6) Horsegram.

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

66. *Deterioration of site quality in second rotation pure teak antation crops.*—There has been a widespread apprehension in the st that there is steady deterioration of soil and consequent wering of site quality under pure teak plantations and that erefore, a second rotation teak plantation raised after clearfelling existing teak plantation will be appreciably poorer in quality an the first rotation crop.

To ascertain how far this is true, Sample plots Nos. 17(*a*), 18(*a*) id 19(*a*) were laid in Nilambur in the exact sites occupied by the ample plots Nos. 17, 18 and 19 which were first rotation teak lantations, after clearfelling and replanting. The site quality of ie first rotation teak plantations in Sample plots Nos. 17, 18 and) is available from measurements. The site quality of the second tation teak plantations has been computed. The following bular statement shows the results:—

TABLE XX.—*Comparative statement showing site qualities of I rotation and II rotation of teak plantations in the same site.*

ample plot numbers.	*All-India site quality in first rotation.*	*All-India site quality in second rotation.*	*Remarks.*
7(a) ..	0·1 II	1·7 II	Considerable increase in site quality.
8(a) ..	0·4 III	0·8 III	Slight increase.
9(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 an appreciable increase in site quality in higher quality soils such as All-India quality II, 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 has 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, 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.*

67. *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, Hopea parviflora, Swietenia macrophylla, Cedrela toona, and Palaquium 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. Palaquim 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.

68. *Calophyllum elatum—Experimental plot No.* 148/35, *Palghat* —This 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 XXI.—*Statement showing the height increment of Calophyllum elatum.*

Year.	*Age in years.*	*Survival.* PER CENT.	*Mean height.* FEET.	*Increase during the previous period.* FEET.
1936	12	100	4·20	..
1941	17	100	7·90	3·7
1946	22	99	11·90	4·0
1951	27	99	16·82	4·92
1955	31	95	19·90	3·08
1956	32	83	20·40	0·50

The mean height of the crop in 1956 was 20·4 feet.

The plot was lightly thinned in 1951. Graphs showing the increase in height with age is attached Seperate. The present stocking is 90 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.

69. *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.

70. *Dipterocarpus indicus-Experimental plot No.* 50/37 *of Wynaad —Growth and development of species.*—Experimental plot No. 50/37 was formed in Chandanathode in 1937 out of the old Experimental ground plot No. 60/34 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.

71. *Gluta travancorica—Experimental plot Nos.* 44/37 *and* 48/37 *of Wynaad.*—Experimental Plots Nos. 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; and

(ii) under top canopy;

respectively. The species was raised as garden experiments in 1933 and 1934 and subsequently converted into experimental plots. The following are the results :—

TABLE XXII.—*Statement showing the growth of Gluta travancoria under complete evergreen canopy and some under top canopy.*

Experimental plot number.	*Survival.*	*Average height in 1954.*	*Average diameter.*	*Remarks.*
	PER CENT.	FEET.	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 No. 48 suffered in a losser degee. However the good height and diameter growths attained by the tress show that the species can be successfully raised in the locality where damage by wild elephants can be minimised or prevented.

72. *Gluta travancorica—Growth and development—Experimental Plots No.* 97/51 *of Chandanathode.*—This was formed in 1951 out of plants raised in Experimental Ground No. 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 Experinmental Plot No. 48/1937 noted above. Out of 26 trees selected for observation, 25 exist and have reached a height up to 40 feet (average height 29·2 inches) and diameter of 4 inches to 5 inches. It may be noted here that the rate of growth in this plot is the same as in Experimental Plot No. 48/37.

Age—height growth curve for the three experimental plots is attached.

73. *Hopea parviflora—Experimental Plot No.* 45/37 *of Chandanathode.*—This was formed in 1937 out of Experimental Ground No. 52/1934 to observe the growth and development of the species from seedlings of known age to the sap ling andpole stage under cover of top canopy only, i.e., removing in the middle storey, (trees up to 3 feet girth) 30 trees are now left after a thinning carried out in 1949. The mean height in 1956 at the age of 21 years is 30 feet. The species can be sucessfully grown in Chandanathode but the rate of growth is considerably less than in Kannoth. A graph showing rate of growth is attached.

74. *Hopea parviflora—Raising after clearfelling and burning secondary growth in shifting cultivation—Experimental Plots Nos.* 41/37, 52/38 *and* 60/39—*Kannoth Range—Wynaad.*—These were formed in the years 1937, 1938 and 1939 to 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

41/37, Hopea was tried in conjunction with *Artocar pushirsuta an Swietenia macrophylla*. Here *Artocarpus* failed completely. Between Hopea and Manogany, the latter has put on better height growth but Hopea has more survivals.

In Experimental Plot No. 52/38 Mesuafailed and was replaced by Hopea after 15 years is 33 feet.

In Experimental Plot No. 60/39, *Balancarpus utilis* were 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 15 years.

75. *Hopea parviflora—Frequency of weeding—Experimental Plots No.* 90/42 *of South Coimbatore Division.*—This 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 Annual Report for 1951–52. In this experiment there were four treatments as 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 subsequnt years ;

C—Plots weeded once in September in the first year and twice a year in July and September in subsequently 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. The sapling crop will be given a thinning and the experiment will be continued to watch the growth and development of an artificially raised crop of *Hopea parviflora* in the natural evergreen forest. Future measurements will be recorded once in five years.

Experimental Plot No. 89/1942 of Wynaad was 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.

76. *Raising evergreen species after clearfelling and burning secondary re-growth in a deciduous forest with a cover crop of Tephrosia candida and a shade crop of Trema orientalis—Experimental Plot Nos.* 153/37, 167/38 *and* 169/39 *of Palghat.*—The three experimental

plots were opened to find out whether it is possible to raise evergreen species such as *Hopea parviflora*, *Artocarpus hirsuta* and *Cedrela toona* in a deciduous clearfelled and burnt area with a nurse crop of Boga and *Trema orientalis*.

Experimental Plot No. 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 No. 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 treatnents are not significantly different being 32·9 feet and 32·6 f et respectively at the end of 17 years.

Cedrela toona under a nurse crop of Trema gives better survivals and mean height (73 per cent and 28·4 feet height in 17 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*.

77. *Experimental Plot No.* 169/39, *Palghat*.—The indications are that *Hopea parviflora* gives a higher percentage of survivals with a nurse crop of Boga than with a shade crop of *Trema orientalis*. After 17 years Hopea has a mean height of 25 feet under both, showing no difference as regards height growth. *Cedrela toona* under Trema has grown to 22 feet height in 17 years and a few *Balanocarpus utilis* plants introduced originally has a mean height of 17 feet.

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 *Tephrosia candida* during the early stages. For *Cedrela toona*, a shade crop of *Trema orientalis* is more beneficial than a nurse crop of Boga.

78. *Raising evergreen species after clearfelling and burning in a dediduous forest whi h was originally evergreen or sub-evergreen—Experimental plots Nos.* 172/40, 173/41 *and* 174/42 *of Palghat*.—The species used are *Vateria indica*, *Cadrela toona*, *Mesua ferra*, *Hopea parviflora*, *A glaia roxburghiana and Balanocarpus utilis*.

Hopea parviflora.—Continues to prefer the nurse crop of Boga (*Tephrosia candida*) better than the shade crop of *Trema orientalis*. Mean height and survivals are distinctly greater under Boga than under Trema. While in the case of *Vateria indica* Trema as a shade crop is distinctly better than Boga as a nurse crop. Vateria under Trema has greater survivals and its mean height at the end of fourteen years is 27 feet while under Boga it is only 22 feet.

Mesua ferrea.—Comes better under Boga than under Trema as regards survivals, though in the mean height the difference is little at the end of 16 years.

Aglia roxburghiana.—Also comes up better under nurse crop of Boga than under a crop shade of Trema as regards survival and mean height growth. The mean height at the end of 15 years is 20 feet under Boga and 17 feet under Trema.

Balanocarpus utilis.—This species shows greater survivals under a nurse crop of Boga than under a shade crop of Trema while the height growth is slightly lesser (14 feet) under the former and greater (16 feet) under the latter at the end of 14 years.

At this stage provisional conclusions are that evergreen species such as *Hopea parviflora*, *Balanocarpus utilis*, *Aglaia roxburghiana* and *Mesua ferrea* can be introduced in the retrograde evergreen forests using a nurse crop of Boga, after clearfelling and burning.

79. *Mesua ferrea.—Experimental plot* 42/1937 *of Wynaad.–Growth and Development of the species*.—Experimental plot No. 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 No . 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.

80. *Mesua ferrea—Rate of growth.—E.P. No.* 147/35 *of Palghat*.—E.P. No 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 XXIII.—*Statement showing the growth statistics for* Mesua ferrea.

Year.	*Age in years.*	*Survival* PER CENT.	*Mean height.* FEET.	*Increase during the period.* FEET.
1936	12	100	4·70	..
1941	17	100	6·88	2·18
1946	22	98	9·90	3·02
1951	27	96	13·70	3·80
1955	31	95	16·80	3·10
1956	32	95	17·20	0·40

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

A thinning is indicated and this will be done during the coming year.

81. *Terminalia crenulata - Seeds from figured trees—Experimental plots Nos.* 38/37 *and* 67/40 *of Wynaad and* 82/33 *of South Coimbatore.*—Experimental plot No. 38/37, Wynaad, was started in 1937 to determinewhether the 'figure' of *Terminalia crenulata* timber istransmitted 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 No. 67/40 of Wynaad is a long term experiment to determine whether 'figure' of *Terminalia crenulata* 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 No. 82/1938 of South Coimbatore is another similar experiment with figured *Terminalia crenulata*. In 1952, when last measured, there were 17 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 my be sown again. By such repeated selection, we may be able to isolate afigured variety of *Terminalia crenulata.*

(c) *Indigenous Softwood Species.*

82. *Artificial regeneration of gaps in evergreen forests.*—Experiments were started during the year 1954-55 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 species.

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

Bombax malabaricum.

Ailanthes malabarica.

Lophopetalum wightianum.

Mangifera indica (dibbling of seed was done).

Sterculia companulata.

Swietenia macrophylla.

All the species have come up fairly well. Bombax has come up best with 86 per cent survival and 2 feet to 3 feet mean height and Mango with 85 per cent survival and 1 foot to 1½ feet high. Owing to damage by game animals, the number of survivals is steadily going down.

83. *Experimental ground* 422/54 *of 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 are—

Swietinia macrophylla.

Mangifera indica.

Vateria indica.

Bombax malabaricum.

Artocarpus hirsuta.

Current year's observations have shown that there is a decline in the survival percentage of all species though mango has shown a greater percentage of survival. 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.

84. *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 1954-55, in Chandanathode evergreen forests. 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′ were either felled or girdled leaving only the top canopy. The espacement was 9′ × 9′. The species tried were :—

Mangifera indica.

Swietenia macrophylla.

Veteria indica.

Lophopetalum wightianum.

Sterculia companulata.

Transplants were put in for all species, except for Mango for which seeds were dibbled. *Mahogany* and *Sterculia companulata* failed even during the first year and the survival is nil at the end of the second year. As regards the other species, though they came up well in the first year with a height growth of 1½′ to 2½′, there was a decline in the survival percentage in the second year. Further observations will be made in future years.

84-A. *Introduction of valuable softwood and hardwood speices in evergreen forests (like Karianshola), without clearfelling.*—Attempts at introducing valuable hard and softwood species in the Karianshola evergreen forests, without clearfelling, under the top canopy, were started in 1953. In 1954, the experiments was impoverised by having two treatments as follows for each of the species tried :—

A—Under top canopy clearing shrubby growth at the stakes where the plants were introduced ;

B—Under top canopy ; but removing besides shrubby undergrowth, all saplings and poles of useless species up to 3 feet girth. The experiment was repeated in 1955 under only canopy condition A—noted above.

The results so far, in 1956 at the end of 1, 2 and 3 years respectively are furnished below :—

TABLE XXIII-A.—*Introduction of valuable species in evergreen forest under top canopy shade.*

	Species. (3)	*E.G. number.* (2)	*How introduced.* (3)	*Age in years.* (4)	*Survivals.* (5)	*Mean height.* (6)	*Remarks.* (7)
1	*Ailanthus malabarica*	469/53	Under top canopy loss shrubby under-growth at the stakes where planting was done.	3	23/25	21"	..
2	Do.	495/54-A		2	19/51	24"	
3	Do.	504/54		2	44/50	38"	
4	Do.	520/55		1	146/192	20"	
5	*Pericopsis mooniana*	470/53		3	26/50	22"	
6	*Hymenodictyon excelsium*	472/53		3	30/50	4"	
7	*Vateria indica*	499/54-A		2	21/30	2"	Badly browsed.
8	*Sterculia companulata*	468/53		3	32/50	1'—2'	Do.
9	Do.	496/54-A.		2	80 per cent.	1'—2'	Do.
10	Do.	519/55		1	82 per cent.	2'—3'	Do.
11	*Swietenia macrophylla*	494/54-A.		2	32/51	12"—18"	Being browsed.
12	Do.	521/55		1	98	24"	Do.
13	*Bombax malabaricum*	503/54		2	39 per cent.	2'	Do.
14	*Zanthoxylum rhesta*	502/54		2	30	1'	
15	*Pterocarpus dalbergioides*	497/54-A.		2	7/30	1'	Very badly browsed.
16	Do.	522/55		1	96 per cent.	2'	Do.
17	*Cinnamomum zeylanicum* (Sandy variety)	501/54		1	58	2'	Seedlings only.
18	Do. *Laterite*	498/54-A.		1	70 per cent.	2' 6"	Do.
19	*Cedrela odorata*	523/55		1	89 Do.	2'	Promising.
20	*Terminalia myriocarpa*	524/55		1	96	6"—9"	Badly browsed.
21	*Eucalyptus citriodora*	518/55		1	71	24"	Promising.
22	*Cinnamomum zeylanicum* (Laterite variety)	498/54-B.	Under top canopy shade but removing besides shrubby growth all saplings and poles of useless species up to 3' in girth.	1	61 per cent.	3'	Seedlings only.
23	*Swietenia macrophylla*	494/54-B		1	32/51	12"	Being browsed.
24	*Ailanthus malabarica*	495/54-B.		1	35/58	18"	
25	*Sterculia companulata*	496/54-B.		1	80 per cent.	1"—2"	Badly browsed.
26	*Pterocarpus dalbergioides*	497/54-B.		1	5/17	12"	Do.
27	*Vateria indica*	499/54-B.		1	8/18	6"	Do.

The indications are that species like *Sterculia companulata*, *Vateria indica*, *Pterocarpus dalbergioides*, *Terminalia myriocarpa*, *Bombax malabaricum*, cannot be successfully introduced in Karianshola Evergreen rain forests on account of heavy browsing damage by large game like deer, sambhur, etc.

Swietinia macrophylla is also found browsed by deer and sambhur off and on and it may be possible to diminish the above damage by introducing the species in dense lines using transplants only.

Hymenodictyon excelsum which is a light demander is not suited to evergreen rain forests with dense top canopy shade.

Ailanthus malabarica is found to grow slowly under the shade of top canopy. Being an associate species of evergreen forests with high rainfall, observations will have to be continued further as the species may, after initial establishment shoot up through a chance gap in the canopy.

Pericopsis mooniana and *Zanthoxylum rhetsa* are very slow grown under the shade. Further observations are necessary.

Eucalyptus citriodora appears to require heavy light as the plants under full shade are bent while those getting some amount of light through chance gaps in the canopy are found growing up. Further observations are continued.

Cedrela odorata as well as *Cinnamomum zeylanicum* are now coming up vigorously, the former having reached a maximum height of 3 feet to 4 feet in one year while the latter has developed vigorous shoots from the collar measuring 2 feet in some cases in two years. Further observations are being continued.

84-B. *Introduction of valuable hard and soft woods in the moist deciduous forests of Palghat Division near Dhoni, under the existing overwood without clearfelling.*— Experiments at introducing valuable hardwood and softwoods in moist deciduous forests of Palghat Division were initiated during the year 1954-55. Various species were planted under the shade of top canopy in one foot cube pits at an espacement of 12′ × 12′. Only shrubby undergrowth was cleared for a radius of 2′ round the pits dug up for planting, i.e., the minimum of clearing was done and the canopywas left untouched. One year old seedlings were transplanted.

At the end of two years the survivols and height growth are as in the following table.

TABLE XXIII-B.—*Introduction of valuable species in the moist deciduous forests without clearfelling.*

Species.	*E.G. number.*	*Age in years.*	*Survivals.*	*Average height.*	*Remarks.*
1 *Sterculia companulata.*	447/54	2	152/279	4′	Slow grown under

TABLE XXIII-B.—*Introduction of valuable species in the moist deciduous forests without clearfelling.*

Species.	*E.G. number.*	*Age in years.*	*Survivals.*	*Average height.*	*Remarks.*
3 *Mangifera indica.* (Seeds dibbled at 2 seeds per stake).	448/54	2	59/126	1′ 3″	Damage by Porcupines present.
4 *Artocarpus hirsuta.*	450/54	2	Only 2 survivals.	6″	
5 *Zanthoxylum rhetsa.*	451/54	2	71/137	1′	Natural forest seedlings of 1′ were used.
6 *Bombax malabaricum.*	452/54	2	47/134	1′ 2″	
7 *Evodia roxburghiana.*	457/54	2	5/146	1′	

Excepting the cases of *Sterculia companulata* and *Ailanthus malabarica*, casualties were 50 per cent and over for the other species at the end of the first growing season. Hence, full stocking was restored by replacement in casualty stakes during 1955-56. However, at the end of two years only species like *Sterculia companulata*, *Ailanthus malabarica*, *Zanthoxylum rhetsa*, *Mangifera indica* and *Bombax malabaricum* show initial success by survival percentage though their height growth is not appreciable. *Artocarpus hirsuta* and *Evodia roxburghiana* are unable to withstand the drip. Further observations will be made.

85. *Ailanthus excelsa.*- This is a 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. Its 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 Bonnari.

The following table furnishes the results of two experiments in Topslip :—

TABLE XXIV.—*Statement showing the growth statistics of* Ailanthus excelsa *in Topslip.*

E.G. number.	*Locality.*	*Age in years.*	*Survival.*	*Mean height.*	*Remarks.*
	Introduction in deciduous forest.				
				FT.	
393/50 ..	Topslip	5	80	12	Poor growth.
461/53 ..	Do.	3	57	7	

The indications are that species like *Sterculia companulata*, *Vateria indica*, *Pterocarpus dalbergioides*, *Terminalia myriocarpa*, *Bombax malabaricum*, cannot be successfully introduced in Karianshola Evergreen rain forests on account of heavy browsing damage by large game like deer, sambhur, etc.

Swietinia macrophylla is also found browsed by deer and sambhur off and on and it may be possible to diminish the above damage by introducing the species in dense lines using transplants only.

Hymenodictyon excelsum which is a light demander is not suited to evergreen rain forests with dense top canopy shade.

Ailanthus malabarica is found to grow slowly under the shade of top canopy. Being an associate species of evergreen forests with high rainfall, observations will have to be continued further as the species may, after initial establishment shoot up through a chance gap in the canopy.

Pericopsis mooniana and *Zanthoxylum rhestsa* are very slow grown under the shade. Further observations are necessary.

Eucalyptus citriodora appears to require heavy light as the plants under full shade are bent while those getting some amount of light through chance gaps in the canopy are found growing up. Further observations are continued.

Cedrela odorata as well as *Cinnamomum zeylanicum* are now coming up vigorously, the former having reached a maximum height of 3 feet to 4 feet in one year while the latter has developed vigorous shoots from the collar measuring 2 feet in some cases in two years. Further observations are being continued.

84-B. *Introduction of valuable hard and soft woods in the moist deciduous forests of Palghat Division near Dhoni, under the existing overwood without clearfelling.*—Experiments at introducing valuable hardwood and softwoods in moist deciduous forests of Palghat Division were initiated during the year 1954-55. Various species were planted under the shade of top canopy in one foot cube pits at an espacement of 12′ × 12′. Only shrubby undergrowth was cleared for a radius of 2′ round the pits dug up for planting, i.e., the minimum of clearing was done and the canopy was left untouched. One year old seedlings were transplanted.

At the end of two years the survivols and height growth are as in the following table.

TABLE XXIII-B.—*Introduction of valuable species in the moist deciduous forests without clearfelling.*

Species.	E.G. number.	Age in years.	Survivals.	Average height.	Remarks.
1 *Sterculia companulata.*	447/54	2	152/279	4′	Slow grown under shade.
2 *Ailanthus malabarica.*	449/54	2	103/142	2′ 6″	..

TABLE XXIII-B.—*Introduction of valuable species in the moist deciduous forests without clearfelling.*

Special.	E. G. number.	Age in years.	Survivals.	Average height.	Remarks.
3 *Mangifera indica.* (Seeds dibbled at 2 seeds per stake).	448/54	2	59/126	1′ 3″	Damage by Porcupines present.
4 *Artocarpus hirsuta.*	450/54	2	Only 2 survivals.	6″	
5 *Zanthoxylum rhetsa.*	451/54	2	71/137	1′	Natural forest seedlings of 1′ were used.
6 *Bombax malabaricum.*	452/54	2	47/134	1′ 2″	
7 *Evodia roxburghiana.*	457/54	2	5/146	1′	

Excepting the cases of *Sterculia companulata* and *Ailanthus malabarica*, casualties were 50 per cent and over for the other species at the end of the first growing season. Hence, full stocking was restored by replacement in casualty stakes during 1955-56. However, at the end of two years only species like *Sterculia companulata*, *Ailanthus malabarica*, *Zanthoxylum rhetsa*, *Mangifera indica* and *Bombax malabaricum* show initial success by survival percentage though their height growth is not appreciable. *Artocarpus hirsuta* and *Evodia roxburghiana* are unable to withstand the drip. Further observations will be made.

85. *Ailanthus excelsa.*—This is a 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. Its 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 Bonnari.

The following table furnishes the results of two experiments in Topslip :—

TABLE XXIV.—*Statement showing the growth statistics of* Ailanthus excelsa *in Topslip.*

		Introduction in deciduous forest.			
E.G. number.	Locality.	Age in years.	Survival.	Mean height.	Remarks.
				FT.	
393/50 ..	Topslip	5	80	12	Poor growth.
461/53 ..	Do.	3	57	7	

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

(1) Ayirangal softwood plantations, Coimbatore South Division ;

(2) Edacode Block (1951 Softwood Regeneration Area), Nilambur 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.

87. *Ailanthus malabarica—Growth and silvicultural requirements.*—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 XXV.—*Statement showing the growth statistics of Ailanthus malabarica.*

E.P. or E.G. number.	Deciduous or evergreen locality.	Centre.	Age.	Mean height.	Survival.	Remarks.
				FT.	PER CENT.	
E.G. 393/50.	Deciduous.	Dhoni ..	6	13	35/50	
E.G. 406/50.	Do.	Topslip.	5	3	34/50	
EP. 184/52.	Do.	Dhoni ..	4	7	44/50	
EG. 426/53.	Do.	Do. ..	3	2¼	72/100	
EP. 196/53.	Do.	Do. ..	2	4	26/40	Plot burnt.
...G. 469/53.	Evergreen.	Topslip.	3	2	23/25	
..G. 504/54.	Do.	Do.	2	3	44/50	

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

In both Nilambur and Topslip, this plant is liable to attack by a defoliator *Eligna narcissus* (*Leph., 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.

88. *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.

This was introduced as an underplant in the evergreen forests of Karianshola in Topslip Centre and the moist deciduous forests of Palghat Division, near Dhoni. The details are furnished below :—

E.G. 503/54, *Topslip.*—Two years old ; 39 per cent survivals ; 2' high, but badly browsed.

E.G. 452/54, *Dhoni.*—Two years old ; 59/135 survivals ; plants 1' high.

89. *Bombax malabaricum—Shoot borer attack on.*—The species is subjected to a shoot borer attack known as '*Tonica neviferana*' (*Aecophoridæ*). The best method of control of this pest is by the mechanical method by destruction of pupæ. 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.

90. *Bombax malabaricum—Manurial experiments.—E.P.* 98/53, *Kannoth.*—With a view to ascertain the effect of nitrogenous and phosphatic manures on the growth of *Bombax malabaricum* seedlings E.Ps. 98 and 99 were formed during 1953 in 1952 and 1953 Softwood Regeneration Areas of Kannoth. In E.P. 98 an area of 3·5 acres planted up with Bombax was selected and divided into 16 subplots 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 Superphosphate mixed into the soil ;
D—One oz. of Ammonium sulphate plus one oz. of Superphasphate.

Analysis of measurements at the end of one year and of two years show that there is no significant difference in the mean heights or survival percentage with any of the treatments as shown below :—

TABLE XXVI.—*Analysis of measurements in E.P.* 98/53, *Kannoth.*

	A	B	C	D
Survival per cent.	83	80	86	91
Mean height ..	32 inches.	33·6 inches.	34·7 inches.	35·2 inches.

91. *Bombax malabaricum—Manurial experiment—E.P.* 99/53, *Kannoth.*—In E.P. 99 formed in 1953 Softwood Plantation at the time of planting of the plantation, the plot was 0·35 acre in extent divided into six sub plots of 35 plants each. Plots A, B, and 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 superphosphate and in C-1 one oz. of each of the above, were put in.

Analysis of the 1954 measurements showed that one oz. of superphosphate gave better height growth than control without manure; while in the other two cases there was no appreciable difference between control and treatment. At the end of the third year, the measurements were as below :—

TABLE XXVII.—*Analysis of measurements in E.P. 99/53, Kannoth.*

Particulars of treatment.	*Control plots.*		*Treated plots.*	
	Survival per cent.	*Mean height.*	*Survival per cent.*	*Mean height.*
		INCHES.		INCHES.
A—One oz. of ammonium sulphate.	91	32·3	54	35·5
B—One oz. of superphosphate.	83	31·5	70	36·2
C—One oz. of ammonium sulphate and one oz. of superphosphate.	54	26·6	46	41·0

While there is a slight increase in height growth in the treated plots, the increase is not significant after a period of three years.

92. *Bombax malabaricum—Manurial experiment—E.P.* 120/54, *Kannoth.*—The same experiment was repeated again in 1954 in Softwood Plantation of 1954. This was a Latin Square Design with four treatments and four replications. The treatments were—

A—Control—no manure;

B—2 oz. of N.P.K. mixture used for potato crops in the Nilgiris;

C—1 oz. of manure mixture and 1 oz. of superphosphate;

D—2 oz. of superphosphate.

At the end of two years, the analysis of measurements is as below :—

TABLE XXVIII.—*Analysis of measurements in E.P. 120/54, Kannoth.*

	A	*B*	*C*	*D*
	INCHES.	INCHES.	INCHES.	INCHES.
1 Mean height in 1954 ..	12·3	12·1	12·3	12·4
2 Mean height in 1956 ..	11·9 top broken.	12·2	12·5	13·5

The above figures show that application of manures has not been beneficial.

93. Combining the results of the above three experiments, the indications are that application of manure in Kannoth to *Bombax malabaricum* is not beneficial. Perhaps due to the very high rainfall of 165" in the year, the manure is washed away during the rains. An experiment similar to that of E.P. 120/54 is repeated in E.P. 125/55. The results will be reported in the next year.

94. *Evodia roxburghiana—Rate of growth—E.P.* 90/43, *Kannoth.*—E.P. 90/43 was started in Kannoth to study the growth and development of the species in the locality. Natural forest seedlings ranging from 12" to 29" 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 12 years show 119 stems with a mean height of 46·4 feet. From 1955 only diameter measurements are recorded. In 1956, 41 trees out of 119 are reported to be dead due to the spread of a fungus disease from the adjoining district plantations of *Evodia.*

A graph showing height increment with age is attached.

95. *Effect of thinning of Evodia plantations—E.Ps.* 91/50, 92/51 *and* 100/53, *Kannoth.*—E.Ps. 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 E.Ps. 92 and 100 there has been no fungus attack so far either in the thinned plot, or in the control (unthinned) plot. But in E.P. 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 8. 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.

E.Ps. 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 E.P. 100/53 there was no significant difference in the diameter in the thinned and unthinned plots in 1954. At the end of three years an analysis of the measurements indicates the same position.

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 4 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.

96. *Pruning of Evodia—E.P.* 118/54, *Kannoth.*—This experiment was started to study the effect of pruning a pure Evodia plantation, the trees being pruned to two-third 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 quarter an acre each, and there is a control plot of two sub-plots of quarter an acre each without pruning. At the end of three years, measurements showed that pruning has no beneficial effect on the mean height growth.

97. *Gmelina arborea.*—This is a valuable semi-softwood used much for planking, panelling and furniture and in the match industry. This is easily raised by direct sowing in soil worked patches at the rate of 5 to 10 seeds per patch, stump planting and entire transplanting. There is no difference in height growth in any of the three methods. The rate of growth as deduced from E.G. 411/52, Dhonis 376/50, 419/53, 401/51, 458/54, Begur, are as below :—

TABLE XXIX.—*Statement showing the rate of growth of Gmelia arbores.*

Age.	Mean height.	Top broken.	Age.	Mean height.
1	2½'		3	8' 14'
2	6' 8'		4	20' 24'

This species is highly susceptible to damage by wild game and hence this cannot be established in centres like Topslip with heavy browsing damage by deer and Sambhur, without a game proof fence (*Vide* E.G. 455/53, Topslip).

98. *Melia dubia.*—The timber of this species has been tested and found to be satisfactory for slate frames, packing cases and cheap plywood. Logs of this species, obtained from Ceylon, are being used by fishermen in the East Coast of Madras State as catamaran. Hence this species is considered important for artificial regeneration work.

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 inches—12 inches can be transplanted at 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 inches—40 inches per annum. A height growth of 10 feet—15 feet is obtained in two years and 40 feet in six years.

E.P. 115/53, *Denkanikota.*—Transplanting seedlings in crow bart holes and 1 foot cube pits, both gave 100 per cent survival and height growth of 43·1 inches and 41 inches respectively at the end of one year. The measurement at the end of the second year, during 1955, shows mean height of 8·4 feet and 9·5 feet with survival per cent of 93 and 100 respectively.

E.P. 29/53, *Denkanikota.*—Half acre was planted at an espacement of 22' × 9'. The plants are well established and at the end of three years, the maximum height is 28·7 feet with 80 per cent survival.

E.G. 313/49, *Wynad.*—This 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 41·0 feet (at the age of 7 years). Hereafter D.B.H. measurements will be given in place of height growth.

As artificial regeneration from seed is difficult, the question of vegetative propagation through stem cuttings using the plant Harmone *Seradix* B-1, *Seradix*-B-2, and *Seradix*-B-3 powders was investigated. The cuttings gave sproutings of about 75 per cent in all cases including control in the beginning; but at the end of the year, all the sproutings died. The indication is that Seradix Harmone is not efficacious in inducing root formation in cuttings of *Melia dubia*.

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

E.G. 229/49 (*Wynad*) *in Kannoth* was maintained during the year to observe the growth and development of the species. There are now 12 plants of an average height of 18·7 feet at the age of seven years. A graph showing height growth with age is attached.

E.G. 434/53, *Topslip.*—Fifty-one-year old seedlings were planted. At the end of one year, the average height was 13·8 inches and survivals 49out of 50. In 1955 at age of 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.

100. *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, Begur, to study the rate of growth and development of the species. The following statement furnishes the data collected so far :—

TABLE XXX.—*Statement showing the rate of growth and development of* Sterculia alata.

Serial number.	Locality.	E.G. number.	Latest measurements.		
			Age.	Survival.	Mean height in inches.
1	Kannoth	244/50	6	12/50	79
2	Begur	379/51	5	60/100	65·2
3	Kannoth	264/51	5	23/50	60·2

101. *Sterculia alata-Comparison experiment—E.G.* 347/49, *Begur-Wynaad.*—E.G. 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 the age of seven years, the two-year old transplants show a survival of 37 per cent and a mean height of 13·2 feet while the two-months old plants give a survival of 43 per cent and a mean height of 10·9 feet. Two months-old transplants give higher survival per cent; but two-year old transplants give increased height growth.

102. *Sterculia alata—Comparison of* 3′ × 3′ *espacement with* 6′ × 6′ *espacement.*—This experiment was started in 1950 in E.G. 381/50 of Dhoni. Latest measurements at the end of four years gave 30 per cent survival and 52·7 inches mean height with 6′ × 6′ espacement and 10 per cent survival and 33·2 inches mean height with 3′ × 3′ espacement. The 6′ × 6′ espacement is therefore distinctly beneficial as regards both mean height growth and survival per cent.

103. *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 per cent to 90 per cent germination.

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

E.Gs. 125/42 *of Kannoth and* 219/42 *of Begur* were started for studying the rate of growth and development of the species. Measurements in 1956 show that in 14 years, it has reached a diameter of 10·6 inches in Kannoth and a mean diameter of 7·2 inches 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 year 1954 S.P. 55 was formed in the 1951 plantation area of Kannoth with 36 saplings of *Sterculia companulata.* On 12th March 1955 the average height was 17·7 feet.

Topslip Centre E.G. 463/53, 493/54, 496/54, 509/55 *and* 519/55.—Owing to heavy and frequent browsing by deer, this species cannot be successfully established at this centre.

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

104. *Sterculia companulata—Espacement experiment.*—Several experiments on espacement in artificial regeneration work were started as shown below :—

E.G. 382/50, Dhoni	..	6′ × 6′ Vs. 3′ × 3′.
E.G. 404/51, Do.	..	9′ × 9′, 3′ × 3′, 6′ × 6′.
E.P. 182/52, Do.	..	6′ × 6′ Vs. 9′ × 9′.
E.G. 428/53, Do.	..	9′ × 9′, 6′ × 6′, 3′ × 3′.
E.P. 193/53, Do.	..	9′ × 9′, 6′ × 6′.

The indications so far are that 9′ × 9′ espacement is probably better than 3′ × 3′ or 6′ × 6′ espacement.

105. *Sterculia companulata—Comparison experiment.*—E.G. 420/53, Dhoni, is a comparison experiment between—

A—Direct sowing;

B—Stump planting;

C—Transplants.

Measurements in 1954 showed that stumps have failed altogether and that transplanting is better from the point of view of mean height—26·1 inches for transplants as against 18·2 inches for sowings. The indications are therefore that transplanting entire seedlings is significantly the best method of raising this species.

106. *Vitex peduncularis—Growth and development—E.P.* 68/40, *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 53 inches and 45 one-year old seedlings of height 8 inches to 30 inches at an espacement of 12′ × 12′, on 23th 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 XXXI.—*Statement showing the growth statistics of* Vitex peduncularis.

Year.	*Number put in.*	*Number surviving.*	*Mean height.*
			INCHES.
1941	75	57	17·7
1942	75	56	38·8
1943	75	53	63·3
			FT.
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	37·9

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 12 years.

107. *Zanthoxylum rhetsa.*—Entire transplanting of nine months to one-year old seedlings 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.

Measurements recorded in E.G. 385/50, Dhoni, 405/51, Dhoni, E.P. 185/52, Dhoni, show that the rate of growth in height of the plant is as below :—

TABLE XXXII.—*Statement showing the rate of growth of* Zanthoxylum rhetsa.

Age.	*Average height.*	*Age.*	*Average height.*
1	1½′	3	6′ 8′
2	3′	4	9′ 10′

A graph showing the rate of growth of the species as disclosed by the above experiments is attached. 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 comparatively rapid.

The timber of the species is light and strong and is especially 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.

108. *Acacia mollissima* (*Black Wattle*).—When exactly Wattle was introduced in the Nilgiris is not known, probably, it was about 1,840. 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 per cent 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 (*Acacia 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 cultivation of only Black Wattle (*Acacia mollissima*) will be done in future.

109. 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.

110. *Acacia Decurrens—Espacement experiment—Experimental plot* 8/1947, *Ootacamund.*—An experiment was started in 1947 in Andy Corner to study the espacement at which *Acacia Decurrens* would give the maximum yield of work with the three espacements 6′×6′, 9′×9′, and 12′×12′. In 1948, the subplot with 12′×12′ espacement got burnt by an accidental fire leaving only the other two sub-plots.

Latest measurements in 1955, which are furnished below, indicate that the 9′×9′ espacement had a significantly better survival per cent as also better height growth than 6′×6′ espacement.

Table XXXIII *Acacia decurrens—Espacement experiment*

	A 6′×6′ *espacement.*	B 9′×9′ *espacement.*	C 12′×12′ *espacement.*
Number put in	210	105	66
Survival per cent	55	78	Plot burnt accidentally.
Mean height	51·0	54′–4″	

111. *Acacia mollissima and Acacia decurrens—Experimental Introduction in lower altitudes of* 1,500 *feet.*—On account of the importance of large scale cultivation of tan bark Wattles in the State, experiments were done in 1954 and 1955 on the introduction of the above two species in Topslip locality with an elevation of 1,500 feet.

Experimental grounds 478/54 *and* 479/54, *Topslip.*—In 1954, seeds pre-treated by soaking in cold water for 48 hours, were sown immediately after the first pre-monsoon showers in soil worked patches at 10 to 20 seeds per take. Till end of June 1954 *Acacia decurrens* germinated in 25 per cent of the patches and *Acacia mollissima* in 12 per cent of the patches with 1 to 3 seedlings per patch. A resowing was carried out in July 1954. Germination was noticed in 45 per cent of the patches sown with *Acacia decurrens* and over 60 per cent of the patches sown with *Acacia mollissima*, by August—September 1954.

Subsequently the seedlings began dying out with the approach of hot season and in February 1955 there were seedlings in 16 per cent of the patches sown with *Acacia decurrens* and with *Acacia mollissima*—The seedlings in these patches died out in the subsequent 2 to 3 months. Now there are no survivals.

Experimental grounds 523/55 *and* 523/55, *Topslip.*—During 1955, the experiment was repeated at Topslip by planting out tossed seedlings of *Acacia mollissima* and *Acacia decurrens* 3 inches

to 6 inches high, got from Ootacamund. In March 1956, about five months after planting, the survivals were 30 per cent for *Acacia mollissima* and 23 per cent for *Acacia decurrens*. There were no survivals.

(15) Experiments will be continued.

112. *Acacia mollissima—Analysis of bark for tannin contents*—Nine samples of barks of *Acacia mollissima* collected from plantations of different ages were sent by the District Forest Officer, Nilgiris, to the Principal, Institute of Leather Technology, Madras, for analysis. The results of analysis are furnished below :—

TABLE XXXIV.—*Results of analysis of Wattle bark from plantations of different ages.*

Year of plantation.	Age of trees in years.	Moisture	Insolubles.	Tannins.	Non-tannins.	Colour.		P.H. of the analytical solutions.
						Yellow.	Red.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1942–43	12	8·00	44.91	33.13	13.86	6·0	2·0	4·6
1943–44	11	9.40	45 23	29.98	15·34	4·2	1·7	4·6
1944–45	10	9·40	..	..	..	..	..	..
1945–46	9	7.40	43·59	35·71	13.30	4·1	1·6	4.8
1946–47	8	5·70	48·63	20·43	16·24	4·0	1·5	4·8
1947–48	7	8.44	30.33	38·27	13·90	4·1	4·5	4·8
1948–49	6	..	..	..	..	..	..	..
1949–50	5	7·60	41·28	33.33	12·74	5·0	3·4	4·6
1950–51	4	7 54	44·07	35·43	12·96	6·9	4·0	4 8
1951–52	3	5·60	49·53	29·83	15·04	6·7	3·5	4.8
1952–53	2	8·44	40·87	34·39	16 03	6·0	3·2	4 8

The results obtained are not comparable with the results, obtained in the previous years. Unless the barks are stripped at the same time every year and from the same localities, reliable results cannot be obtained. No conclusions can, therefore, be drawn on the figures furnished above regarding the tannin content of barks from plants of different ages—(Vide letter No. 751/51, dated 15th April 1955 of the Principal, Institute of leather Technology, Madras-21.)

113. *Acacia mollissima—Pre-monsoon planting experiment—Experimental plot* 27/55, *Ootacamund*.—The general practice is to plant mossed seedlings of Wattle during the South West monsoon Experimental plots 27/55 was started to find out if Wattle can be planted during the pre-monsoon showers in April and thereby enable the plants to grow sufficiently tall to withstand the frost in November to February in the first year. Sixty mossed seedlings of *Acacia mollissima* were planted in April 1955 and 60 in June 1955. By the beginning of November 1955, the early planted seedlings had a height of 5 feet to 6 feet and the late planted seedlings had a height of 3 feet to 5 feet. But there was a very severe frost in the

first week of November 1955 which killed away a large number of seedlings in both the treatments. This experiment will therefore be repeated during 1956–57.

114. *Acacia mollissima—Manurial experiment—Experimental plot* 24/54, *Mukurti*.—An experiment was started in 1954, to find out the effect of applying chemical fertilizer on the growth and development of Wattle in virgin grassland. An area of 1·11 acres was divided into 16 sub-plots, with a Latin Square Design. There were four treatments as follows :—

A—Addition of one oz. of N.P.K. Manure Mixture with scraping to 3 feet diameter.

B—Addition of 2 oz. of N.P.K. Manure Mixture and scraping to 3 feet diameter.

C—Addition of 2 oz. of N.P.K. Manure Mixture but no scraping.

D—Direct sowing of seeds in patches with the addition of 2 Oz. of Manure Mixture.

Mossed *Acacia mollissima* seedlings were planted in one foot cube pits at 11′ × 11′ espacement in A, B, C treatments and seeds were dibbled in the ' D ' treatment. Measurements in 1956 showed the following results :—

TABLE XXXV.—*Measurements taken in March* 1956 *on the growth of Acacia mollissima.*

	A	B	C	D
Number put in	100	100	100	100
Survival per cent.	96	97	97	79
Mean height	7′ 4″	8′ 0″	7′ 3″	3′ 8″

Two ounces of Fertilizer Mixture with 3 feet diameter scraping has given the best results. Treatments ' A ' and ' C ' have also given fairly satisfactory results, which are only slightly lower than treatment ' B '. Treatment ' D '—Direct sowing—has given the poorest results from the point of view of both survival per cent and mean height growth. It is too early to draw final conclusions.

The experiment was repeated in Experimental plot 28/55 with four intensities of manurial treatment, namely, zero fertilizer, one oz. of fertilizer, 2 oz. of fertilizer, and 3 oz. of fertilizer. But due to very severe frost in November 1955, all the seedlings died and hence the experiment will be repeated in the coming year.

115. *Acacia mollissima—Experimental with different rotations—Sample plots* 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 8 feet 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 and 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 clear-felled and the yield of bark measured. Measurements for the six sub-plots already felled show that the M.A.I. of green bark culminates at about the 10th year. But the M.A.I. of dry bark shows a continuous increase up to age 13 years. Previous experiments have shown that the tannin content in the dry bark increases upto age six years and then decreases. Hence the M.A.I. for effective tannin content per acre will culminate somewhere between six years and 13 years. Further indications will be available in 1957 when the sub-plots allotted to 16 years rotation will be clearfelled.

The following statement furnishes the data obtained so far :—

TABLE XXXVI.—*Statement showing the yield of bark of Acacia Mollissima.*

Year of felling.	Age in years.	Yield in lb. per acre.		Yield in lb. per acre.		Percentage of Dryage.
		Green bark.	Dry bark.	Green bark.	Dry bark.	
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	7,117	1,061	593	42·3
		Plus 1,461 windfalls.	Plus 618 windfalls.			
		=13,797	=7,735.			

The indications are that as the M.A.I. increment for dry bark increases continuously up to 13 years, a rotation of 13 or more years will yield the maximum production of bark. In fixing the 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 obtained. The experiment has to be repeated in other centres to confirm the indications already obtained.

115-A. *Ailanthus grandis.-Prain.*—It is an enormous tree attain 120 feet in height, found in Assam and in the foothills of the Himalayas. It has importance as yielding a valuable softwood similar to that of *Ailanthus excelsa*.

One hundred seedlings were planted as entire transplants in experimental grounds 440/54 of Dhoni. There were heavy casualties and there were no survival after end of April 1955. In experimental grounds 316/55 of Kannoth and 475/55 of Bagur, there were 23 and 28 per cent survivals with mean height of 21·2" and 12·4 inches respectively. The increased height growth in Kannoth, probably indicates that the species prefers a high rainfall of over 100 inches. Further observations are being made.

116. *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

higher grade pulp. The great advantage of *Albizzia falcata* for this purpose is its rapid growth-reaching exploitable dimensions in 10 years. In view of the importance of the species artificial regeneration is being attempted in this State.

There are two plants in Dhoni Nursery, raised from the 1950 sowings. Their measurements in 1956, at age 6 years, were—

(1) 33 feet high with 18 inches B.H. girth.

(2) (*a*) 34 feet high with 17 inches B.H. girth.

(*b*) 32 feet high with 18 inches B.H. girth.

The plants have not flowered so far.

Experiments were made on the artificial regeneration of this species in experimental grounds 312/54, Kannoth, 438/54, Dhoni, and 490/54, Topslip. The experiments have failed so far. Attempts are being made to procure the seed from Jamaica and results will be reported in future Annual Reports.

117. *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. *Aleurites fordii* occurs in the warm temperate parts of China, ascending up to 51,000 feet elevation while *Aleurites montana* is a tree of warmer localities rarely ascending higher than 1,500 feet.

The following plants now exist in the various research centres :—

TABLE XXXVII.—*Statement showing the growth statistics of Aleurites fordii and A. montana* (*Tung oil trees*).

Experimental ground number.	Locality.	Year of planting.	Species.	Number of plants.	Heights.	Mean heights.
Arramby nursery.		1950	Aleurites fordii.	5	..	1′ 11″
	Do.	1952	A. montana.	6	..	1′ 9″
336/50	Kannoth ..	1950	A. montana.	24/50	..	17′ 6″
235/50	Do. ..	1948	A. fordii ..	38/50	..	4·5′
334/48	Dhoni ..	1948	A. forsii ..	1	4′ 3″	..
335/48	Do. ..	1948	A. montana	1	22′	..
	Topslip ..	1948	A. montana	1	16′	..
				8		5′ (In flowers and fruits.)
354/49	Dhoni ..	1949	A. montana.	1	..	15′×12″ girth.
381/49	Topslip ..	1949	A. montana.	10	..	7·4′ in flowering and fruiting.
370/49	Dhoni ..	1949	A. fordii ..	10	..	8′ 8″

During the year, about 80 seeds collected from *Aleurites montana* in the Topslip garden, were sown in nursery. Besides 1½ lb. of seeds of Tung oil received from the District Forest Officer, Thirunelveli, collected in plantations at an elevation of 3,000 feet to 4,000 feet were sown in Topslip and Bogur and Kannoth Research Centres. Results will be furnished in future reports.

118. *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 now only five plants in the Denkanikota Pot Culture Garden of heights of 12 feet, 9 feet, 7 feet, 4 feet and 4 feet, respectively. The plants flowered during April-May 1954; but did not yield any fuits. Attempts to raise plants by vegetative propagation, through cuttings or air-layering 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.

119. *Broussonetia 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 successfully introduced in Dehra Dun, Sharanpur, Lahore, Calcutta and Madras (Chandanathode, Topslip, Begur and Denkanikota Research Centres.)

It starts seeding when about 2 to 3 years old. The seed weight is about 15,000 to 17,000 per oz. Germination capacity is 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 Reserved forest) it has attained a height of 50 feet and D.B.H. of 20 inches in eight years.

There are over 50 trees of this species with an average height of 40 feet and an average B.H. girth of 25 inches and maximum B.H. girth of 40 inches in Dhoni and Topslip Centres, raised in the years 1943 to 1945. The trees bear a good crop of seeds every year and seeds collected locally are supplied to other forest divisions in and outside Madras State.

In Bogur in Experimental plot 83'42, the species has reached a height of 39 foot in 1946 at age of four years. There are now 10 trees which yield a good crop of seeds every year.

120. *Cassia javanica* (*Java cassia*).—It is indigenous in the Malay Isles, Hawii, Mauritius and Philippines. It is cultivated in India in gardens as an avenue tree, on account of its beautiful bright pink flowers. The Principal, Institute of Leather Technology Madras, has pointed out that *Cassia javanica* contains tannins in its bark, fruits and flowers. The analytical data as furnished by him are given below :—

TABLE XXXVIII.—*Analytical data of Cassia javanica.*

Particulars.	*Barks percentage.*	*Fruits percentage.*	*Leaves percentage.*	*Flowers percentage.*
Moisture	10·00	10·00	10·00	10·00
Insolubles	61·00	61·12	63·18	44·86
Tannins	17·97	24·56	10·61	28·40
Non-tannins	11·03	4·32	17·21	16·74
Colour of analytical solution—				
Red	2·0	1·5	1·5	1·5
Yellow	6·6	3·5	6·0	7·0
P.H. of analytical solution.	4·8	5·2	4·8	4·4

It may be pointed out that *Cassia javanica* contains a higher percentage of tannin in its bark, leaves and pods than *Cassia siamea* as noted below :—

TABLE XXXIX.—*Statement showing percentage of tannin content in Cassia javanica and C. siamea.*

Percentage of tannin in	*Cassia javanica.*	*Cassia siamea.*
		PER CENT.
Bark	17·97	9
Leaves	10·61	7
Pods	24·56	6

On account of the importance of *Cassia javanica* in the Tanning Industry, which is a Key Industry in the Madras State, experiments were started in the research centres at Denkanikota, Nilambur, Vemburili, Rameshwaram and Markanum. Seeds for these experiments were obtained from nurserymen. Seeds weigh 185 to the ounce (or 2,960 to the pound). Germination tests of the seeds show 12·5 per cent germinative capacity and plant per cent.

121. *Casuarina cunninghamiana*.—Seeds of this species received from the Central Silviculturist were sown in 1954 in Dhoni Nursery. The seedlings were planted out in Dhoni and Topslip Gardens in 1954 and the results are furnished in the following table :—

TABLE XXXIX-A.—*Growth of Casuarina cunninghamiana.*

Name of Research Centre.	*Expremental garden number.*	*Method of planting.*	*Year of planting.*	*Age in years*	*Per centage of Survivals.*	*Mean height Ft.*	*Remarks.*
Topslip ..	489/54	Planting basket plants.	1954	2	..	..	Species came up well; but badly browsed by wild game.
Dhoni ..	441/54	Do.	1954	1½	83	4	Plants subsequently burnt by fire.
Dhoni ..	439/54	Do.	1954	1½	83	4	..
Top slip..	510/55	Do.	1955	1	88	2	Damaged by game.
Nilambur..	10/55	Do.	1955	1	4	3	..

It is too early to draw any conclusions on the suitability of the species. Further observations are required.

122. *Casuarina junghuhniana*.—The Thailand casuarina which was introduced into Markanum Centre from Thailand has been identified as *Casuarina junghuhniana*, Miq. Var. 5 (Syn. *Casuarina montana*, Jung) by the Forest Research Institute, Bogor, Indonesia. Subsequently, the plant was identified as a hybrid, viz., *Casuarina equisetifolia*—Linn. X. *C. junghuhniana*—Miq.

Fifty layered cuttings received from Thailand were planted in Markanum 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, 2½ years after planting, gave an average height of 25 feet 6 inches for the 21 plants and a maximum height of 28 feet. Successful vegetative propagation of this species is possible through airlayerings. The trees have not so far flowered or fruited.

122-A. *Cedrela odorata*—(*Jamaica or Honduras or Central American Cedar*).—It is a handsome tree on account of its long graceful pinnate leaves. It grows to a height of 100 feet and a girth of 15 feet. The wood is similar to that of *Cedrela toona* (Indian Red Cedar) but more fragrant. It is well-known as the usual wood for Cigar-boxes. It is an important timber and cabinet wood in the Tropics, and is reasonably immune from white-ants. It is indigenous in Central America, and the West Indies Islands.

Seeds received in 1954 from Jamaica and Equador did not germinate. There are now three trees in N lambur and one tree near Mount Stuart Bungalow in Topslip. The age of these trees is unknown. But these trees produce good seeds every year and it is not uncommon to find the seedlings germinating around the mother trees from seeds dispersed by wind.

During 1955, seeds collected from Topslip were sown in nurseries at Topslip and N.lambur. *In Experimental grounds* 514/55 of *Topslip*, entire transplants were planted in the deciduous garden in July 1955. By end of March 1956, there were 88 per cent survivals with a mean height of 17 inches.

Further observations will be made and the experiments will be repeated.

123. *Ceratonia siliqua* (*The Carob Tree*).—This is a small tree, native of Cyprus and s 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, Cyprus and were sown in three centres, viz., Topslip, Dhoni and Bogur, and the results are furnished below :—

Seed weight	154 per oz.
Germinative 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, viz.—

A—Control—no treatment :

B—Soaking in cold water for 24 hours ;

C—Soaking in hot water for 24 hours ;

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

The results were as follows :—

	Garmin tive 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 Cyprus 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. The seedlings were basketted and tried, but there were no survivals. There are a few seedlings in the nursery at both Nilambur and Topslip and these will be allowed to grow without transplanting.

In Begur six bamboo tube plants out of 98 are surviving with a height of 4 inches.

124. *Chlorophora excelsa.*—This species, commonly known as "African Teak" is distributed over extensive areas in Africa. It is said to attain a height of over 100 feet in its natural habitat, where it is used for a large number of purposes, such as, furniture joinery, coach building, paving, co-operages, motor boats and yachts. It is reputed to be proof against rot and termite attack.

This species was introduced in the Madras State in 1941 in Experimental Gardens in Nilambur, Wynaad, Palghat and Topslip Centres. Details of the existing trees in the different centres are furnished below —

TABLE XL.—*Details of* Chlorophora excelsa *plant.*

Research centre	*Raised in year.*	*Age in years.*	*Number of plants.*	*Mean height.*	*Mean girth.*	*Maximum height.*	*Maximum girth.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				FT.	INCH.	FT.	INCH.
1 Dhoni ..	1941-42	14	40	40	25	60	50
2 Topslip ..	1941	15	48	40	32	60	48
3 Nilambur Edacode 1941 pln. Compt. 490.	1941	15	260	30	28	..	..
4 Begur ..	1939	17	88	37	..	..	..
5 Kannoth ..	1939	17	63	..	..	74	..

In Wynaad the plant was raised through cuttings and stumps which gave good results.

In Topslip, the mean height and girth of the 1941 Teak Plantation adjoining the *Chlorophora excelsa* patch is only 35 feet and 30 inches respectively. Hence it is seen that *Chlorophora excelsa* is faster in both height and diameter increment than teak.

125. *Cinnamomum camphora* (*Japan or Formosa Camphor trees*).—This is a native of Japan, Formosa and China, which yields camphor by the wet distillation of the wood leaves and twigs. On account of the synthetic manufacture of camphor, the importance of this plant has waned in recent years. Besides the herbacious fast growing *Ocimum kilimanjaricum* also comes up well as in the medium to high rainfall tracts of this State and this can be grown comparatively easily, the importance of *Cinnamomum camphora* is well nigh gone.

The following plants exist in the Research Gardens :—

TABLE XLI.—*Particulars of* Cinnamomum camphora.

Locality.	*Method of propagation.*	*Year of propagation.*	*Age in years.*	*Number now surviving.*	*Heights.*		
					Maximum.	*Average.*	*Minimum.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					FT.	FT.	INCH.
Begur 281/46 ..	Transplants.	1946	10	32/120	..	8·6	..
Kannoth 252/50 ..	Do.	1950	6	42/50	..	12·8	..
Begur 93/50 ..	Do.	1944	12	24	..	..	3·6 Dbh.
Topslip 92/51 ..	Do.	1946	10	48	..	9·8	..
Do. ..	Do	1945	11	7	..	25	..
Aramby, Nilgiris ..	Do.	1943	13	1	..	20	Girth 2.
Do. ..	Do.	..	..	13	13	8·5	4·2

126. *Cinnamomum camphora—E. P.* 92/51 *of South Coimbatore.*—Two hundred *Cinnamomum camphora* seedlings were planted in 1946 in E.G. 339 1946 of Topslip at an espacement of 6i × 6′ in the open (without top canopy). The Annual Report for 1949–50 has 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 7 years and 42 inches height in three years respectively. In March 1956, There were 48 numbered plants (Total number of plants surviving 97), with a mean height of 9 feet 8 inches at the age of 10 years. In November 1955, sixty teak poles which were suppressing the *Cinnamomum camphora* were removed The plants have responded to the opening up of the canopy. So far no flowering has been noticed.

127. *Cinnamomum camphora.—E. G.* 339/46 *of South Coimbatore.*—E.G. 339/46 was converted into E.P. 92/51 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 9 feet 8 inches. The plot is reported to have suffered from a ground fire in 1953–54. Hence lesser mean height in 1953–54.

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

TABLE XLII.—*Height growth of* Cinnamomum camphora.

Year.	*Age in years.*	*Mean height of 48 numbered steams.*		*Remarks.*
		FEET.	INCHES.	
1952	6	7	2	
1953	7	7	8	
1954	8	6	8	
1955	9	8	3	
1956	10	9	8	

Note.—In addition there are 7 trees of this species raised in 1945 with an average height of 25 feet in the adjecent area. They too have grown bushy with about 4 shoots per stool with girth 10″ to 12″. They have not yet flowered.

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

TABLE XLIII.—Cinnamomum zeylanicum—1956 *measurements.*

Research Centre.	*E. P. or. E.G. Number.*	*Sandy variety.*		*Laterite variety*		*Remarks.*
			FT, INCH		FT. INCH	
Kannoth (all one year old transplants).	E.P. 75/40	85	20 4	..	..	Top broken.
	E.P. 76/40	..	..	55	16 1	
	E.G. 237/50	70	10 4	..	..	
	E.G. 238/50	..	..	50	10 4	
	E.G. 269/51	60	7 9	..	..	
	E.G. 271/51	..	..	76	7 2	

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 XLIV.—Cinnamomum zeylanicum—*comparison on the best method of raising*—1956 *measurements.*

Centre.	*E. G. No.*	*Transplants.*		*Stumps.*		*Cuttings.*	
		Survival per cent.	*Height.* FT. IN.	*Survival. per cent*	*Height.* FT. IN.	*Survival per cent.*	*Height.* FT. IN.
Kannoth. ..	241/50 Sandy.	47	11 4	53	12 2	40	11 1
Do. ..	242/50 Laterite.	30	10 4	43	12 3	30	11 4
Do. ..	256/51 Sandy.	43	6 1	47	5 5	23	6 1
Do. ..	257/51 Laterite.	53	7 1	30	6 11	20	5 9

The indications are that both transplants and stump plants come up well with a survival per cent of 43 and a height of 10 feet to 12 feet in six years. There does not seem to be any difference in growth or survival per cent between the sandy and laterite varieties.

In the paragraph 70 of the Report on Silvicultural Research in Madras State for 1953–54 it was stated—

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

The results of the above four experiments indicate that the species can thrive well in the open attaining a height of 10 feet to 12 feet in six years, whereas under canopy manipulation a height of 18 to 20 feet was attained only in 20 years.

129. *Underplanting of Cinnamomum zeylanicum 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, Topslip and Nilambur. The results obtained are tabulated below :—

TABLE XLV.—*Results of Underplanting Experiment on* Cinnamomum zeylanicum.

Serial. number Name of centre.	*Locality underplanted.*	*Planting material used.*	*Survival.*	*Height growth.*
				INCHES
1 Nilambur (Sandy variety) ..	E.P. 188/54 in 1924 Regional Area Plantation 30 years old).	Seedlings 2 years old.	Nil	
		Stumps of 2 yearls old plants.	Nil.	
2 Topslip (Sandy variety)	E. G. 487/54 in 1937 R.A. (i.e., Plantation 17 years old).	Stumps of 2 years old. seedlings.	24/60. Sprouting Survival in Feb. : 2/60.	
3 Kannoth (Sandy variety	E.G. 301/54 (Teak Preservation plot of 1876 79 years old.	Sowing : 50. Transplants 1 year old ;	Nil.	..
		Stumps :	36 per cent.	18
			26 per cent.	6
4 Kannoth (Laterite variety).	E.G. 302/54	Do.	Sowing : 50 Transplants 1 year old : 50.	Nil. ..
				56 per cent. 23
			Stumps : 50.	32 per cent. 6
5 Begur (Sandy variety) ..	E.G. 477/55 1924 Teak Pln. Age 31 years	One year Transplants 156.	88 per cent	13.2
6 Begur (Laterite variety) ..	E.G. 478/55 1924 R.A. (Plantation 31 years old).	One year Transplants: 156.	88 per cent.	5·7

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 percent of both stumps and transplants, were poor. In the Teak Preservation Plot of Kannoth (age 78 years) one year old transplants have given 36 per cent to 56 per cent survival and height growth of 18 inches .23 inches for sandy and laterite varieties respectively.

Planting one-year old seedlings will be tried once again in the failed E.P. 188/54 of Nilambur and E.G. 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 10 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.

130. *Introduction of Cinnamomum zeylanicum (Laterite variety) as an under plant in evergreen forests.*- This was tried for the first time during 1954–55 at Topslip (E.G. 498/54 two-year old seedlings; and E.G. 500/54 stumps of two-year old plants). In each of these experiments there are two treatments, viz.-

A --Removing the shrubby growth only the planting ;

B --Removing the middle storey and shrubby growth and planting.

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

TABLE XLVI—*Cinnamomum zeylanicum*—1956 *measurements.*

Experimental Ground Number.	*Treatment.*	*Survival*	*Mean height.*
		PER CENT	FEET.
498/54 Seedlings	Shrubby growth only removed.	70	2¼
	Shrubby growth and middle storey removed.	61	3
500/54 Stumps.	Shrubby growth only removed.	Nil.	..
	Shrubby growth and middle storey removed.	Nil.	..

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

131. *Introduction of Cinnamomum zeylanicum (Sandy variety) - E.G.* 501/54, *Topslp—Introduction of Cinnamomum zeylanicum (Sandy variety) by stumps and seedlings as an underplant in Karianshola Evergreen Forests.*—After removing shrubby undrgrowth in

E.G. 501/54 two-year old 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 roults at the end of 1955–56 were as follows :—

Transplants—58 per cent survival with an average height of two feet.

Stumps — Sprouting—Nil.

The experiment will be watched further.

132. *Copernicia cerifera* (*Carnuba wax palm*).-Experiments with this species were continued during the year under report. No new sowings were done and only the previous year's plants were kept under observation.

(i) *Topslip.*—The two seedlings of 1951 in the Research Forester's premises at Topslip have grown to a height of two feet (including leaf blades). The overground stem is four inches high with a cluster of 8 to 12 leaves.

Twenty seedlings were put in 1954 in Topslip Deciduous Gardens (E.G. 482/54) and now there are only 13 survivals with only leaf blades. Overground stems have not been formed yet.

(ii) *Dhoni.*--Out of 18 seedlings put in 1953 (E.G. 423/53) there were only five survivals in December 1955 with a few leaves above ground. The stem has not yet formed.

1954 in E.G. 443, 28 seedlings were put in. There were seven seedlings surviving in December 1955.

During March 1955, a forest fire swept over the area planted with *Copernicia cerifera* and burnt away the leaf blades. It will be watched whether new leaves will come from underground.

(iii) *Kannoth* :—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.

133. *Crocus kashmiriana* (*Saffron*)—*Introduction in Ootacumund and Topslip.*—This is a small showy bulbous plant 6 inches to 10 inches high. It is a native of South Europe, cultivated in Spain, France, Turkey, Persia, Kashmir and China, for the sake of the orange coloured stigmas of the flowers. From these, the true saffron commerce is obtained. This is employed in India, chiefly on medicine and as a colouring and flavourng agent for food stuffs. It is propagated from bulbs (corms), which when once established, may be left in the ground, undisturbed, for 10 or 15 years.

Saffron bulbs received from Kashmir were planted in Blackbridge Research Nursery, and in Doddabetta Forest Guard's quarters, Ootacamund, in November 1955. Out of 16 bulbs planted there were only 4 survivals in both localities even though the bulbs sprouted well and gave shoots up to 12 inches high.

Eight bulbs were handed over to Curator, Government Botanical Gardens, Ootacamund, for planting. It is reported that all the bulbs put on fresh growth by the end of the year and subsequently entered a dormant stage.

*E.G.*530/55, *Topslip.*—Another consignment of Saffron bulbs received from Kashmir was planted in Topslip. The survival were nil. The indications are that the plant does not thrive at low elevations such as Topslip.

134. *Dalbergia cochinchinensis.—E.G.* 378/50—*Palghat.*—Twenty one entire transplants of mean height 8 inches, put in Dhoni deciduous garden, in 1950, are growing up well. In 1956 at the age of six years there were 16 survivals out of 21 with a mean height of 22 feet and a girth of 10 inches.

135. *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.

136. Experiments with *Dalbergia sissoo* were continued in Begur, Topslip Dhoni and Denkanikota. Transplanting one-year old seedlings with or without a Kumri crop, such as, Ragi (*Elucine coracana*) or Thenai (*Setaria italica*) or Horsegram (*Dolichos biflorious*) appears to be the best method of raising the species. Transplanting two year old plants and stumps planting one of one-year, two-years old plants are also successful.

TABLE XLVII.—*Results of trials of* SISSU.

Research centre.	*Experimental ground or Experimental plot. number.*	*Age in years.*	*Mean height.*	*Survival per cent.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)
			FT. INC.		
Begur	.. E.G. 369/50.	6	4 9	65	One-year old transplants.
Do.	.. E.G. 416/52.	4	1 9	27	Two-years old transplants.
Dhoni	.. E.P. 181/52.	4	11	66	One-year old transplants.
Do.	.. E.P. 198/53	3	9	57	One year old transplants.
Topslip	.. E.G. 460/53	3	5	54	
Dhoni	.. E. G. 410/52.	4	16 2	87	Direct sowing.
Do.	.. Do.	4	16·2	70	Stumps.
Do.	.. Do. ..	4	16·0	70	Transplants.

137. *Dalbergia sissoo.—E.Gs.* 61/47 *and* 62/48, *Denkanikota.*—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 re-afforesting 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 Conservators Plots. The results are generally quite satisfactory.

138. *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) *E. gomphocephala.*
(3) *E. patens.*
(4) *E. rudis.*
(5) *E. redunca.*
(6) *E. marginata.*
(7) *E. diversicolor.*
(8) *E. saligna.*
(9) *E. grandis.*

139. *Eucalyptus globulus* (*Blue gum*).—This was introduced in the Nilgiris in the year 1843. It has acclamatised itself 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 (a 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 Eucalyptus will be dealt with in the alphabetical order of thier 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.

139-A. *Eucalyptus species.—Introduction in the Plains Districts in the East Coast.*—Introduction of several species of Eucalyptus on an experimental scale in the research gardens of Marakanum Vemburili and Rameshwaram, was taken up during the year.

The results were fairly satisfactory. *Eucalyptus grandis* and *E. regnans* showed specially rapid height growth. The survival per cent and height growth for the several species are shown in the following table:

TABLE XLVII–A.—*Result of trials of various species of Eucalyptus in Research Gardens during* 1955-56.

Species.	*Research Centre.*	*E.G. Number.*	*Date of planting.*	*Survival per cent.*	*Height in March* 1956.
					INCH.
1 *Eucalyptus patens.*	Markamum	42	July 1954	100	33·75
2 *E. gamphocephala.*	Markamum	44	Do.	100	31·8
	Rameswaram	14	March 1955.	100	10·38
3 *E. hybrid*	Markamum	30	October 1955	73	11·3
	Vemburili	6	November 1955.	100	18
	Rameswaram	33	January 1955.	98	13·7
	Ootacamund	23	October 1955	90	6·3
4 *E. citriodora*	Vemburili	7	November 1955.	100	12
	Topslip	491	September 1954.	87	38·3

140. *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 the Forest Research Institute will be furnished in the next year's report.

Eucalyptus citriodora.—Experiments. (i) *E.G.* 462/54, *Begur.* One hundred tubed plants were planted at an espacement of 9 feet × 9 feet on 8th July 1954 in one foot cube pits. By March 1956 therewere 54 per cent survivals with a mean height of 5 feet 7 inches and a maximum height of 10 feet in two years.

(ii) *E.G.* 456/54, *Begur.*—This is a comparison experiment between direct sowings at 10 seeds per stake and planting tubed plants 3 inches to 4 inches hight (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 March 1956 shows 10 per cent survival for sowing as against 67 per cent for tubed plants. The mean height of tubed plants is 9.5 feet against 10 feet for plants for direct sowings. The preliminary indication is therefore that, while one year old tubed plants give better survival per cent than direct sowings, there is no difference as regards height growth.

(iii) *E.G.* 456/54, *Dhoni.*—Naked seedlings of 3 inches to 6 inches high were got from Bennari Nursery to Dhoni and put in Bamboo baskets in June 1954. The seedlings were planted in July1954 at 9 feet × 9 feet espacement in deciduous ResearchGarden. In December 1955, there were 20 per cent survivals with an average height of 8 feet and a maximum height of 10 feet. The plot was burnt by fire in March 1956.

(iv) *E.G.* 491/54, *Topsslip.* Seeds were sown in Bamboo baskets in July 1954. When the seedlings were 3 inches to 6 inches high in 1954, they were planted out at an espacement of 9 feet × 9 feet in 100 stakes. In February 1955, at age one yearthe survivals were 91/100 and average height was 38 inches and maximum height 64 inches. By the end of two years, the survival was 76 per cent due to breaking down of the plants by vild game like deer and Sambhur which rub their horns on the plants. But in two years the mean height was 14 feet 9 inches and maximum height was 24 feet.

(v) *E.G.* 305/55, *Topslip.*—Seedlings raised in Bamboo tubes by direct sowing in November 1955 were used. The height of seedlings at the time of planting was 8 inches. At the end of one year there are 89 per cent survivals with a mean and maximum heights of 6 feet and 12 feet respectively.

(vi) *E.G.* 12/55, *Nilambur.*—Nine months old seedlings basketted in Dhoni were planted in Nilambur in August 1955. As the seedlings were unhealthy and lanky when planted out, there are now 9 per cent survivals with a mean height of two feet.

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.

141. *Eucalyptus globulus* (*Blue gum*). This species was first introduced in Nilgiris in 1843 by Capt. Cotton 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 pace for early naturalisation of an Australian species in this country goes to Blue gum. From 1856 extensive areas were planted with Blue gum as it solved the fuel problem. At present there is a scheme to plant Blue gum on parts of the Wenlock Downs on a very extensive scale. Blue gum is now worked on a coppice rotation of 15 years for three sucessive rotations after which the area is re-planted with seedlings. With increase in area and the importance it has assumed, research on various directions has become necessary.

142. ***Eucalyptus globulous* (*Blue gum*).—*Treee Increment Plot (1) of Nilgiris*.**—The Tree Increment Plot at Aramby, Nilgiris. 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 treo in peninsular India. The mean girth of the trees is 10 feet 11 inches at age 91 years in 1954.

143. *Eucalyptus globulus*.—*Manurial experiment*.—*E.P.25/54. Pykara, Nilgiris*.—This experiment was stared in July 1954,to ascertain whether the growth of the plants can be accelerated by the addition of N.P.K. Fertiliser Mixture. There were two treatments, viz.—

A—Control—No. manure added ;

B—2 oz. N. P. K. manure mixture added at the time of planting.

Mos:ed Blue gum seedlings were planted in one foot cube pits Lat st measu.ements in March 1956, which are furnished below show tnat tne addition of 2 oz. of maure mixture is definitely benef.cial in promoting height growth and increasing survival per cent. Further observations will be recorded.

TABLE—XLVIII.—Eucalyptus globulus—*Manurial Experiment*.

	A Control.	*B* 2 oz. of manure.
Number put in	220	220
Survival per cent	62	71
Mean height	2' 1"	1' 1"

144. *Eucalyptus globulus* (*Blue gum*)—*Experiment on lopping of leaves more than once during the rotation*.—At present in the Government plantations the leaves are lopped only in the year prior to the year of clear-felling at the rotation age of 15 years. The yield of leaves is about 15,000 to 20,000 lb.. per acre, yielding a revenue of about Rs. 50 to Rs. 150 per acre. The actual lease amounts during the three years from 1952-53, for the Cairnhill Coupe were Rs. 200, 35, 85, 125 and 40 respectively per acre. Private plantation owners are known to lop the leaves more than once during the rotation at intervals of three or four years until actually the trees lose vitality and become dead. This is so because the revenue obtained from the leaves for distillation of oil is substantial and private garden owners do not hesitate to kill the tree by frequent lopping of leaves.

An experiment was started during the year to find out whether Blue gum trees can be lopped more than once during the rotation of 15 years without adversely affecting the volume increment of the species and in any case without killing the trees.

For this purpose an area of 1·63 acres in the 1951 Blue gum Plantation of Muthorai, in the Nilgiris Forest Division, was selected and divided into eight sub-plots with four treatments as follows :—

A—4 loppings at ages 4, 8, 12, 15 years.
B—3 loppings at ages 5, 10, 15 years.
C—2 loppings at ages 8, 15 years.
D—1 lopping at age 15 years.

Lopping was done in the sub-plots alloted to 'A' treatment during the year.

The object of the experiment is to find out whether lopping adversely reduces the volume increments of the trees, and if so, whether the increased revenue from the leaves will counter balance the loss of revenue due to decrease in volume production.

During 1956, lopping of leaves was done in two sub-plots, allotted to Treatment 'A' The branches were cut for two-third of the height of the crown, leaving the top one-third of the crown untouched. The yield of leaves from the two sub-plots (aggregating to 0·2 acre) was 1,200 lb. of cleaned leaves free from twigs and branches, or the yield of leaves only per acre at age 4 years is 6,000 lb. 1,200 lb. of cleaned leaves fetched Rs. 9 when sold and the fagged wood when sold fetched Rs. 2. Hence the total revenue for this operation was Rs. 11 for 0.2 acre or per acre Rs. 55.

The experiment is in progress and final results will be available only after the lapse of about 15 years.

145. *Eucalyptus globulus* (*Blue gum*).—***Experiment on the reduction of coppice shoots*.**—The silvicultural system prescribed for the management of Eucalyptus plantations in the Nilgiris Forest Division is the coppice system with a rotation of 15 years. With a view to offset the continued decrease in vitality of the stools in producing coppice shoots once in every four coppice rotations, seedlings will be planted.

Blue gum coppices very well. sending numerous coppice shoots from the exposed cambium and from the periphery of the stool. The young coppice shoots may be as numerous as 10 to 30 per stool depending upon the size of the stump. The number of coppice shoots gets thinned naturally leaving only about 4 shoots in the fifth year and about three shoots at the rotation age of 15 years.

The object of the experiment is to find out whether it is advisable to reduce the number of coppice shoots in a one year old Blue gum coppice plantation. Here there are four treatments as follows :—

A—Control—all coppice shoots left intact.
B—Number of coppice shoots reduced to 2 per stool.
C—Number of copplice shoots reduced to 2 per stool.
D—Number of coppice shoots reduced to 4 per stool.

buttons. There are several button factories in India including two at Coimbatore, which import the nuts from the Sudan and manufacture buttons.

Seeds obtained from Egypt were sown in Research Nurseries and the following plants exist :—

Dhoni.—Three plants with 4 to 7 leaves measuring 2 feet high. Overground stem has not yet formed.

Topslip.—One similar plant in the Nursery.

During 1954–55, seeds were again obtained from Egypt and sown in Topslip and Dhoni nurseries, and six seedlings have been planted in the range compound at Olavakkot and Topslip Forester's quarters.

149. *Morus alba* (*Mulberry*).—This is probably a native of China. This species has attained great importance on account of the keen demand for the wood in the sports goods industry and also because it is a good host to the silk worms in the Sericulture Industry. This has been cultivated extensively in irrigated plantations in the Punjab for use in the sports good 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 1954–55, seeds were obtained from Sericultural Expert Kollegal and from Meerut and supplied to District Forest Officers, Vellore East, Vellore West, Salem South, Coimbatore South, Madurai West and Salem North Divisions for raising plantations.

Topslip E. G. 511/55.—Eight months old entire transplants, of an average height of 15 inches were transplanted in one foot cube pits in Topslip, in June 1955. By March 1956, there were 97 per cent survivals. The seedlings were very badly browsed by deer and sambhar and the survivals were bushy with an average height of only 9 inches. Hence adequate game proof fencing is necessary for its development in a locality like Topslip.

E.G. 138/55, *Denkanikota.*—In this a comparison experiment was made between (i) naked seedlings ; (ii) stumps ; (iii) cuttings ; and (iv) direct sowings. Direct sowings were a complete failure. In one year, the results are as follows.—

TABLE L.—*Comparison Experiment on Morus alba.*

	Survivals.		*Mean height in one year.*		*Remarks.*
			FEET.	INCHES	
I	Naked transplants.	150/150	1	2	Planted 1 foot 2 inches plants.
II	Stumps ..	50/50	3	4	Comes up very well.
III	Cuttings ..	29/50	4	7	Do.
IV	Direct sowings. ..		..	..	
V	Basket plants ..	50/50	1	7	
VI	Naked tranplants.	50/50	1	5	Planted 6 inches high plants

According to results of experiments in previous years, the best method of raising the plant is through transplanting one-year transplants.

150. *Ochroma lagopus* (*Balsa*).—This is a tree which is a native of tropical America. It has an extremely soft height wood much used in air-craft manufacture. Wood of this species was sent to the Hindustan Aircraft, Ltd., 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 c.ft. 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 seedlings with containers (Bamboo tubes). The seeds are sown in bamboo tubes filled with earth and seedlings raised. When they are 4 inches to 9 inches high, they are planted out.

The wood has an appreciable use in production of cinema films. In stunt pictures, where a man smashes his adversary through a table or chair or in which a house collapses over any person, or furniture, etc., are made of Balsa wood. During the year, Balsa wood was supplied to two film companies in Madras State and their reports are awaited.

Small consignments of the wood were supplied to a manufacturer of toy air craft in Calcutta. Some of these toy air crafts are fitted with miniature petrol engines and can remain in the air for a few minutes. It is reported that the wood was eminently useful for this purpose and the question of undertaking extensive plantations in the Madras State for supply to this manufacture is under consideration.

(i) *E.P. No.* 165/49, *Nilambur.*—There are now 65 trees with an average height of 70 feet in seven years. The average girth at B.H. is 36 inches.

(ii) *Dhoni Balsa Plantations of* 1951 *and* 1953 (*District Plantations*).—In five years, the tree attains an average height of 30 feet with a clean bole of 10 feet, where a branching into three branches takes place. In another E.G., in three years the height growth was 24 feet with a B.H. girth of 22 inches with a clean bole of 10 feet.

(iii) *E.P. No.* 180/49, *Dhoni.*—Mean height of 47 feet in seven years with B.H. girth of 21 inches.

(iv) *E.G. No.* 387/49, *Topslip.*—There are 33 trees with an average height of 27 feet in seven years.

(v) *E.G. No* 253/50, *Kannoth.*—The average height of the trees is 35.6′ feet in six years at an espacement of 6′ × 6′.

(vi) *E.G. No* 348/49, *Begur.*—The mean height is 31.7 feet in seven years.

An analysis of the figures of growth for the various centers indicates that the growth and development of the species is greater in an area of greater rainfall such as Nilambur and Kannoth, than in areas of lesser rainfall such as Topslip and Begur. A graph showing the rate of development of the species is attached.

151. *Ocimum camphora* (*Syn. O. kilimandjaricum*).—This species was tried in Topslip, Dhone, Buyer 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 1954–55 a plot of half acre was divided into two sub-plots. In one the existing growth was clearfelled, burnt and seeds of *Ocimum camphora* sown and broadcast at the rate of 2 lb. per acre and at the same time teak stumps were put at an espacement of 6′ × 6′. In the other sub-plot, the same treatment was given with the addition of hoeing the soil to a depth of 3 inches before broadcast. Sowing of seeds and teak stumps were put in. Raking of soil before sowing increases the yield of leaves by about 2 to 3 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 were done in 1955–56 in E.G. No. 14/55 of Nilambur and E.G. No. 525/55 of Topslip, by broadcast sowing *Ocimum camphora* seeds in a one-year old teak plantation. Due to late sowings in an area already covered up with weeds, the experiment was a failure. This experiment will be repeated again next year.

Plucking of the leaves was done thrice during 1954–55 (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 figures are furnished below for all the three pluckings taken together :—

TABLE LI. *I. Seeds sown after raking the soil* :—

Serial number and Research Centre.	*Mature leaves or tender leaves.*	*Green weight per acre in lb.*	*Dry weight per acre in lb.*	*Total distillage in dry weight in lb*	*Percentage of Camphor in total distillage.*	*Percentage of Camphor on dry weight of leaves.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1 Topslip ..	Mature ..	14,050	1,893	5·11	40 to 50 per cent in all cases.	2·2
2 Do. ..	Tender ..	3,920	710	6·48		2·9
3 Dhoni ..	Mature ..	3,920	590	3·96		1·8
4 Do. ..	Tender ..	960	180	4·87		2·2
5 Begur ..	Mature ..	3,736	716	3·65		1·6
6 Do. ..	Tender ..	1,444	284	4·83		2·0

TABLE LII.—*II. Seeds sown without raking 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
4 Do. ..	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

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 yield of dry leaves per acre for all the three pluckings 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 LIII.—*Camparative statement on the yield of camphor.*

Centre.	*Particulars of soil working.*	*Tender leave.*	*Mature leave.*
(1)	(2)	(3)	(4)
Topslip ..	Raked ..	2·9	2·3
Topslip ..	Unraked ..	2·7	2·2
Dhoni ..	Raked ..	2·2	1·8
Dhoni ..	Unraked ..	2·2	1·9
Dhoni ..	Raked ..	2·0	1·6
Begur ..	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, Minor Forest Products Branch, Forest Research Institute, Dehra Dun, the percentage of total distillage (O moisture basis) varies from 4 to 6. Of this total distillage the Camphor content is 40 per cent 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 diffe entiating 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 foot to 2 feet above ground level and utilize all the pol ard 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. This method of plucking the leaves could not be tried in 1955–56 due to failure of sowings in Begur and Topslip.

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 (annas 10 per lb. of total distillage being the rate furnished by the Officer-in-charge, M.F.P. Branch, Forest Research Institute, Dehra Dun). 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 p esent 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. Further experiments on improved methods of cultivation and harvesting of the leaves of *Ocimum camphora* will be undertaken during 1956–57 and further indications will be furnished in the next Annual Report.

152. *Pinus caribae* (*Slash Pine*)—*E.G. No.* 17/55, *Ootacamund.*—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 Centre at Ootacamund. The seeds were sown in the Aramby Research Nursery in 1953–54 and two-year old seedlings about 2 inches to 4 inches in height were planted out in Brooklands in June 1955. In March 1956, there were 17/55 survivals. The plants have not shown any growth so far. The height of the plants is only 2 inches to 4 inches. The growth is therefore not at all encouraging.

153. *Pinus taeda* (*Loblolly Pine*).—This is a native of Southern and Eastern United States of America. It yields timber for general purposes and is sometimes tapped for resin.

Seeds obtained from United States America were sown in nursery and two seedlings were planted in the Aramby Research Garden during 1950. In March 1956, their heights were 9 feet and 6 feet respectively after six years.

153 A. *Prosopis juliflora* (*Mesquite*).—This species has achieved great importance in Madras State on account of its use in the artificial regenera ion of dry fuel forests. Its chief virtue for this purpose lies in its ability to thrive in dry and arid areas. It forms a good live fence if sown in lines. In suitable areas such as the Padugais of Tiruchirappalli district and parts of Madurai and Ramanathapuram districts, it regenerates itself naturally with ease. It is fast growing and yields pods which are useful for feeding goats and sheep. It is practically immune to browsing by goats.

For this reason, it is used extensively in the artificial regeneration of dry fuel forests. This species is being tried in the sandy areas in Rameshwaram Islands. Results will be available next year.

154. *Pterocarpus dalbergioides.*—In paragraph 67 of the Annual Report on Silvicultural Research for 1953–54 it was reported that the species could be raised successfully in Kannoth where it had attained the height of 82 feet in 12 years. This is based on the results of experimental plots 64/39 and 82/41. In order to collect further data on the growth and development of the species, an area of 0·75 acre in experimental plots 44/39 was formed into a sample plot, S.P. 51 of Kannoth in 1954. Measurement in 1954 showed an average girth of 24 inches in 15 years.

E.G. No 459/53, *Topslip.*—This species is susceptible to great damage by brow ing by game animals and hence this is unsuited to localities liable to brow ing by wild game, such as Tops'ip.

E.G. No 11/55, *Nilambur.*—Transplants one year old planted in August 1955 gave in one year 67 p r cent survivals and 18 inches mean height.

E.G. No 309/54, *Kannoth.*—Two-year old seedlings transplanted in K nnoth have given 47 per cent survivals and a mean height of 4 feet 5 inches in two years excluded two years in the nursery.

A graph sh owing bright and dismeter increment is attached.

155. *Salix babylonica* (*Willow*).—The Willow plot in Double Crossing, Ootacamund, has been maintained. Out of 82 cuttib planted in 1936, there are now only 9 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 LIV—*Rate of growth of Salix baby lonica.*

Year.	*Age in years.*	*Survivals.*	*Mean height in feet.*	*Mean D.B.H. in inches.*
1936	0	82	..	..
1944	8	12	15·8	4·8
1947	11	12	23·3	8·1
1950	14	11	30·2	11·5
1951	15	10	29·9	12·2
1954	18	9	33·9	12·9
1955	19	8	41·0	13·6

During the year 1954-55 the leaves were plucked by hand singly diffe entiating 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 foot to 2 feet above ground level and utilize all the pol ard 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. This method of plucking the leaves could not be tried in 1955–56 due to failure of sowings in Begur and Topslip.

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 (annas 10 per lb. of total distillage being the rate furnished by the Officer-in-charge, M.F.P. Branch, Forest Research Institute, Dehra Dun). 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 p esent 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. Further experiments on improved methods of cultivation and harvesting of the leaves of *Ocimum camphora* will be undertaken during 1956–57 and further indications will be furnished in the next Annual Report.

152. *Pinus caribae* (*Slash Pine*)—*E.G. No.* 17/55, *Ootacamund.*—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 Centre at Ootacamund. The seeds were sown in the Aramby Research Nursery in 1953–54 and two-year old seedlings about 2 inches to 4 inches in height were planted out in Brooklands in June 1955. In March 1956, there were 17/55 survivals. The plants have not shown any growth so far. The height of the plants is only 2 inches to 4 inches. The growth is therefore not at all encouraging.

153. *Pinus taeda* (*Loblolly Pine*).—This is a native of Southern and Eastern United States of America. It yields timber for general purposes and is sometimes tapped for resin.

Seeds obtained from United States America were sown in nursery and two seedlings were planted in the Aramby Research Garden during 1950. In March 1956, their heights were 9 feet and 6 feet respectively after six years.

153 A. *Prosopis juliflora* (*Mesquite*).—This species has achieved great importance in Madras State on account of its use in the artificial regenera'ion of dry fuel forests. Its chief virtue for this purpose lies in its ability to thrive in dry and arid areas. It forms a good live fence if sown in lines. In suitable areas such as the Padugais of Tiruchirappalli district and parts of Madurai and Ramanathapuram districts, it regenerates itself naturally with ease. It is fast growing and yields pods which are useful for feeding goats and sheep. It is practically immune to browsing by goats.

For this reason, it is used extensively in the artificial regeneration of dry fuel forests. This species is being tried in the sandy areas in Rameshwaram Islands. Results will be available next year.

154. *Pterocarpus dalbergioides.*—In paragraph 67 of the Annual Report on Silvicultural Research for 1953–54 it was reported that the species could be raised successfully in Kannoth where it had attained the height of 82 feet in 12 years. This is based on the results of experimental plots 64/39 and 82/41. In order to collect further data on the growth and development of the species, an area of 0·75 acre in experimental plots 44/39 was formed into a sample plot, S.P. 51 of Kannoth in 1954. Measurement in 1954 showed an average girth of 24 inches in 15 years.

E.G. No 459/53, *Topslip.*—This species is susceptible to great damage by browsing by game animals and hence this is unsuited to localities liable to browsing by wild game, such as Topslip.

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E.G. No 309/54, *Kannoth.*—Two-year old seedlings transplanted in Kannoth have given 47 per cent survivals and a mean height of 4 feet 5 inches in two years excluded two years in the nursery.

A graph showing bright and dismeter increment is attached.

155. *Salix babylonica* (*Willow*).—The Willow plot in Double Crossing, Ootacamund, has been maintained. Out of 82 cuttib planted in 1936, there are now only 9 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.—

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Year.	*Age in years.*	*Survivals.*	*Mean height in feet.*	*Mean D.B.H. in inches.*
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1955	19	8	41·0	13·6

155-A. *Stylosanthes gracilies* (*Brazilian Lucarne*).—This is a leguminous green manure and cover crop. It supplies good and nutritions fodder for cattle and is useful in preventing soil erosion if grown in the hills.

This plant can be established either by direct sowings in situ or by cuttings using the tender terminals of stems 5 inches to 7 inches long, cut immediately above a leaf. Established cuttings in baskets can also be planted out.

In E G. No. 8/55 of Nilambur, 50 plants were planted out at 9′ × 9′ espacement. At the end of March 1956, the whole area was covered up by the plant and the prostrate runner was spreading outside the area of the plot. It spreads freely into a thick bush which is able to keep down the growth of grass.

In E.G. No. 526/55 *of Topslip*, 100 patches were planted with cuttings in between *Eucalyptus citriodora* lines. There were 27 per cent survivals. The plants were in flowers.

155-B. *Terminalia myriocarpa, Heurek* (*Hollock*).—It is a gigantic deciduous or semi-deciduous tree with long dropping branches. This tree is found in a tract extending from Nepal eastwards into Assam and Upper Burma ascending the Hills up to 5,000 feet. The wood is considered to be very valuable for plywood and for manufacture of Tea chests.

Attempts at introduction of this species in Madras were taken up from 1949 onwards.

E.P. No 186/52, *Palghat.*—There were 18/50 seedlings at the end of three years with a mean height of 4 feet.

E P. No. 195/53, *Palghat.*—There were 14/40 seedlings at the end of two years with a mean height of 34 inches.

E.G. No·515/55, *Topslip.*—Seeds of Assam origin were sown in nurseries in March 1955. Seedlings of 5 inches in height were planted out as transplants in Topslip. At the end of the year there were 90 per cent survivals. But due to frequent browsing by game animals, they remain bushy with a height of only 9 inches. The plant is not suited for regeneration in localities such as Topslip where game animals are abundant.

(e) *Bamboos and Canes.*

156. *Dendrocalamus strictus.—E.P.* 71/37, *South Coimbatore.*—E.P. *No.*71/37 of South Coimbatore was started in 1937 to find out the best method of raising *Dendrocalamus strictlus* after clear felling and burning a mixed deciduous forest of poor quality, for the purpose of intensive working when mature. The plot has been severely 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 was closed during 1955–56 with the conclusion that in Pollachi Range. *Dendrocalamus strictus* can grow to a height of 30 feet in 17 years and that it can be raised from rhizomes or from nursery seedlings.

157. *Dendrocalamus strictus—E.P. No.* 84/40, *South Coimbatore.*— This Experimental plot was started as an experiment to raise Dendrocalamus strictus with a Ponam crop of Ragi (*Elusine coracana*) in a poor mixed deciduous forest. One year old rhizomes were planted at 9′ × 9′ espacement. Due to heavy and repeated damage by elephants, there are only 15 survivals with a mean height of 19 feet after 10 years. This was closed during 1955–56 as due to heavy damage by wild elephants no conclusions could be drawn.

158. *Dendrocalamus strictus.—E.P.No.* 160/37, *Palghat.*—This was started in 1937 to find out whether *Dendrocalamus strictus* could be raised in a fair quality dry deciduous clearfelled forest with an annual rainfall of 48 inches mostly from South West Monsoon for the purpose of intensive working when mature. One-year old rhizomes of 0·2 inches to 0·3 inches were planted out at an espacement of 12′ × 12′ in standard pits in an area of one acre near Walayar. Casualties were replaced till full stocking was obtained and height measurements recorded once in every year. At the end of the growing season there were 95 per cent survivals and the mean height of the culms was 46 inches. After four years a 50 per cent mechanical thinning out of alternate diagonal rows was carried out. By this operation 2,000 utilizable culms of 2 inches to 5 inches girth were obtained After 16 years there were 35 clumps with an average of 76 culms per clump, with an average height of over 0 feet.

This Experimental plot was closed during the year 1954–55 with the conclusion that it is quite possible to raise *Dendrocalamus stirictus*, in a clearfelled deciduous forest in a locality similar to the above locality by the method of planting out one year old nursery raised culms in one foot cube pits at an espacement of 12′ × 12′. Saleable material is obtainable from thinning from fourth year itself.

159. *Bambusa arundinacea.—E.P. No.* 85/41 *of South Coimbatore*—This was started in 1941 to raise the species with taungya 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.

160. *Importance of Research on Canes.*—The canes or rattans of commerce, are the long slender stems of certain trailing or climbing palms notably of the genus Calamus. In India, these occur in moist places at the edges of fresh water swamps or banks of rivers and streams throughout the evergreen or semi-evergreen forests of Assam, Bengal, West Coast of Madras and Travancore-Cochin. They are comparatively rare in the rest of India. It is, therefore,

only natural that the demand for the material in India is much excess of the supply and in the years following World War II, about 35,000 cwts. of rattans valued at about Rs. 12,00,000 were being annually imported into India, from Burma, Malaya and Indonesia. It is, therefore, necessary to expand the collection of home grown canes and improve their quality by better and more scientific methods of collection, seasoning and processing. It is also necessary to take up artificial regeneration of the better varieties of the indigenous canes as also the two chief imported varieties, namely.—

(i) *Calamus caesius* (chair bottom Cane);

(ii) *Calamus scipionum* (Malacca Cane), suitable for walking sticks.

Research is therefore urgently required on the above subjects.

161. *List of Madras Canes.*—In Madras, as at present constituted, including the West Coast districts of Malabar and South Kanara, there are 11 species of Canes occuring gregariously. They are listed below in the ascending order of their diameter, the thinnest Cane being given at the top. Their usefulness is also indicated.

(1) *Calamus travancoricus.—Bedl.*—Size.—Pencil thickness and below; good for chair bottoms and fine rattan work.

(2) *Calamus metzianus.*—Size.—Same as above.

(3) *Calamus rotang*, Linn.—Pencil thickness and slightly above pencil thickness. Most popular indigenouss cane for chair bottom and fancy work.

(4) *Calamus hookerianus.*—Size—Same as above.

(5) *Calamus pseudotenuis*, Becc.—Size—Up to $\frac{1}{4}$ inches, Good for basket work.

(6) *Calamus gamblei*,—Becc.—Size—Up to $\frac{1}{2}$ inch. Good for walking stick.

(7) *Calamus rivalis.*—Size—Medium size.

(8) *Calamus heugelianus*,—Maart.—Size $\frac{1}{2}$ inch.

(9) *Calamus brandisii*—Becc.—Size— $\frac{1}{2}$ inch to 1 inch.

(10) *Calamus thwaitessi.*—Becc. Size.—$\frac{3}{4}$ inch to 1 inch. Good for furniture frames.

(11) *Calamus rheedii.*—Griff.—Size. 1 inch to 3 inches. Very good for furniture frames.

162. *Calamus species.—Seed weight and Germination tests.*—In view of the importance of artificial regeneration of Canes, nursery experiments were started in Begur, Chandanathode, Kannoth

Dhoni and Topslip Research Centres. The results obtained so far are furnished below.—

TABLE LV.—*Seed weight and germinative capacity of Calamus species.*

Species.	*Seed weight per Oz.*	*Germinative capacity.*	*Plant per cent.*	*Remarks.*
Calamus rotang ..	25 to 50	50 per cent	50 per cent	
C. pseudotenuius ..	6 to 80	6 „	6 „	
C. scipionum ..	93 to 100	..	..	Nil germination.
C. rheedii	(Topslip) 170	..	..	do.
C. caesius	25	..	..	do.

163. *Calamus caesius—Blume.*—This is the imported chair bottom cane. It is a slender cane of diameter $\frac{1}{4}$ inch to $\frac{1}{2}$ inch popular throughout India as Singapore cane and used extensively for chair seats and backs and other fancy articles. This and *Calamus scipionum* are imported into India from Burma, Malaya and Indonesia, the annual imports being about 35,000 cwt. valued at Rs. 12, 00,000. On account of the importance of *Calamus caesius* in the rattan trade, experiments were started on the artificial introduction of the species in India.

Thirty seeds received from Singapore were sown in Topslip Nursery. There was no germination at all. The seed weight is 25 per oz. or 400 per lb.

164. *Calamus gamblei*—Becc.—A cane of medium thickness. It is a cane which is remarkable in that the culms grow singly and not in groups of several culms in a clump. It is suitable for manufacture of walking sticks.

Seed weight—

Germinative capacity—

165. *Calamus pseudotenuis.*—Becc.—(*Western Ghat Rattans.*)—This is found extensively in the West Coast of the present Madras State. The canes are slender of diameter up to $\frac{1}{2}$ inch. These are good for basket work.

Eight nursery seedlings of *Calamus pseudotenuis* with rhizomes were planted in Kariashola near Topslip in foot cube pits. The seedlings at the end of one year were all surviving; but there was no height growth.

166. *Calamus rheedii.*—Griff.—(*Malabar cane*).—This is found extensively on the West Coast of the present Madras State. This is a medium sized cane with a diameter of 1 inch to 3 inches. It is not suitable for taking splits; but it is by far the best cane for making the frames of rattan furniture.

Seed weight.—170 per oz.

Germinative capacity.—Experiment just started.

167. *Calamus rotang*—Linn.—(*Chair bottom cane*).—This is the common rattan of South India, slender (Pencil thickness and slightly above) strong and used extensively for chair backs and seats, fancy basket and box-making, etc. This is quite as good as the imported *Calamus caesius*, as regards strength and durability; but it lacks the lustre of the imported cane. Research is, therefore, necessary on the proper processing of the cane.

168. *Calamus rotang.—E.G.* 433/54, *Chandanathode.*— A comparison experiment with:—

(i) planting natural rhizomes ;

(ii) planting natural seedlings ;

(iii) sowing seeds ;

was started in 1954 in Chandanathode in evergreen forest under cover of full canopy less undergrowth. At the end of two years, rhizomes gave 3 per cent survival with 4 inches mean height and natural seedlings gave 43 per cent survival and 6·2 inches mean height. Direct sowing gave 6 per cent survival and 6 inches mean height. The indications are that natural transplants give the best results so far.

169. *Calamus rotang—Experiment on the period of viability of the seed.—Calamus rotang.*— Seeds obtained from Nilambur Division evergreen sholas were sown on two different dates, e.g., a fortnight after collection and one month after collection. Out of 200 seeds sown a fortnight after collection, only two two seeds have germinated after an interval of 100 days. Cuttings test carried out on seeds sown one month after collection showed that the seeds had perished due to the embryo being loose in the socket even though the seeds looked externally to be sound and viable. Hence, seeds of Calamus species require to be sowm immediately after collection. Further experiments are required.

170. *Calamus scipionum*—Lour.—This is known as Malacca cane. It is a comparatively thick cane with a diameter of $\frac{1}{2}$" to $1\frac{1}{2}$" with internodes about 4 feet long. It is chiefly used for high grade walking sticks as there will be no unsightly node in the stick on account of the long internodes.

Seed weight 83 to 100 per oz. There was no germination at all from seeds received from outside.

171. *Supplies of plant materials of cane.*—During the year 1955–56, one hundred seedlings of *Calamus rheedii* with rhizomes and three cane samples 15 feet long were supplied from Topslip to the Officer-incharge, Minor Forest Produce Branch, Dehra Dun for experimental cultivation. Also 200 rhizomes and 20 lb. of seeds of *Calamus rotang* from Nilambur Centre, were supplied.

172. *Proposals for future Research.*—In future years, on account of the immediate economic importance of the following species, namely—

(1) *Calamus rotang* .. .. } For chair bottoms and fine
(2) *C. travancoricus* .. .. } rattan work.
(3) *C. rheedii* .. .. .. } For furniture frames.
(4) *C. thwaitesii* .. .. }

research will be confined to these species, while at the same time collecting data on other species referred to in paragraph 161 above.

In Bengal a felling cycle of four years is adopted for exploiting canes. In Madras previous experience shows that annual working is extremely deliterious and the felling cycle of four years was introduced in Nilambur and a felling cycle of two years was introduced in Mangalore. Experiments have to be started now to ascertain the best felling cycle for each species of Cane in the Madras State in order to secure sustained annual yield. For the present, these experiments may be confined to the following four species :—

(1) *Calamus travancoricus.* ;

(2) *C. rotang* ;

(3) *C. rheedii* ; and

(4) *C. thwaitesii.*

These experiments will be initiated in the coming year.

(*f*) *Medicinal plants.*

173. *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 surrounded by a slightly brown tissue is commonly found in Nilambur. The other variety with a complete white roots 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 10 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 10,00,000 acres of forests which will yield 200,000 lb annually. The maximum practical yield may be taken as $\frac{1}{4}$ of the potential yield. Hence the sustained annual yield in practice may be about 50,000 lb.

174. 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 prepared and sent to them.

175. *Underplanting of Rauwolfia serpentina in deciduous forests, Amarampalam Range*.—Underplanting of Rauwolfia serpentina in deciduous forests was done on a large scale in Kanhirakadavu in Amarampalam Range in 1955-56. Out of 13,500 natural seedlings planted, 9,983 or 74 per cent were surviving at the end of the year. The plants were healthy and some were beginning to flower and fruit. Further observations will be reported.

176. *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.

E.G. 314 *of* 1954, *Kannoth*.—Here underplanting was done in Teak Permanent Preservation Plot, aged 79 years. The survival here was only 27 per cent in the first year, 5 per cent in the second year and nil in the third year.

E.G. 463/54, *Begur*.—This is located in S. P. No. 36 of Begur in the 1982 regeneration area, i.e., teak plantation, aged 62 years at the time of underplanting. 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 the first year, 57 per cent in the second year and 47 per cent in the third year by March 1956.

The total failure of the plant in Kannoth is due to inability of the seedlings to withstand the heavy drip in the early periods of its growth. In Begur it has come up better with 47 per cent survival after two years. The plant attain a height of 4 inches in two years. They bore flowers but did not produce viable seeds. The indications are that underplanting of *Rauwolfia serpentina* in teak plantaions is not encouraging as the plants are affected on account of drip and formation of earth mounds round the plants.

177. *Rauwolfia serpentina*.—*Nilambur E. Gs.* 1 *of* 1953 *and* 2 *of* 1954 *in the* 1917 *Teak Plantation in S. P. No.* 56 *of Aravallikava*.—*E.G.* 2 *of* 54.—This was inspected on 28th May 1955 by the State Silviculturist Ootacamund, along with Mr. Ramaswamy, Forest Officer, Minor Forest Products Branch Forest Research Institute, Dehra Dun. There were 58 per cent survivals, but the plants were only 1 foot to 1½ feet high with one to three whorls of leaves. The plants had not flowered or fruited. Also a few plants uprooted at random showed that they did not contain exploitable thickened roots.

E.G. 1 *of* 1953.—This was inspected on 28th May 1955 by State Silviculturist, Ootacamund along with Mr. Ramaswamy, Forest Officer, Minor Forest Products Branch, Forest Research Institute, Dehra Dun. Due to recent rains there were about 50 per cent survivals. But the plants had not flowered or fruited. A few plants were dug at random and these did not contain any exploitable thickened roots.

Underplanting of *Rauwolfia serpentina* in teak plantations was also done in Dhoni and Nilambur Research Centres. The results are furnished in the following table :—

TABLE LVI.—*Rauwolfia Serpentina—underplanting.*

Centre.	E.G. number.	Locality planted.	Method of planting.	Survival per cent.	Remarks.
Nilambur ..	1/53	1917 teak plantation.	Shoot cuttings of 6 inches to 9 inches long.	19	Plants are 6 inches to 9 inches high. At the end of two years, they have not flowered or fruited.
Do. ..	2/54	Do.	Do.	20	
Dhoni ..	430/53	S. P. 3 teak plantation of 1937.	Do.	18	
Do. ..	445/54	Do.	Do.	22	

The general indications are that underplanting in teak plantations are not encouraging due to drip and formation of sand mounds round the stem.

178. *Comparison experiment to find out the best method of raising Rauwolfia serpentina—Experimental growth* 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 LVII.—*Comparison experiment—Rauwolfia Serpentina.*

Treatment.	Number put in.	Survival. 1955.	Survival. 1956.	Height. 1955. INCHES.	Height. 1956. INCHES.	Remarks.
Direct Sowings ..	30	14	14	14	14·7	
Shoot cutting with root.	30	11	9	14	20·0	
Shoot cuttings alone	30	7	3	14	15·0	

Direct sowings have given good results in Begur. Shoot cuttings with root attached have also come up well.

The indications in the above experiment which was conducte l under nursery conditions are that the plant can be raised by all the three methods, even though direct sowings and shoot cuttings with root attached give better survival per cent than shoot cuttings alone.

179. *Rauwolfia serpentina—Experimental grounds* 480/55 *and* 481/55 *of Begur.*—The same experiment was repeated under field conditions (the experiment described above was done in nursery beds) during 1955–56 in experimental grouth 480/55 and E. G. 481/55 of Begur under two canopy conditions. The results are tabulated below :—

TABLE LVIII.—*Comparison experiment on raising Rauvolfia Serpentioua.*

Centre.	E. G. number.	Canopy condition.	Treatment.	Survival per cent in March 1956.	Mean height.
					INCHES.
Begur ..	480/55	Cleared and burnt natural forest	A—Direct sowing	7	2
			B—Shoot cutting with root attached.	93	6
			C—Shoot cutting	57	4
Do. ..	481/55	Natural forest under top canopy.	A—direct sowing	0-4	2
			B—Shoot cutting with root attached.	77	6
			C—Shoot cutting	17	3
Dhoni ..	444/54	Clearfelled and burnt area—no canopy.	A—Direct sowing	Nil.	..
			B—Shoot cutting with root attached.	Nil.	..
			C—Shoot citting plants burnt.	3/27	..
Nilambur ..	6/53	Clearfelled and burnt area.	A—direct sowing	9/161	1
			B—Cutting with root attached.	41/162	6
			C—Shoot cuttings ..	25/161	6
Topslip ..	462/53	Do.	B—Shoot cuttings with root attached.	38	Browsed.
Do.	517/53	Do.	B— Do.	67/156	9

The height growth and survival per cent are better in natural forest clearfelled and burnt than in natural forest under top canopy. Also planting shoot cuttings with root attached (4 niches to 5 inches of shoot with 1 inch to 2 inches of root) has given the best survival per cent and height growth. Next best is shoot cuttings. Direct sowings in field conditions are not encouraging though under nursery conditions in E. G 464/54, Begur, they gave 47 per cent survivals. The experiments have to be continued particularly on the germinative capacity and period of retension of viability of the species before experiments on direct sowing of seeds can be declared to be failure.

180. *Rauwolfia canescens.*—This plant is found in abundance in the Chaliyam Timber Depot in the Nilambur Division. Germination tests gave a germination per cent of 39. Direct sowings give 9 inches height groth in one year and the plants bear flowers and fruits in one year (E. G. 516-A of Topslip). The seedings can be transplanted successfully with 97 per cent suvival (E G. 516-B/55 of Topslip). Planting stem cuttings give 19/30 survivals at the end of two years and the plants bear flowers and fruits (E G. 4/55, Nilambur) abundantly from the first year onwards. In one year it reaches a height of 12 inches; but natural plants are as high as 3 feet to 4 feet in height as compared with *Rauwolfia serpentina* which grows to a height of only 18 inches.

181. *Rauwolfia serpentina—Yield of exploitable root at different ages—E G.* 446/54, *Dhoni.* —An experiment was started in Dhoni in 1954 to find out the yield of roots by planting root-shoot-cuttings at :

A—1 year ; C—3 years ;

B—2 years ; D—4 years ;

after planting. Uprootal of plants at age 1½ years gave a green weight of 0·9 tola or a dry weight of 0·24 toal per plant. Uprootal of plants at age 2½ years gave a green weight of 2·1 tola and a dry weight of 0·8 tola per plant. The plants in the remaining treatments will be uprooted at ages 3½ and 4½ years. The indications are that at least two years are necessary for producing exploitable roots.

(vi) RECLAMATION AND AFFORESTATION INCLUDING IRRIGATED PLANTATIONS.

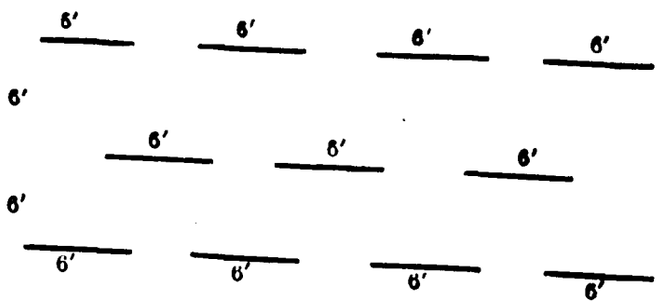
182. *Afforestation of the Nilgiris grass lands.*—The two experimental gardens located at Jacosnullah within the grass lands in Wenlock Downs, were maintained; but no new experiments were started during the year.

183. *Afforestation of sandy waste lands in Rameswaram Island and fixation of shifting sand—Experiment of fixation of shifting sand near Rameswaram Road Railway station in E. G No.* 12/55.—With the co-operation of the District Engineer, Southern Railway, Madurai, an experiment was started with n the station yard of Rameswaram Road Railway Station. This section of the railway track is subjected to severe wind action and deposition of sand on the railway track. During the year large numbers of mazdoors were employed for manual removal of the sand from the track and making the track fit for traffic. This involves an expenditure of a few thousands of rupees for this small section only. For the whole Island the expenditure on manual removal of sand from the track is believed to be enoromous.

An experiment was started during the year with a view to find out whether deposition of shifting sand on the railway track can be eliminated by a system of baffle walls erected on the windward side of the railway track. The design of the experiment was as follows:—

Baffle walls consisting of condemned railway sleepers were erected for a length of 6 feet and a height of 3 feet as per design below :—

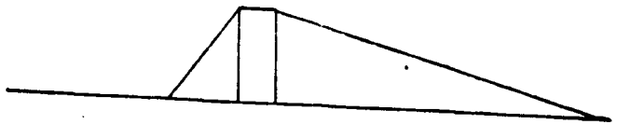
Design.



When baffle walls are constructed in this way the effect of win carrying sand particles is to deposit the sand on either side of baffle wall and to form a sand mound as shown below :—

Design.

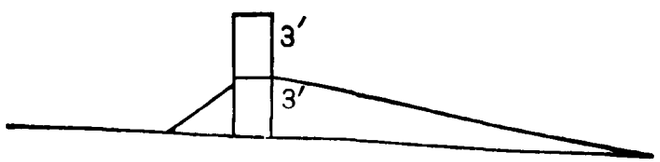
Direction of wind.



The mound formed, as per theoritical considerations, will be three times the height of the baffle wall on the windward side and the height of the baffle wall on the leeward side. When a mound had been formed the baffle walls which are now completely buried in sand will be lifted for a further height of say, 3 feet, as shown below —

Design.

Direction of wind.



In this manner the shifting sand can be fixed and the land on the windward side of the baffle wall will be protected from deposition of shifting sand.

The experiment was started on 30th August 1955. By 2nd October 1955 it was clear that the baffle walls had exercised a very beneficial effect on the deposition of the sand on the railway track. When previously 35 mazdoors per day were being engaged, now only 10 mazdoors are being engaged.

When the sand mound was formed as per design noted above the following plants were planted at the toe of the mound and subsequently all over the mound in order to fix the sand still further. The plants used were—

(1) *Spinifex squarrosus.*
(2) *Ipomea biloba.*
(3) Sowings of *Pueraria Javanica.*
(4) *Pueraria phaseoloides.*
(5) *Prosopis juliflora.*
(6) *Dalbergia sissoo.*

Also cutting of Pandanus with leaves were planted 1½ feet apart in lines. Farthest away from the railway track palmyra huts were dibbled 3 feet apart in lines for a length of 2 chains and over a width of 6 feet. The general indication from the experiment is that a system of baffle walls does help in protection of the railway track from deposition of shifting sand. The experiment will be continued and further observations will be made.

The baffle wall was erected on 30th August 1955 with Cadjan leaves over a small section and subsequently with condemned railway sleepers on 16th September 1955. This period is one of very severe wind activity and erection of baffle walls was immediately effective.

184. *Experiments on sand fixation through afforestation—Rameswaram.*—In Rameswaram, there is a very strong wind from the south during the months of April to September. As a result of wind action, sand is shifted from place to place in the island and deposited in sand mounds which are continuously changing. The soil is suitable for the cultivation of Casuarina, Palmyras and Coconuts which have all been tried in the past with success ; but the menace of shifting sand should be removed before the land could be put under the above crops. Experiments were started during the year 1955–56 with direct sowings, entire transplants and basket plants of various species, with a view to find out whether these can be successfully established and if so, whether they can effectively function as soil binding plants. Preliminary indications are that the plants put out in the rains of October to December, during the

North East monsoon are apt to get scorched and dry up, resulting in heavy casualties during the coming hot weather when there is a continuous hot dry wind and also that tiny plants are liable to get covered by shifting sand.

To protect the plants from the wind and sand, dwarf baffle walls 3 feet high, made of woven Coconut leaves tied to posts were tried. It was found that one dwarf wall 3 feet high can protect one row of plants on the leeward side and 3 rows of plants on the windward side of the baffle wall.

During November and December 1955, there were cyclonic rains in the districts of Tanjore, Thiruchirappalli and Ramanathapuram. There was 14·42 inches of rainfall in November and 20·32 inches in December 1955 in Rameswaram Island. Part of the experimental areas was under water for some days and this accounts for larger casualties than can be expected in a normal year.

The results of survivals of various species tried are furnished in the following table :—

TABLE LIX—*Statement of species tried in Rameswaram Island with survivals and hight growth.*

Serial number and species.	Date of planting.	Method of introduction.	Survival per cent.	Mean height.
(1)	(2)	(3)	(4)	(5)
1 *Anacardium occidentale* ..	15th July 1955.	Pot plants	38	18"
2 *Acacia ferruginea*	19th September 1955.	Basket plants. ..	100	2'
3 *Albizzia lebbeck*	21st September 1955.	Do.	95	12"
4 *Ailanthes malabaricum* ..	6th November 1955.	Do.	95	1·4'
5 *Acacia decurrens*	23rd September 1955.	Mossed seedlings ..	50	18"
A. leucophloea	20th October 1955.	Transplants	94	9"
7 *A. mollissima*	23rd September 1955.	Mossed	92	18"
8 *A. planifrons*	20th September 1955.	Basket plants ..	80	12"
Azadirachta indica ..	6th November 1955.	Transplants ..	100	9"
9 *Casurina equisetifolia* ..	23rd March 1955.	Do. ..	100	2'
11 *Dalbergia sissoo*	21st September 1955.	Basket plants ..	100	2'
1 *Eucalyptus camaldulensis.*	21st March 1955.	Do. ..	100	2'
E. coccophospha'a	Do.	Do.	100	12"
E. radis	Do.	Do. ..	100	12"
13 *E. hybrid*	24th January 1955	Do. ..	100	2'
16 *Pongamia glabra*	19th November 1955.	Direct sowing ..	100	10"
7 *Pithecolobium dulce* ..	20th September 1955.	Basket plants ..	100	2½'
8 *Prosopis juliflora*	5th August 1955.	Do. ..	100	1'

185. Another experiment was tried, sowing a mixture of seeds of *Cassia siamea, Dalbergia sissoo, Azadirachta, indica, Dichrostachys cinerea, Eugenia jambolana, Albizzia lebbeck, Acacia ferruginea, A. planifrons,* in furrows in triple lines one foot apart. Seeds of all

the species germinated well, but due to ensuing hot weather all plants died of drought except some seedlings of *Eugenia jambolana Dalbergia sissoo. Azadirachta india.* The results are not encouraging.

As Palmyra is indigenious species in the island, line sowing of palmyra nuts was also tried. This gave 54 per cent germination and 90/1000 shoots have come up above ground.

Sets of *Spinifex squarrosus* and *Ipomea biloba* were planted to study their rooting capacity and ability to fix shifting sand. There was 100 per cent rooting; but the spread of the plants is slow. Further observations are necessary.

186. *Vegetative propagation through stem cuttings.*—Vegetative propagation of *Hibiscus tiliaceous, Thespesia populnea, Poinciana elata* and *Erythrina indica* were tried and the results areas follows :—

TABLE LX.—*Results of introduction through stem cuttings.*

Serial number and species.	Percentage of sprouting.	Remarks.
1 Hibiscus tiliaceous	7	
2 Thespesia populnea	14	
3 Poinciana elata	6	
4 Erythrina indica	20	

187. *Hopea as an underplant or as an alternative species in a failed teak area.*—Experimental plot 138/36 was started in Nilambur to study the growth and development of Hopea in a lateritic soil where teak almost failed. In the 1,888 teak plantation, Hopea was introduced in 1929 by dibbling seeds at an espacement of 9 feet into 9 feet. While most of the teak has practically disappeared, the Hopea plants have grown steadily and at the end of 27 years have reached an average height of 53 feet and the tallest plant is 60 feet. The mean diameter of the crop is 4·4 inches.

At present there are 126 plants in an area of half an acre and hence the crop is congested. A thinning will be done in the coming year. The desirability of convertion of this experimental plot into a sample plot will be considered after the thinning is done. The indications so far obtained are—

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

(ii) The growth during the first 5 to 10 years is very slow. After the tenth year the growth is vigourous and maintains a steady rate till the 15th 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.

188. *Afforestation of grass land in Chandanathode—Experimental ground* 7/53 *and experimental ground* 8/54.—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 8½ feet × 8½ feet. In 1954 the experiment was continued over an area of 5½ 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 × 12 feet. In one sub-plot grass was scraped to diameter of 3 feet while in the other no scraping was done.

Species tried in 1953.

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

Species tried in 1954.

Vateria indica.	*Ailanthes malbarica.*
Artocarpus hirusta.	*Mangiferra indica.*
Sterculia companulata.	*Pterocarpus dalbergioides.*

An analysis of the measurements taken in March 1956 show that the height growth and survival per cent are slightly better in the scraped area than in the unscraped area. On the whole the height growth ranges from 5 inches to 20 inches in 2 to 3 years and the survival per cent from 5 to 75. At this rate, the plants will take 8 to 10 years if not more, to overtop the grass which grows to a height of 8 feet to 10 feet. The preliminary indications are therefore that the species tried are unsuitable for introduction in the grass lands on account of their low rate of height growth. Faster growing species like *Eucalyptus citriodora* (which has come up well in Topslip), *E. rostrata*, *E. grandis* and *E. saligna* and *E. hybrid* will be tried during the coming year.

(vii) Tending, thinning, cleaning, climber and weeds.

189. *Pruning in teak plantations—Nilambur Centre.*—Pruning experiments were conducted in teak plantations in 1938, 1939 and in 1949 in one and two year old crops. It was pointed out in 1954-55 report that measurements indicated that in early years there was slightly a better height growth generally in pruned plots than control though in some cases reverse results were obtained. But

the differences has been much narrowed down with advancing age particularly from nineth year onwards, as to be of no significance at all as shown in the tabular statement below.—

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TABLE LXI.— *Measurements on pruning experiment in teak Plantations.*

Research Centre.	E.P. number.	Year of measurement.	Age.	Average height in Feet. Pruned plot.	Average height in Feet. Control unpruned plots.
Illambur	151/38	19[illegible]	15	40·2	41·4
Do.	158/39	1954	15	[illegible]	39·1
Do.	158/39	1956	[illegible]	47·3	47·7
Do.	172/47	1956	9	29·6	31·7
Do.	171/47	1956	9	47·4	48·4

The tentative conclusion noted in 1954–55 report that pruning is not beneficial from the point of view of height growth is confirmed by measurements of this year also as noted above.

190. The experiments were repeated in 1954 but this time they were started in plantations of ages from 2 to 6 years in different centres. The results obtained are tabulated below:—

TABLE LXI-*A*:— *pruning exprements in* 1954.

Centre.	E.P. number.	Age of plants at the time of purnning.	Mean difference in height between initial height in 1954 and measurements in 1956. Control plot in feet.	Mean difference in height between initial height in 1954 and measurements in 1956. Pruned plot in feet.	Mean difference in diameter between initial measurements in 1954 and measurements in 1956. Pruned plot in inches.	Mean difference in diameter between initial measurements in 1954 and measurements in 1956. Control plot in inches.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
		YRS.				
Begur	107/54	4	10·2	7·7	1·52	1·16
Kannoth ..	116/54	4	3·0	2·8	0·54	0·42
Nilambur ..	178/54	4	14·6	6·0	..	..
Begur	109/54	5	5·0	6·0	0·7	0·57
Nilambur ..	177/54	5	6·0	7·9	..	..
Do. ..	176/54	6	4·4	6·4	..	..
Begur	108/54	6	4·9	5·1	0·53	0·57
Kannoth	119/54	6	1·2	1·7	0·3	0·27
Do.	117/54	3	2·5	2·8	0·69	0 50
Nilambur ..	179/54	3	8·8	8·6	..	..
Do.	180/54	3	8·0	7·7	..	..
Topslip	95/54	4	3·6	3·9	..	..
Do.	96/54	3	6·4	6·9	..	..

A look at the measurements shows that a slight difference between the control and pruned plot exists in some cases the control showing better growth and in some other cases the pruned plot showing better results, a difference which has been noted in the previous experiments also. But this difference in all cases is found to be no practical significance. It is worthy of note that the diameter increments also showed the same kind of results as seen from the measurements in Wynaad.

The analysis of the measurements further shows that pruning either in the early ages of the plantations in the first three years or in a little later ages up to sixth year makes no difference so far as the growth of the plants (both in height and diameter) is concerned. In the light of all these experiments it can finally be concluded that pruning is not beneficial and has no significant effect on the growth and development of teak plants.

191. *Effect of pruning teak plantations on diameter increment.*—Pruning does not appear to have any effect on the diameter increment of the plants as per measurements furnished in the following table :—

TABLE LXII.—*Effect of pruning an diameter increment.*

Centre.	*E. P. number.*	*Age of plants at the time of pruning.*	*Age of plants in 1956.*	*Mean Diameter.*		*Remarks*
				Pruned plot.	*Control plot.*	
		YRS.	YRS.	INCHES.	INCHES.	
Nilambur ..	158/39	1	18	5·3	5·2	
Do.	171/47	2	11	5·0	4·9	

The same indication is also given out by the figures in Table LXI above wherein the mean difference between diameter measurements in 1954 and measurements in 1956 are furnished and it is found that generally there is no significant difference.

192. *Effect of pruning on branchiness.*—In the pruning plots, the effect of purning on branchiness was also studied. The number of branches in the control plots and the number of epicormic branches which appeared after pruning were counted in some pruning plots, and the average number of branches per tree in the pruned and control plots have been worked out in Nilambur and Wynaad centres. The tabular statement below gives the details :—

TABLE LXIII.—*Effect of pruning on branchiness in teak plants.*

Centre.	*E. P number.*	*Age at the time of pruning.*	*Number of branches per tree up to 2/3 height in control plot*	*Number of epicormic branches in the pruned plots up to two-third height.*
Wynaad	117/54	3	4·2	2·6
Do.	116/54	4	3·4	1·8
Nilambur	179/54	3	7·1	2·8
Do.	178/54	4	4·0	5·7
Do.	177/54	5	7·3	4·0
Do.	176/54	6	3·5	2·9
Do.	180/54	2	5·6	4·9
South Coimbatore ..	94/54	5	2·8	3·9
Do.	95/54	4	6·3	5·4
Do.	96/54	3	5·4	4·1

With the exception of expremental plot Nos. 178/54 and expremental plot 94/54 of Nilambur and Topslip (South Coimbatore) Centres respectively, it will be found that the number of branches in all other cases, is greater in the control than the epicormic branches that appeared in the pruned plots. The preliminary indication is that pruning keeps down the branchiness in teak plants, at least for 1½ years after pruning. Further observations are required to see whether this difference in favour of pruning will continue.

Inasmuch as the object of pruning is not only to get a better height growth, but also to get a clean bole free from knots and other defects which are generally the result of branching, it remains to be a matter of further investigation whether the reduction in the number of branches on account of pruning will produce a better and cleaner bole.

The pruning experiments will be closed with the conclusion that the pruning has no beneficial effect on the height and diameter growth of plants.

193. *Teak plantations, Wynaad—Experiment to find out the best time for first thinning.*—S.P. Nos. 26 to 34 of Wynaad were formed in 1936 in 1931 regeneration area to determine the best time for carrying out first thinnings. There were three treatments as follows :—

(i) First thinning at age 5, S.Ps. 26, 27 and 34.
(ii) First thinning at age 7, S.Ps. 28, 30 and 31.
(iii) First thinning at age 9, S.Ps. 29, 32 and 33.

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

The measurements of the S.Ps. as taken in March 1952 are furnished below :—

TABLE LXIV.—*Measurements of* 1952 *in teak S.Ps. 26 to 34 of Wyannd.*

S.P. 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)
		FEET.	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	1,923·3

S P. number;	Main crop number of stems per ac e 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) FEET.	(4) INCHES.	(5)	(6)	(7)
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 Sratement.

A. First thinning at age 5 yrs.	187·6	60·0	8·6	74·4	557·6	1,923·3
B. First thinning at age 7 yrs.	190·6	59·6	8·1	68·2	410·6	2,003·0
C. First thinning at age 9 yrs.	183·3	58·3	8·0	64·9	329·0	1,969·3

Analysis of these measurements show that the thinning at the age of 5 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 thinnings at age 7 years and 9 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 5 years is definitely superior to first thinnings at age 7 years or 9 years in the Wynaad plateau.

As per sanctioned Working Plan for the Wynaad Division, the espacement for Begur and Chedleth Ranges is 6′ × 6′ and the first thinning is done at age 4 years or 5 years according to the quality of the crop.

The continuance of this experiment is not necessary; but the S.Ps. 25 to 34 may be maintained in order to observe periodical volume increment of teak, giving all the plots uniform treatment in future.

194. *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 Nos. 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—S.Ps. 12, 18, 23 and 25.

D grade—S.Ps. 10, 14, 17 and 24.

E grade—S.Ps. 11, 16, 21 and 22.

X grade—S.Ps. 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, 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.

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. (The files have been fowarded to Forest Research Institute for computation and they have not yet been received back).

TABLE LXV.—*Measurements of 1947 for S.P. Nos. 10 to 25 of Wynaad experiment on different intensities of thinning.*

Intensity of thinning.	*S.P. number.*	*Main crop.*			*Basal area per acre after thinning.*	*Stem timber volume standing.*	*Stem timber and small wood standing and thinnings.*
		Number of stems.	*Top height.*	*Average diameter.*			
			FEET.	INCHES.	SQ. FT.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
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	63·85	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	216	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 ..		100·0	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	51·6	5·6	64·90	76·5	2,116·2
D do. ..	..	250·0	52·5	6·9	64·32	122·5	1,792.7
E do. ..	..	175·5	51·2	7·4	52·45	127·2	1,499·0
X do. ..	..	124·0	53·2	7·9	42·85	166·5	1,263·7

195. *Analysis of the* 1947 *measurements shows 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 inches 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 increases as shown below :—

	SQ. FT.
C grade	64·9
D grade	64·32
E grade	52·45
X grade	42·86

(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. FT. PER ACRE.
C grade	2,116·2
D grade	1,792·7
E grade	1,499·0
X grade	1,263·7

This indication is confirmed by similar results obtained in Sample Plots 120 to 125, referred to in paragraph 198 below.

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.

196. *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 194 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.

The definitions of the different grades are as for Sample plots 10—25 of Wynaad (vide paragraph 194 above).

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 :—

TABLE LXVI.—*Measurements of* 1950 *of cample plots Nos.* 69 *to* 86 *of Nilambur—Experiment on different intensity of thinning.*

Intensity of thinning.	*S. P. number.*	*Main crop.*			*Basal area per acre after thinning.*	*Stem timber volume standing.*	*Stem timber and small wood standing and thinning.*
		Number of stems.	*Top height.*	*Average diameter.*			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			FEET.	INCHES.	SQ. FT.		
C grade ..	76	179	67	7·8	59·0	261	1,632
	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	1,497
	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 do.		137·2	67·2	8·2	50·4	310·7	1,315·0
E do.		100·5	67·7	8·6	39·6	282·2	1,262·2
X do.		99·5	66·5	8·9	42·7	368·5	1,205·0

197. *Analysis of the* 1950 *measurements shows that*—(i) the different intensities of thinning have no appreciable effect on height growth as the top heights are as below :—

	FEET.
C grade	65·7
D grade	67·2
E grade	67·7
X grade	66·5

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

C grade	7·3	diameter in 21 years.
D grade	8·2	Do.
E grade	8·6	Do.
X grade	8·9	Do.

(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	sq. ft. per acre.
D grade	50·4	Do
E grade	39·6	Do.
X grade	42·7	Do.

(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.FT.
C grade	1,584·7
D grade	1,315·0
E grade	1,262·2
X grade	1,205·0

These indications are identical to the conclusions drawn already from Sample plots 10 to 25 of Wynaad, which have been detailed in paragraph 195 above and similar to results obtained from Sample plots 120 to 125 of Nilambur described in paragraph 198 below.

198. *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 S.Ps. 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 repid 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 LXVII.—*Abstract of measurements recorded during* 1954–55.

Items.	*S. P. No.* 120	*S. P. No.* 121.	*S. P. No.* 122.	*Average for all three plots taken together.*
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
	S. P. No. 123.	*S. P. No.* 124.	*S. P. No.* 125.	
Control plots.—				
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

Comparison of the figures in the above two tables shows that in ordinary district practice there are 141 stems with an average diameter of 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.

199. *Measurements of* 1949.—

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

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.*	*Stem timber and small wood volume produced to-date.*	*Remarks.*
		FEET.	INCHES.	SQ FT.	C. FT.	C. FT.	
Treated ..	50	63	10·9	59·0	190	1,293	Measurements of 1955 are awaiting computation at Forest Research Institute, Dehra Dun.
Control ..	142	64	9·5	75·2	271	1,732	

200. *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 inches in the treated plots as against annual diameter increment of only 0·67 inches 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 cubit feet in the treated plot as against 1.732 cubit feet in the control plot.

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 S.Ps. 69 to 86 of Nilambur Division referred to in pragraph 195—197 supra.

The S. Ps. 120 to 125 were measured during 1954–55 and the measurements are under computation by the Central Silviculturist, Forest Research Institute, Dehra Dun. After computation, further data will be available regarding the effect of Craib's thinning on useful basal area and total volume production, as furnished above in Table LXVIII.

201. *Thinning research plots S.Ps.* 136 *to* 141 *of Nilambur.*— As a repetition to the thinning experiment noted above, S.Ps. 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 S.Ps. 120 to 125 above.

The three S.Ps. 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 S.Ps. were treated as Control (thinnings as per District Practice, viz., a 'D' grade thinning).

In S.Ps. 136, 139 and 141, thinnings were done at ages 2, 6 years. In the Control plots, these were done at the ages 3, 6 years. Inspection in 1954 showed that the thinnings done in S.Ps. 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 was not

sufficiently heavy. In fact there was very little difference as regards intensity of thinning, between the treated S.Ps. and the control S.Ps. 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 S.Ps. 120 to 125 of Nilambur.

202. *Eradication of Lantana through bamboos.*—In E.P. No. 67/36 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 underplanted 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 11 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 was closed in 1955–56.

203. *Eradication of Lantana through clear felling and burning and planting forest crops with Kumri.*—The invasion and dence growth of Lantana in the Sandalwood forests of Salem North Division, and also elsewhere, has become a serious menace, and experiments were started during 1954–55 to see whether it is possible to eradicate the Lantana and re-afforest the area with valuable timber and fuel species.

In E.P. No. 31/54 in Noganur Reserved Forest an area of six acres was demarcated and divided into six sub-plots of one acre each. There were two treatments as below with three replications—

A.—Clearfelling the entire growth and burning the debris and planting *Dalbergia sissoo*, *Melia dubia*, *Eucalyptus citriodora*, *E. hybrid*, in lines 22 feet apart at an espacement of 9 feet along the lines with a kumri crop of ragi (*Elusine coracana*) in the beginning of the north-east monsoon.

B.—Clearing strips 3 feet to 4 feet wide in the Lantana growth, at intervals of 22 feet and planting seedlings of five species in the centre of the cleared strips at an espacement of 9 feet in the beginning of the north-east monsoon. (There was of course no kumri crop in this treatment.).

At the end of 1½ years in January 1956 measurements show that cutting and burning Lantana though costly is significantly better than planting in strips without cutting and buring the Lantana. As the Kumri dar does the work of clearfelling and burning, there is no expenditure involved in this operation. Hence the indications are that clearfelling and burning Lantana infested areas and planting in lines 22 feet apart with a kumri crop of Ragi is distinctly successful. In 1956, at the age of two years, the plants in the area clearfelled and burnt with a kumri crop of Ragi were as below :—

Table LXIX.—Height growth in a clearfelled Lantana area with Kumari.

Species.	Number put in.	Percentage of survival.	Mean ht. heights.
			FEET.
Eucalyptus rostrata	135	31	5
E. citriodora	135	20	5·7
E hybrid	135	15	3·6
Cedrela toona	135	31	3·1
Dalbergia	135	9	2·1

The height growth of *Eucalyptus citriodora*, *E. rostrata* and *E. hybrid* is encouraging.

204. *Eradication of Lantana through Weedicides.*—Experiments on the eradication of *Lantana camara* through Weedicides such as 2-4-D, 2-4-5-T, Pentachor phenol were initiated during the year in Javalagiri Reserved Forest of Salem North Forest Division.

An area of 2·4 acres containing a dense growth of Lantana was taken and divided into 24 sub-plots of one square chain each.

The following treatments were applied in December 1955 :—

( ) Four sub plots were sprayed with Hexamar 2-4-D, Weed Killer, using 3 oz., 4½ oz., 6 oz., and 8 oz., respectively dissolved in 10 gallons of water. Spraying was repeated three more times at intervals of three weeks (total 4 sprayings).

(ii) Four sub-plots were sprayed with Hexamar 2-4-5-T, using 3 oz., 4½ oz., 6 oz., and 8 oz., diluted in 10 gallons of water. Spraying was repeated three more times at intervals of three weeks (total four sprayings).

(iii) Four sub-plots were sprayed with Pentachlor phenol, using 3 oz., 4 oz., 6½ oz., and 8 oz., diluted in 10 gallons of water. Spraying was repeated three more times at intervals of three weeks (total four sprayings).

(iv) Four sub plots were sprayed with Extar-A (Sandoz Product) using 6 oz., 9 oz., 12 oz., and 15 oz., diluted in 10 gallons of water. Spraying was repeated three more times at intervals of three weeks.

(v) In two sub-plots, the Lantana was clearfelled and the cut surfaces were painted with Shell Weed Killer 10 per cent (10 oz. adedd to 90 oz. of water) and She'l Weed Killer 20 per cent (20 oz. dissolved in 80 oz. of water), on 21 t December 1955. Repainting was done three more times at intervals of about three weeks.

By end of March 1956, it was found that Lantana was almost dead in sub-plots treated with all concentrations of 2-4-D, 2-4-5-T., Extar-A and Shell Weed Killer. It was beginning to die in the sub-plots treated with Pentachlor phenol (P.C.P.).

Furthter observations will be made and given in the next year's report. It is a point for observat'on whether only the above ground portion of the stem will die and fresh shoots will come from under-ground roots, and also whether fresh plants will arise from dormant seeds lying on the ground.

205. *Eradication of Lantana through biological methods.*—In and around Denkanikota, Lantana is subject to the attack of the sale Insect *Orthezia insignis*—Browne, the Lantana Scale Insect (Family Coccidae—Order Hemiptera). These insects are prolific during the rainy season; but are scarce during the hot weather When fully attacked, the foliage turns black in colour. They do not produce flowers or seed and the plant is kept under control. After one or two years the plant dies.

This Lantana Scale Insect is found in Salen North Division with a rainfall of 40 inches and not in Wynaad or in Nilambur with a higher rainfall.

206. *Ocurrence of Loranthus in teak plantations.*—The genus Loranthus consists of evergreen parasitic shrubs living mostly on the stems and branches of other shrubs or trees. The species are really semi-parasites taking up carbon-dioxide through their green leaves and branchlets and relying on the forster plant on which they grow for mineral and nitrogenous food materials. When the seeds of Loranthus germinate on the bark of a tree, the roots penetrate through the bark into the wood where they spread and are gradua'ly enclosed by the new layers of wood. The roots of the parasite decay readily and hence the wood of the foster tree becomes riddled and worthless. Th s consideration. however, does not apply in the case of teak trees as the Loranthus is found only in the crown of the trees and not in the main stem yielding t mber.

There are about 60 species of Loranthus in Ind'a which affect a variety of forest plants as also garden plants. The most common of the Ind'an species is *Loranthus longiflorus Desrousseaux*. Three varieties are distinguished in Brandd's' "Indian Trees". The variety "Falcata" "Kurz" of this species is stated to be the most common in India. It grows on 110 species of trees in India.

such as species of the Genera, Melia, Bauhinea, Albizzia, Mallottus, Bassia, Buchanania, Diospyros. The most important forest tree parasitised by Lornthus is *Tectona grandis.*

All species of Loranthus do considerable damage to forest trees. However, the damage caused by *Loranthus longiflorus* variety, Falcata on teak trees in the teak plantations in South India, is probably the most important.

207. *Loranthus Infestation in teak plantations—Need for research.*—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 longiflorus*—variety Falcata Kurz. The instensity of attack would in some cases be as much as 25 per cent of the total crown of the teak trees. In the 1923 teak plantation near Sungam in South Coimbatore, nearly 75 per cent of the grow'ng stock was infested with Loranthus in December 1955 at the age of 32 years.

The attack of Loranthus on forest trees particularly teak trees, has been known for a long time. In the past, the only measure adopted for dealing with the attack of Loranthus on the teak, was to cut aw. y the affected branches with the Loranthus bushes during thinning. In practice, this is a very difficult matter, as it is d'fficult for the mazdoors to reach the tip or middle of the branches where the Loranthus bushes are located. In practice the branches containing Loranthus bushes are cut very near the point where they are attached to the main tree. Thus, eradication of Loranthus by cutting has been almost synonymous with reduc ng the crown of the tree to about half or one-third of its size. Sometimes, the trees are full of white ants and men cannot climb such trees and cut the Loranthus affected branches.

It is, therefore, necessary to undertake investigations on—

(i) whether the infestation of Loranthus on teak is adversely affecting the volume increment of the teak;

(ii) whether the Loranthus can be eradicated from the teak by methods other than manual removal of the affected branches.

New experiments in these directions were taken up for the first time in the Madras State during 1955–56 and are described below.

208. *Experiment—Effect of Loranthus on the volume increment of teak.*—Th s is designed to study the effect of Loranthus on the girth increment of teak trees and to compare the effect of lopping of affected branches with no lopping. There will be three treatments as below:—

(1) Trees with Loranthus—no cutting;

(2) Trees with Loranthus—cutting of affected branches

(3) Trees without Loranthus.

There will be 50 individual trees for each treatment, and the girth increment of the trees will be observed under the above three treatments.

This experiment was started in E.P. No. 124/55 in Thoppatty Teak Plantations in Wynaad. Similar experiments are being started in the Nilambur and Topslip research centres also. Results will be available only after five or more years as the difference in the standing volume or basal area of the teak trees will be necessary under the three treatments before conclusions can be drawn.

209. *Loranthus—Eradication by chemicals.*—This is designed to study the effect of applying Copper sulphate and Fernoxone to teak trees with Loranthus. The chemicals will be introduced in augur holes in the trunk of the affected trees. Eradication of Loranthus by injecting chemicals in augur holes was started in Begur and Topslip centres during the current year, in the month of November, with the following four treatments :—

A—1/32 oz. of Fernoxone ;

B—1/8 oz. of Copper sulphate ;

C—1/64 oz. of Fernoxone followed by 1/16 oz. of Copper sulphate.

D—1/16 oz. of Copper sulphate followed by 1/64 oz. of Fernoxone.

NOTE.—In Top Slip for 'C' and 'D' actually double the dosage of chemicals was used.

Observations at the end of six to nine months reveal that there was no appreciable effect by the application of chemicals. It is proposed to do the same experiment on another set of trees during the season May-June 1956. The season of injection may have an influence on the effect of chemicals on the Loranthus bushes and on the trees. During May-June when the teak trees burst into new flush of leaves the season of vegetative activity will be at its height and translocation of sap will be rapid and hence application of chemicals during the season May-June, may have better and quicker effect than during the season October-November. This experiment will be repeated during 1956–57 and further results reported in the next Annual Report.

A small scale experiment on the injection of Copper sulphate only was tried in the Topslip Teak Plantation in Coimbatore South Division and in the Aravallikava Teak Plantation of 1917 in the Nilambur Division. There was no effect either on the teak trees or on the Loranthus bushes in the above two experiments.

210. *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, E.P. No. 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 1956, 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.

211. *Teak Plantations in Wynaad and Nilambur—Is underplanting necessary.*—Inspection of teak plantations in Nilambur and Wynaad 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 such as *Swietenia microphylla* or *Sterculia companulata* or other products such as *Rauwolfia serpentina*, *Ocimum kilimanjaricum* or *Cinnamomum zeylanicum*. Underplanting does not seem to be necessary solely from the point of view of soil protection. Attention is invited to paragraph 66 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.

Again previous experiments on underplanting of teak with *Cephalostachyum 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 subsidiarry crop. Hence looked at from this point of view also, underplanting of pure teak plantations does not appear to be desirable.

212. *Origin of underplanting experiments in Madras State.*—However, in the years previous to 1930, there was a genuine apprehension, that with the increase in the area of teak plantations artificially raised by the clearfelling of mixed deciduous forests the continued cultivation of pure teak plantations, would gradually lead to deterioration of the soil with a consequent adverse effect on the future regeneration of teak, unless effective measures were undertaken to protect the soil particularly in the latter half of the rotation. It was with the primary object of providing the soil with a cover and at the same time to have a valuable subsidiary crop, that experiments in underplanting were first started in Nilambur in 1930.

213. *Teak plantations—Underplanting experiments*, 1930-1940.—The several experiments that were started in 1930 and repeated in several years, subsequently, may be brought broadly under two divisions—

(i) Experiments with bamboos as underplants; and

(ii) experiments with selected tree species as underplants.

A close study of these experiments will reveal that they were mainly confined to the establishment and growth of the underplants.

214. *Teak Plantations—Underplanting with bamboos—Nilambur experiments.*—Both the indigenous and exotic species (Burma Bamboos only) were tried, especially the species *Cephalostachyum pergracile* which was promising. The species of bamboos tried in various experiments between the years 1930 to 1949 are shown below with the heights attained by them, as measured in 1944-45 :—

TABLE LXX—*Measurements of* 1944-45 *of the experiments of* 1930 *to* 1940.

Species.	*Planted in the year.*	*Age in years.*	*Height* 1944-45. FEET
Bambusa arundinacea	1930	14	38
Cephalostachyum pergracline	1930-31	14	61 to 70
Bambusa polymorpha	1937	7	40
Dendrocalamus longispathes	1939	5	34
Melaconna bamboosiodes	1940	4	37

The experiments have shown that the bamboos can be successfully introduced in teak plantations, but adequate attention seemed to have not been bestowed to study the effect on teak by the underplants in the early years. But later E.P. 153/38 was started in 1938 to study the effect of *Cephalostachyum pergracile* on the growth and development of teak. The measurements taken in March 1956 have shown that the average diameter in the treated plot with bamboo as underplant was 16·7 inches as against 17·25 inches in the control plot, thereby indicating that the increment of teak is adversely affected by the underplant though it is a slight one.

Experiments with *Bambusa polymorpha* and *Malaconna bamboosoides* in E.Ps. 163/40 and 146/37 have shown that underplanting produces a singificant adverse result on the height and diameter increment of teak in the poor quality localities. This leads to the provisional indications that it is not advisable to have bamboo as an underplant in poor quality areas.

215. *Teak plantations—Underplanting with tree species as underplants.*—Several experiments were started in 1930 and subsequently, to study the effect of underplanting teak with tree species and to find out the best species for underplanting and the best time for

introducing the same. On a closer study of these experiments it has been found that they were more in the nature of qualitative experiments to determine whether the introduced underplant can be successfully established as under-crop.

In the earlier experiments from 1930 to 1949, Mahogany, *Cedrela toona*, *Dalbergia latifolia* and *Hopea parviflora*, were tried in Nilambur. The experiments have proved that both Mahogany and *Cedrela toona* can be successfully underplanted under teak if deer and other browsing animals are excluded. These experiments have also shown that damage can be diminished if both these species are introduced in dense lines and better still with transplants the case of Mahogany and stumps rather than direct sowing with *Cedrela toona*. In the case of *Dalbergia latifolia* it has been concluded that it cannot be introduced under teak successfully as an under-storey and Hopea is found to be difficult to establish on account of large casualties.

From 1950 with the growing demand for Softwood species from the expanding matchwood and other industries, a desire to introduce Softwood species arose and some of the chief Softwood species which are particularly useful for matchwood or plywood industry were tried as underplants.

The experiments were repeated in 1954 in Nilambur and were extended to other Centres like Begur, Karnoth, Topslip and Honi. The results from 1950 to 1956 are combined and tabulated below specieswar :—

TABLE LXXI.—*Statement showing the results of underplanting experiments of softwood species.*

Centre.	Experiment number.	Year of Regn. area.	Year of under-planting.	Measure-ment year.	Age in years.	Height.	Survival per cent.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			Ailanthus malabaricum.					
Nilambur	E.P. No. 168/53-A ..	1943	1953	1956	3	6′	65	..
Do.	E.P. No. 185/54 ..	1943	1954	1956	2	36″—48″	80	..
Topslip	E.G. No. 486/54 ..	1937	1954	1956	2	24″—36″	65	..
Dhoni	E.G. No. 454/54.. ..	1930	1954	1956	2	15″	76	Since burnt away by fire.
Begur	E.P. No. 104/54 ..	1939	1954	1956	2	24·2″	47	..
Kannoth	E.P. No. 102/54 ..	1941	1954	1956	2	14·4″	37	..
			Mahogany.					
Nilambur	E.P. No. 167/50 ..	..	1950	1953	3	4′	..	..
Do.	E.P. No. 183/54 ..	1943	1954	1956	2	36″	54	..
Top slip	E.G. No. 486/54 ..	1937	1954	1956	2	18″	40	..
Dhoni	E.G. No. 459/54 ..	1930	1954	1956	2	16″	54	Since burnt.
Begur	E.G. No. 106/54 ..	1939	1954	1956	2	20″	50	..
Kannoth	E.P. No. 114/54 ..	1941	1954	1956	2	4′—5′	51	..
			Mango.					
Topslip	E.G. No. 486/54 ..	1937	1954	1956	2	1′—2′	20	..
Dhoni	E.G. No. 453/54 ..	1930	1954	1956	2	15″	29	..
Begur	E.P. No. 102/54 ..	1939	1954	1956	2	16·8″	79	..
			Dalbergia latifolia.					
Nilambur	E.P. No. 187/54 ..	1937	1954	1956	2	40″	64	..
			Artocarpus hirsuta.					
Nilambur	E.P. No. 166/54 ..	1943	1950	1953	3	5′	67	..
Do.	E.P. No. 182/54 ..	1943	1954	1956	2	15″	61	..
Dhoni	E.G. No. 458/54 ..	1930	1954	1956	2	7·2″	14	Since burnt.
Kannoth	E.P. No. 110/54 ..	1941	1954	1956	2	4·5″	24	..
			Evodia roxburghiana.					
Nilambur	E.P. No. 168/50 ..	1943	1950	1953	3	Vitiated and closed.		..
Do.	E.P. No. 186/54 ..	1943	1954	1956	2	26″	95	..
Begur	E.P. No. 105/54 ..	1939	1954	1956	2	13·8″	6	..
Kannoth	E.P. No. 111/54 ..	1941	1954	1956	2	22″	70	..
			Sterculia companulata.					
Nilambur	E.P. No. 184/54 ..	1943	1954	1956	2	3′	52	..
Dhoni	E.G. No. 460/54 ..	1930	1954	1956	2	82″	66	Since burnt.
Begur	E.P. No. 103/54 ..	1939	1954	1956	2	47.9″	5	..
Kannoth	E.P. No. 113/54 ..	1941	1954	1956	2	18″	38	..

TABLE LXXI.—*Statement showing the results of underplanting experiments of softwood species.*

Centre.	Experiment number.	Year of Regn. area.	Year of underplanting.	Measurement year.	Age in years.	Height.	Survival per cent.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			Ailanthus malabaricum.					
Nilambur	E.P. No. 168/53-A ..	1943	1953	1956	3	6′	65	..
Do.	E.P. No. 185/54 ..	1943	1954	1956	2	36″—48″	80	..
Topslip	E.G. No. 486/54 ..	1937	1954	1956	2	24″—36″	65	..
Dhoni	E.G. No. 454/54.. ..	1930	1954	1956	2	15″	76	Since burnt away by fire.
Begur	E.P. No. 104/54 ..	1939	1954	1956	2	24·2″	47	..
Kannoth	E.P. No. 102/54 ..	1941	1954	1956	2	14·4″	37	..
			Mahogany.					
Nilambur	E.P. No. 167/50 ..	..	1950	1953	3	4′	..	..
Do.	E.P. No. 183/54 ..	1943	1954	1956	2	36″	54	..
Top slip	E.G. No. 486/54 ..	1937	1954	1956	2	18″	40	..
Dhoni	E.G. No. 459/54 ..	1930	1954	1956	2	16″	54	Since burnt.
Begur	E.G. No. 106/54 ..	1939	1954	1956	2	20″	50	..
Kannoth	E.P. No. 114/54 ..	1941	1954	1956	2	4′—5′	51	..
			Mango.					
Topslip	E.G. No. 486/54 ..	1937	1954	1956	2	1′—2′	20	..
Dhoni	E.G. No. 453/54 ..	1930	1954	1956	2	15″	29	..
Begur	E.P. No. 102/54 ..	1939	1954	1956	2	16·8″	79	..
			Dalbergia latifolia.					
Nilambur	E.P. No. 187/54 ..	1937	1954	1956	2	40″	64	..
			Artocarpus hirsuta.					
Nilambur	E.P. No. 166/54 ..	1943	1950	1953	3	5′	67	..
Do.	E.P. No. 182/54 ..	1943	1954	1956	2	15″	61	..
Dhoni	E.G. No. 458/54 ..	1930	1954	1956	2	7·2″	14	Since burnt.
Kannoth	E.P. No. 110/54 ..	1941	1954	1956	2	4·5″	24	..
			Evodia roxburghiana.					
Nilambur	E.P. No. 168/50 ..	1943	1950	1953	3	Vitiated and closed.		..
Do.	E.P. No. 186/54 ..	1943	1954	1956	2	26″	95	..
Begur	E.P. No. 105/54 ..	1939	1954	1956	2	13·8″	6	..
Kannoth	E.P. No. 111/54 ..	1941	1954	1956	2	22″	70	..
			Sterculia companulata.					
Nilambur	E.P. No. 184/54 ..	1943	1954	1956	2	3′	52	..
Dhoni	E.G. No. 460/54 ..	1930	1954	1956	2	82″	66	Since burnt.
Begur	E.P. No. 103/54 ..	1939	1954	1956	2	47.0″	5	..
Kannoth	E.P. No. 113/54 ..	1941	1954	1956	2	18″	38	..

An examination of the height growth and survival per cent of the species reveals that though the survival per cent is high, the height growth is poor, varying from a few inches to 3 feet. It is very clear that the species put in as underplants have not established themselves; they are still below the height of surrounding shrubby undergrowth. Hence no conclusion can be drawn at this stage about the suitability of the species and much less can we speak of their utility in the protection of the soil. The experiments will therefore be continued. There is no question at this stage of the adverse effect of the underplants, if any, on the volume increment of teak. This can be taken up for consideration, only after the under crop has been successfully established.

216. *Teak plantations—Underplanting with shrubby plants.*—Experiments with tree species as underplants having proved inconclusive, the question of raising commercially important shrubby species, such as *Cinnamomum zeylanicum* and *Rauvolfia serpentina* as underplants in teak plantations was taken up in 1954. Underplanting with these species was done in teak plantations of age 30 years at the end of the penultimate thinning, both in Nilambur and Wynaad. These experiments are still in the preliminary stage and it is too early to draw any indications regarding their suitability as underplants or their effects on the growth and developments of the teak.

217. *Underplanting of teak plantations with Rauvolfia serpentina.*—Attention is invited to paragraph 212 wherein the reasons for starting experiments on the underplanting of teak plantations was described. Among other species tried as underplants, *Rauvolfia 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 most deciduous timber forest and also, in teak plantations.

In paragraph 176 a description is given of experiments conducted at Nilambur, Dhoni, Bogur, on the underplanting of *Rauvolfia serpentina* in teak plantations. The general indication is that it does not thrive in older plantations above mid-rotation age due to effect of drip and formation of sand mounds around the stems. Further trials are necessary on underplanting in young plantations of ages 15 to 30 years.

218. *Underplanting of teak plantations with cinnamomum Zeylanicum.*—Attention is also invited to paragraph 129 wherein experiments were conducted in Nilambur, Topslip, Kannoth and Bogur on the underplanting of teak plantations with *Cinnamomum Zeylanicum*. The preliminary indications are that it is possible to raise a crop of this species as an under-crop in teak plantations.

219. *Lac cultivation in Denkanikota.*—During the year Lac cultivation was carried on at Denkanikota on a small scale. In June 1955, 246 lbs. of Brood Lac and 214 lb. of stick Lac were

obtained from 23 *Schleichera trijuga* trees and 8 *Zizyphus jujuba* trees. Out of this, 200 lb. of Brood Lac were given to Salem North Division for inoculation, and 46 lbs. were inoculated on 23 *Schleichera trijuga* trees and 3 *Zizyphus jujuba* trees. The brood inoculated in June 1955 was ready for harvest in January 1956. Fifty-seven lbs. of good Brood Lac and 53 lb. of Stick Lack were obtained. Thirty lb. of Brood Lac were given to Salem North Division for inoculation and 27 lb. were inoculated on 3 *Schleichera trijuga* trees and 6 *Zizyphus jujuba* trees. The settlement in all these cases was satisfactory.

The proportion of Brood Lac used to that harvested was 1 : 2 for the harvest in June 1955 and 1 : 2 : 5 for the harvest in January 1956 against a proportion of 1 : 3 : 6 for the crop harvested in June 1955.

220. *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. This work has not yet been taken up in the Division.

221. *Manufacture of Lac Products at Denkanikota.*—The statement below furnishes the quantities and value of lac products manufactured at Denkanikota during the year as compared with the previous year.—

TABLE LXXII —*Statement showing the quantity and value of lac products manufactured at Denkanikota.*

Description of produce.	*Rate per lb.*	*During 1954-55.*		*During 1955-56.*	
		Quantity in lb.	*Value.*	*Quantity in lb.*	*Value.*
	Rs. A. P.		Rs. A. P.		Rs. A. P.
Spirit composition polish (French polish).	1 5 0	4,902	6,433 14 0	5,747	7,542 15 0
Superior I.V. sealing wax.	3 1 0	51	156 3 0	2,091	6,403 11 0
Ordinary I.V. sealing wax.	2 3 0	—87½	191 6 6	93	203 7 0
Cheap grade sealing wax.	0 13 0	150½	122 4 6	80	65 0 0
Royal Vermillion sealing wax.	7 10 0	..	..	71	541 6 0
Shellac varnish ..	1 11 0	..	..	220	371 4 0
Bleached lac ..	4 10 0	..	..	15	69 6 0
Total value ..	..	..	6,903 12 0	..	15,197 1 0

The substantial increase in the value of manufactured products during the year is due to securing an order from the Controller of Stationery and Printing, Madras, for the supply of 2,500 lb. of Superior Imitation vermillion sealing wax.

During the year, a total quantity of 2,692 lb. of washed kusum lac, 158 lb. of Shorea lac and 45 lb. of Dust lac (total 2,895 lb) were used in the manufacture of lac products against 1,187 lb. of washed lac utilized in the previous year. During the year, owing to failure of the lac crop in the Madurai West Division and lack of successful crops in Salem North Division, 1,927 lb. of washed lac were purchased from a lac factory in Ranchi in Bihar.

222. *Revenue, expenditure and profit on lac manufacture.*—The revenue obtained by the sale of lac products, the expenditure incurred in their manufacture and the net profit are furnished in the following table, which gives also the corresponding figures for the previous year :—

TABLE LXXIII.—*Abstract of Revenue and expenditure in manufacture of lac products.*

Particulars.	1954–55.			1955–56.		
	RS.	A.	P.	RS.	A.	P.
1 Total revenue	8,922	3	9	16,327	0	6
2 Expenditure	5,561	9	9	10,838	10	8
3 Profit in manufacture	3,360	10	0	5,488	5	10

223. *Shifting of lac factory to Cumbum (Madurai district).*—The location of the lac factory at Denkanikota is not a sound business proposition. The nearest railway station is Malur at a distance of 36 miles and this long lead is inconvenient for receipt of raw materials such as lac and denatured spirit and for despatch of the manufactured products. It has, therefore, been decided by the Chief Conservator of Forests that the factory should be transferred to Cumbum in the Madurai district and that the Forest Utilization Officer, Madras, should be in administrative control of the factory. The transfer of the factory to Cumbum will take place in 1956–57.

(x) SILVICULTURAL SYSTEMS.

224.—Nil.

(xi) MISCELLANEOUS.

225. *Teak—Experiment on girdling mature teak trees one year before felling to observe the degree of seasoning of timber.*—During 1954-55, an experiment to study the effect of girdling of mature teak trees one year before felling at rotation age was started in Nilambur teak plantation of 1891 at Edacode. In an one acre plot of III quality 37 trees of comparable girths were marked. Seventeen trees were girdled in June 1954 while the other 20 trees were girdled in October 1954 coinciding with the break between south-west and north-east monsoons.

Girdling was done to a width of 2½ feet and 1 foot above ground level and up to the cambium all round the tree. No chemical or poison was used.

The trees were kept under observation for a period of about one year and observations showed that mature teak trees, if girdled up to the cambuim layer, during June to October, can cause death to the extent of 60 per cent of the trees girdled. External effects due to fungii or rot were not noticeable during the one year period.

	Number of trees dead.
June girdled trees	10/17.
October girdled trees	12/20.

Signs of dying off was noticed from about April 1955, i.e., about ten months after the operation.

The District Forest Officer, Nilambur, has been requested to sell these dead trees separately and to obtain a report from the purchaser as to the behaviour of the girdled logs and ordinary teak logs, as regards sawing quality. The object of this experiment is to find out if trees which are killed by girdling one year ahead of felling will be better due to partial seasoning, as regards sawing quality and workability with tools. Results are awaited from the District Forest Officer.

PART III.

WORKING PLANS AND STATISTICS.

(i) Working plans.

226. The State Silviculturist was in touch with the Working Plans Officers of the several Divisions and gave them whatever information was required with reference to Ledger Files. He was generally consulted with regard to prop sed prescriptions on silvicultural matters and statistical work.

227. The following statement shows the Working Plans under propration at the beginning of the year, new ones undertaken during the year and those completed during the year :—

Divisions for which working plans were under preparation at the beginning of the year.	*New divisions undertaken during the year.*	*Divisions for which working plans were finalised during the year.*
Nilambur	Cuddalore	Nilambur.
Tiruchirappalli	Kollegal	Tiruchirappalli.
Coimbatore North	Salem South	Coimbatore North.

(ii) Yield, Volume and Form Factor Tables.

228. *Simple plots.*—No new sapmle p'ots were opened during the year. But teak sample plot Nos. 128, 129 and 130 of Nellicutha in Nilambur were finally measured and clearfelled. The measurements have been sent to the Central Silviculturist, Forest Research Institute, Dehra Dun, for computation. The plots have been closed and handed over to the Division for replanting with teak.

229. Sample plot No. 2 in Coimbatore North Division has also been closed during the year. There are now 184 sample plots representing 21 species in seven Forest Divisions. An abstract is furnished under paragraph 6 giving the distribution of sample plots. Appendix 'B' furnishes a detailed list of all sample plots in existence in Madras State at the close of the year.

230. *Permanent preservation plots.*—No new plots were opened during the year. There are now 14 permanent preservation plots at the close of the year. Appendix 'B' furnishes a detailed list. These are situated in four Divisions and cover 8 species.

231. *Tree increment plots.*—Two new tree increment plots were opened during the year. There are now 26 tree increment plots. Appendix 'B' furnishes a detailed list of all tree increment plots. These are situated in six forest divisions and cover 11 species.

232. *Multiple yield tables for teak.*—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) Mueras Barkments, heartwood measurements, etc.

Bark—Measurements.

233.—Nil.

(iv) Miscellaneous Formulae, etc.

District Experiments.

234. 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 'G'.

PART IV.

MISCELLANEOUS.

A. Forest Botany.

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

B. Forest Entomology.

(a) *Systematic Entomology.*

236. Nil.

(b) *Economic Entomology.*

(i) Specific Investigation.

237. *Teak defoliator attack in Madras—Investigations.*—During February 1955, the Entomologist of the Forest Research Institute Dehra Dun (Dr. Roonwall), along with the Statistician (Dr. K. R. Nair) toured in Nilambur Division. The question of teak defoliation, on which no research of value had been done in the past was considered. A detailed note on the subject was prepared as a result of discussions at a conference at which the Entomologist, the Statistician, the Conservator of Forests, Ootacamund Circle, the State Silviculturist, the District Forest Officer, Nilambur and the Working Plan Officer, Nilambur, participated. This Note was given as Appendix 'G' in the Annual Report on Silvicultural Research in Madras State for 1954–55.

The experiments suggested in the above Note will be taken up during 1956–57.

(ii) Miscellaneous Investigations.

238. *Ailanthes excelsa and A. malabaricum.*—In Madras State, large areas are being taken up for artificial regeneration with Softwoods suitable for the Match Industry, such as *Bombax malabaricum*, *Ailanthes excelsa* and *Ailanthes malabaricum*. The latter two plants are subject to the attacks of a Defoliator "*Eligna narcissus*" —(*Noctuidae*). Investigations have been undertaken by the Forest Entomologist in February 1955, to study the life history of this insect.

Experiments on the spraying and dusting of insecticides on plants for eradication of this pest are under contemplation and will be referred to in the next report.

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

Experiments on the spraying and dusting of Insecticides on plants for eradication of this pest are being undertaken and the results will be furnished in the next report.

(ii) Unclassified or Unidentified Damage.

240. Nil.

(C) Forest Zoology.

241. Nil.

(D) Utilization.

242. In Madras State, there is a wholetime Forest Utilization Officer with Headquarters at Madras, working under the administrative control of the Conservator of Forests, Development Circle, Madras. A copy of the report prepared by him on Forest Utilization for the year 1955–56 is furnished as Appendix 'I'.

P. VENKAIRAMAN,
State Silviculturist, Ootacamund.

APPENDIX A,

Rainfall statement of the Research centres

Months.	*Evergreen forests.*					
	Topslip.		*Chandanathode.*		*Nilambur.*	
	Rainfall.	*Number of days.*	*Rainfall.*	*Number of days.*	*Rainfall.*	*Number of days.*
April 1955	4·00	5	9·10	7	4·88	9
May 1955	12·30	11	36·70	15	20·09	21
June 1955	13·20	19	59·49	28	31·05	27
July 1955	5·10	13	46·70	29	13·07	20
August 1955	6·30	17	41·30	31	12·26	22
September 1955	9·20	19	18·00	23	20·65	22
October 1955	5·10	10	15·60	14	23·67	21
November 1955	4·60	6	2·80	3	4·04	5
December 1955	1·80	3	..	..	0·20	1
January 1956	..	..	..	..	..	..
February 1956	..	..	..	..	..	..
March 1956	..	..	..	..	0·18	1
Total rainfall for 1955–56	61·60	103	229·69	155	130·18	149
Total rainfall for number of years	1,877·28	2,835	7,436·21	5,526	8,734·11	9,425
	30		38		79	
Average rainfall per year	62·58	95	195·70	145	110·56	119

Months.	*Mixed deciduous forests.*							
	Begur.		*Kannoth.*		*Dhoni.*		*Walayar.*	
	Rainfall.	*Number of days.*	*Rainfall.*	*Number of days.*	*Rainfall.*	*Number of days.*	*Rainfall.*	*Number of days.*
April 1955	4·81	10	2·38	4	1·98	6	3·20	9
May 1955	13·35	15	25·52	14	22·48	17	8·60	8
June 1955	13·19	22	39·44	28	24·65	25	16·20	15
July 1955	5·02	22	28·20	27	12·63	23	1·40	5
August 1955	6·96	25	27·39	31	18·31	28	7·50	15
September 1955	7·85	22	13·63	18	14·05	19	5·70	10
October 1955	8·78	16	15·40	24	19·30	19	3·00	5
November 1955	0·78	3	4·01	5	4·25	6	2·70	9
December 1955	..	..	..	..	..	..	..	..
January 1956	..	..	..	..	0·45	2	..	..
February 1956	..	..	..	..	..	..	..	..
March 1956	..	..	..	..	..	..	..	..
Total rainfall for 1955–56	60·74	135	155·97	151	118·10	145	48·30	67
Total rainfall for number of years	2,556·00	3,718	6,288·07	5,430	3,003·63	3,665	1,817·74	2,602
	37		38		27		34	
Average rainfall per year	69·10	100	165·47	143	111·25	136	53·46	77

APPENDIX A—contd.

Rainfall statement of the Research centres—contd.

Month.	*Dry deciduous forests Inland districts.*						*East Coast district casuarina planting.*		*High elevation forest.*	
	Denkanikota.		*Markanum.*		*Rameswaram.*		*Vemburili.*		*Aramby.*	
	Rainfall.	*Number of days.*	*Rainfall.*	*Number of days.*	*Rainfall.*	*Number of days.*	*Rainfall.*	*Number of days.*	*Rainfall.*	*Number of days.*
April 1955	1·67	5	2·29	4	0·40	4	Opened only in July.		4·40	6
May 1955	5·53	17	10·25	6	0·50	1	Do.		18·17	11
June 1955	1·37	8	1·70	7	..	..	..	..	5·79	17
July 1955	1·35	5	2·92	11	..	..	1·90	8	3·72	8
August 1955	3·79	15	4·93	14	0·15	1	2·58	5	1·61	7
September 1955 ..	5·33	11	3·02	5	1·11	2	4·01	7	6·20	12
October 1955 ..	4·00	10	6·79	11	7·03	7	7·62	13	5·38	11
November 1955 ..	1·35	3	4·50	7	14·42	8	2·92	8	2·38	7
December 1955	1·35	4	5·67	6	20·32	4	6·27	7	1·42	7
January 1956 ..	..	..	1·94	4	0·05	1	0·88	4	..	..
February 1956 ..	..	..	..	..	..	..	..	..	..	..
March 1956	..	..	..	..	..	..	..	..	..	..
Total for 1955–56 ..	25·74	78	44·01	75	43·53	28	26·18	52	49·07	86
Total rainfall for number of years.	1,063·13	2,157	44·01	75	43·53	28	26·18	52	873·59	1,687
	31		1		1		1		16	
Average rainfall per year.	34·30	69	44·01	75	43·53	28	26·18	52	54·60	110

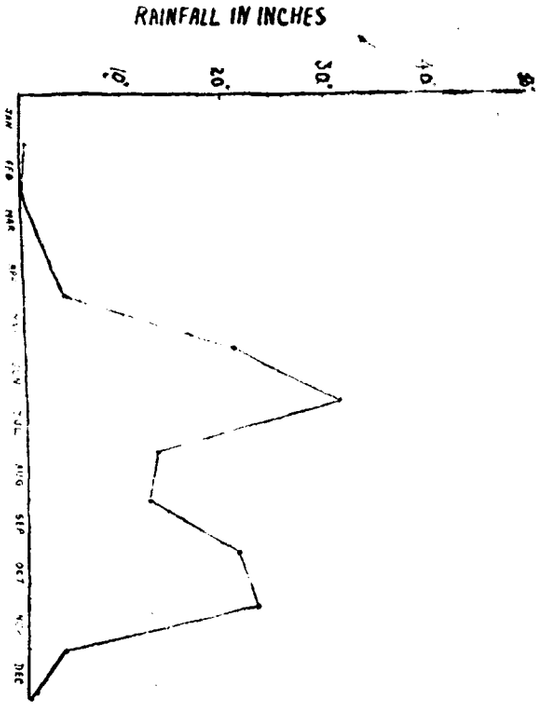
Begur Research Centre.

Climate Factors.—
Altitude.—2,700 ft.
Long tude.—760–770.
Latitude.—11°4120-N.

Months averages.—

Month.	Rain fall in inches. (1)	Number of rainy days.
(2) January.	Nil.	Nil.
(3) February.	Nil.	Nil.
(4) March.	0·23	2
(5) April.	4·81	10
(6) May.	11·35	15
(7) June.	13·19	22
(8) July.	5·12	32
(9) August.	6·06	25
(10) September.	7·85	22
(11) October.	8·78	16
(12) November.	0·78	2
(13) December.	Nil.	Nil.
(14) Total rainfall.	60·97	127

RAIN FALL CHART
BEGUR 1955.



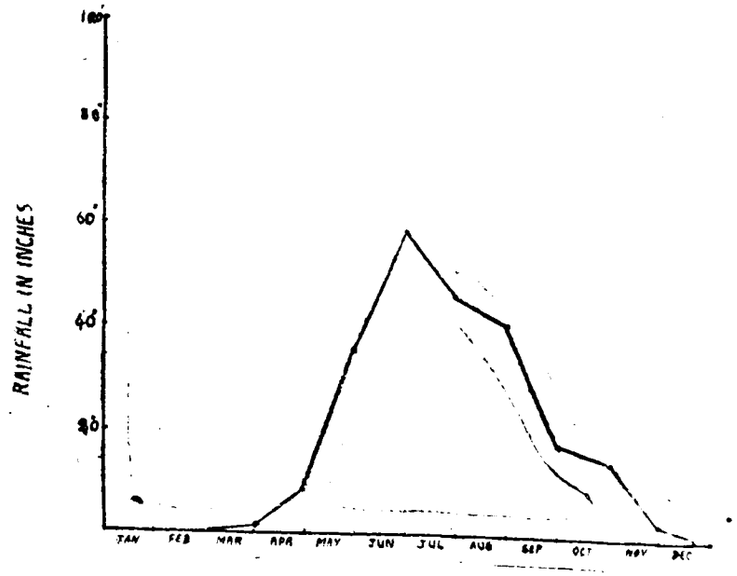
CHANDANATHODE RESEARCH CENTRE.

Climatic Factors.— Altitude.—2600 ft.

Months averages.— Longtitude.—750–760.

Latitude.—110–120–N.

RAIN FALL CHART.
CHANDANTHODE 1955.



Months.	January.	February.	March.	April.	May.	June.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Number of rainy days.	Nil.	Nil.	2	[illegible]	15	28
Rain fall in inches ..	Nil.	Nil.	1·10	9·10	36·70	59·49

Months.	July.	August.	September.	October.	November.	December.	Total rain-fall.
(8)	(9)	(10)	(11)	(12)	(13)	(14)
Number of rainy days.	29	31	23	14	8	Nil.	15
Rain fall in inches ..	46·63	31·30	18.00	15·60	2·80	Nil.	230 70

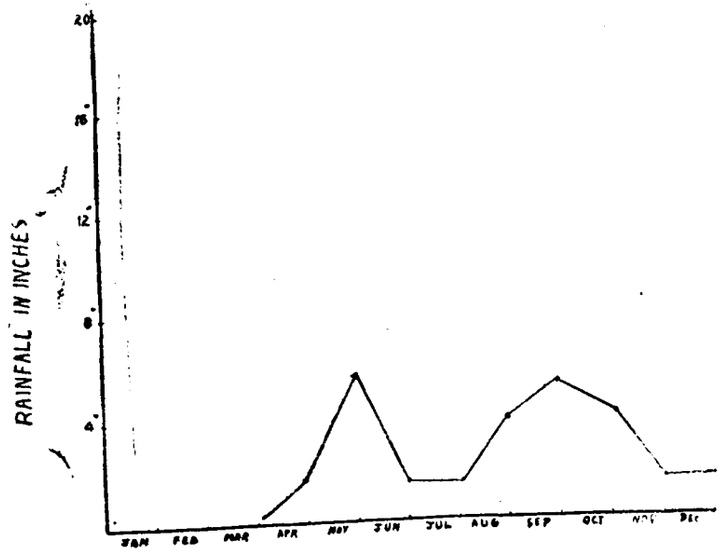
DEVKANIKOTA RESEARCH CENTRE.

Climatic factors.— Altitude.—1800 ft.

Monthly averages.— Longtitude.—177–30–78 7o.

Latitude. –12–4oN–12–44oN

DEVKANIKOTA.



Months.	January.	February.	March.	April.	May.	June.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rain fall in inches ..	..	..	..	1·67	5·53	1·37
Number of rainy days.	..	..	..	5	17	8

Months.	July.	August.	September.	October.	November.	December.	Total rain-fall.
(8)	(9)	(10)	(11)	(12)	(13)	(14)
Number of rainy days.	5	15	11	10	3	4	78
Rain fall in inches ..	1·35	3·79	5·33	4·00	1·35	1·25	25·7

Kannoth Research Centre.

Claimate Factors.—

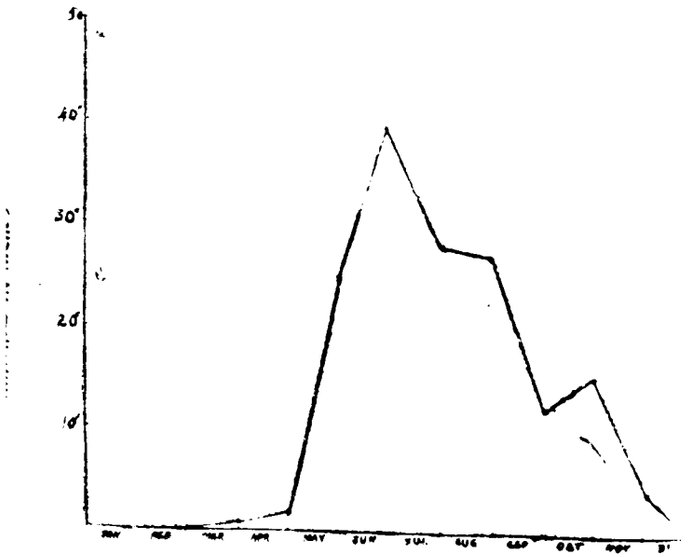
Months averages.—

Altitude.—300 ft.

Longtitude.—75o-76o.

Latitude.—12o-N.

RAIN FALL CHART.
KANNOTH 1955.



Months.	January.	February.	March.	April.	May.	June.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
fa'l in inches ..	Nil.	Nil	1·12	2·38	25·52	29·44
ber of rainy days.	Nil.	Nil	1	4	14	22

Months.	July.	August.	September.	October.	November.	December.	Total rain-fall.
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
fall in inches ..	28.20	27 39	13 63	15 40	4·01	Nil.	157·09
ber of rainy days.	17	21	18	24	5	Nil.	152

Masakapum Research Centre.

Climatic Factors.—

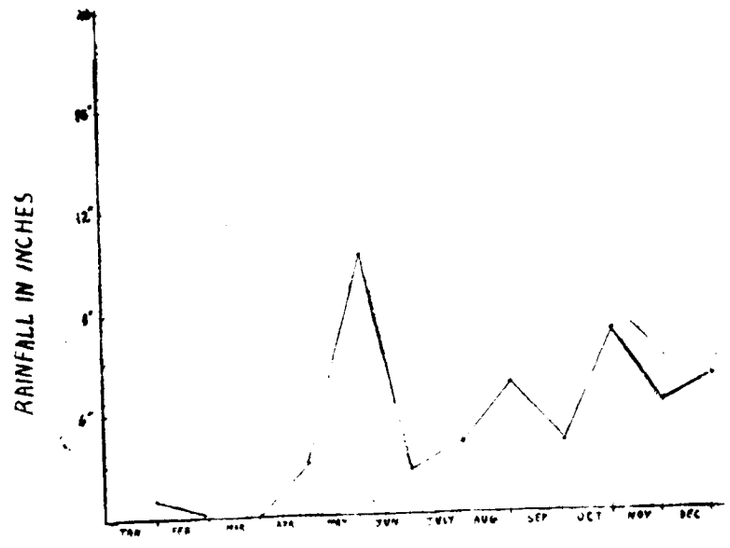
Months average.—

Altitude.—20 ft.

Longlitude.—80o.

Latitude.—12o-12—N.

MAKANAM



Months.	January.	February.	March.	April.	May.	June.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rain f'll in inches ..	0·87	..	..	2 29	10·25	1 70
Number of rainy days	3	..	..	4	6	7

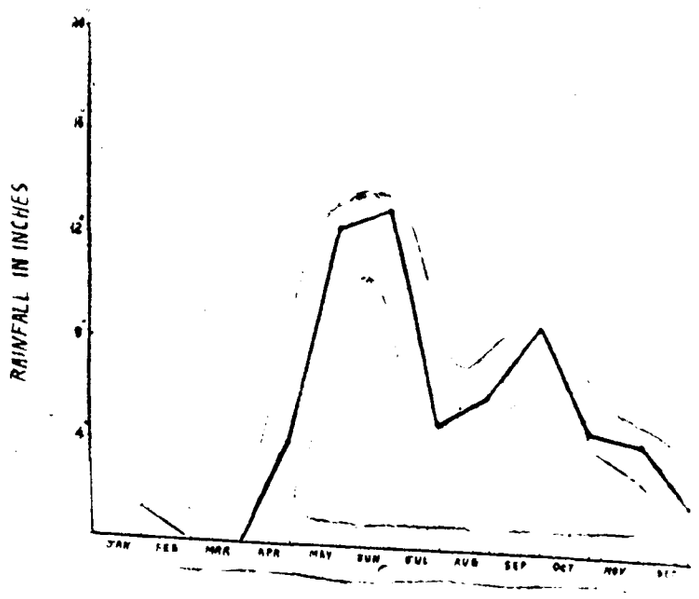
Months.	July.	August.	September.	October.	November.	December.	Total rain-fall.
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Rain fa'l in inches ..	2·92	4·93	3·02	6·79	4·50	5·67	42·94
Number of rainy days.	11	14	8	11	7	6	75

Nilambur Research Centre.

Climatic factors.—
Months averages.—

Altitude.—100 ft.
Longtitude.—11°–12°.
Latitude.—76°–77°.

NILAMBUR.



Months.	January.	February.	March.	April.	May.	June.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rain fall in inches ..	0·32	Nil.	Nil.	4·88	20·09	31·05
Number of rainy days.	1	..	..	2	21	27

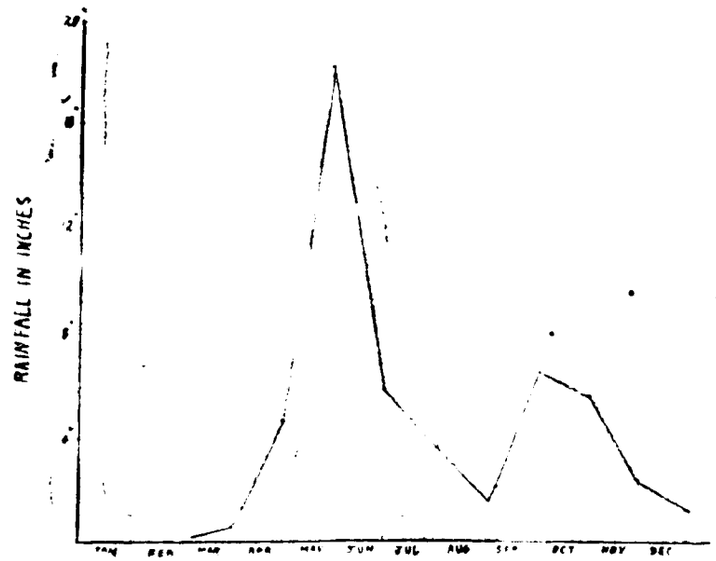
Months.	July.	August.	September.	October.	November.	December.	Total rainfall.
(8)	(9)	(10)	(11)	(12)	(13)	(14)	
Rain fall in inches ..	13·07	12·26	20·65	23·67	4·04	0.20	130·23
Number of rainy days.	20	22	22	21	8	1	150

Ootacamund Research Centre.

Climatic factors.—
Months averages.—

Altitude.—7,200 ft.
Longtitude.—76°–77°–N.
Latitude.—11°–12°.

OOTACAMUND.



Months.	January.	February.	March.	April.	May.	June.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rain fall in inches ..	..	..	0·50	4·40	18·17	5.79
Numer of rainy days.	..	..	4	6	11	17

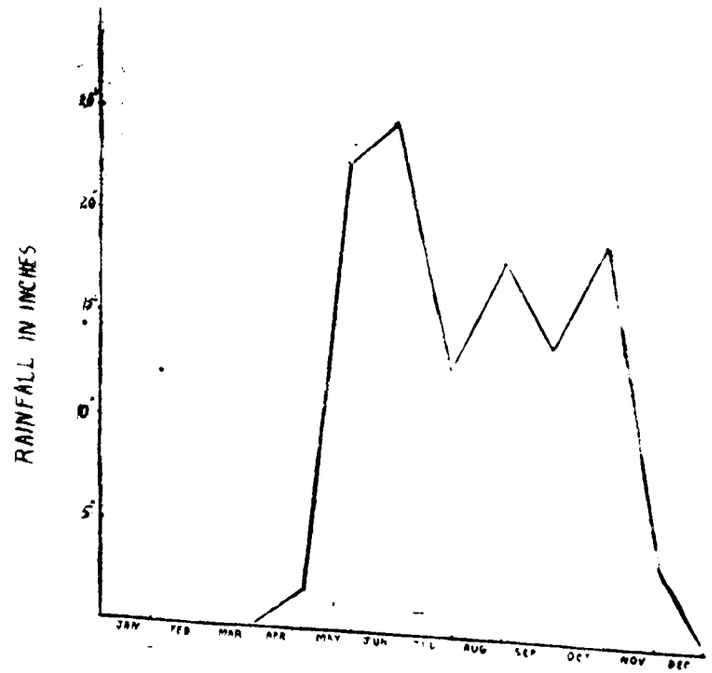
Months.	July.	August.	September.	October.	November.	December.	Total rainfall.
(8)	(9)	(10)	(11)	(12)	(13)	(14)	
Rain fall in inches ..	3·72	1·61	6·20	5·38	2·38	1·42	49·57
Number of rainy days.	8	7	12	11	7	7	96

Dhoni Research Centre.

Climatic factors.—
Months averages.—

Altitude.—4,001 ft.
Longtitude.—76 –77°.
Latitude.—10°–11°–N.

PALGHAT.



Months.	January.	February.	March.	April.	May.	June.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rain fall in inches	..	..	..	1·98	22·48	24·65
Number of rainy days.	..	..	..	5	17	24

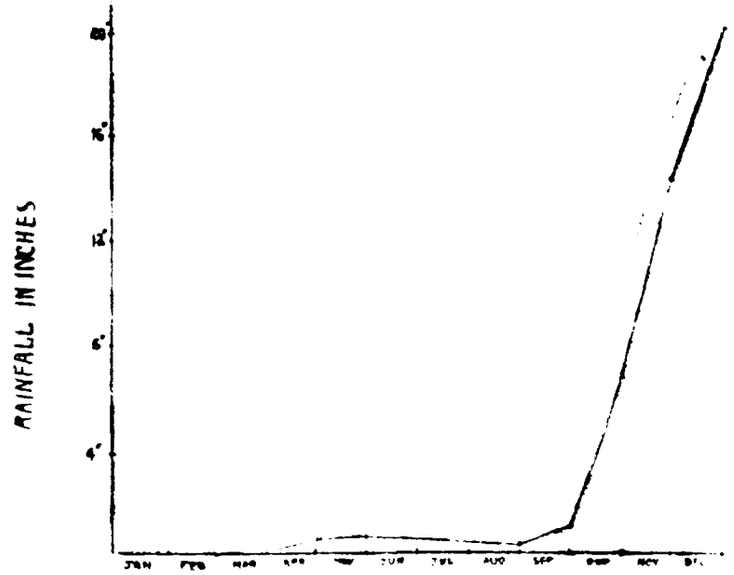
Months.	July.	August.	September.	October.	November.	December.	Total rain-fall.
(8)	(9)	(10)	(11)	(12)	(13)	(14)
Rain fall in inches	12·61	9·31	14·03	19·30	4·25	..	117·65
Number of rainy days.	22	28	19	19	6	..	143

Rameshwaram Research Centre.

Climatic factors.—
Months averages.—

Altitude.—10 ft.
Longtitude.—79°–80°.
Latitude.—9°–10°.

RAMESHWARAM.



Months.	January.	February.	March.	April	May.	June.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rain fall in inches	..	..	..	0·40	0 50	..
Number of rainy days.	..	..	..	1	1	..

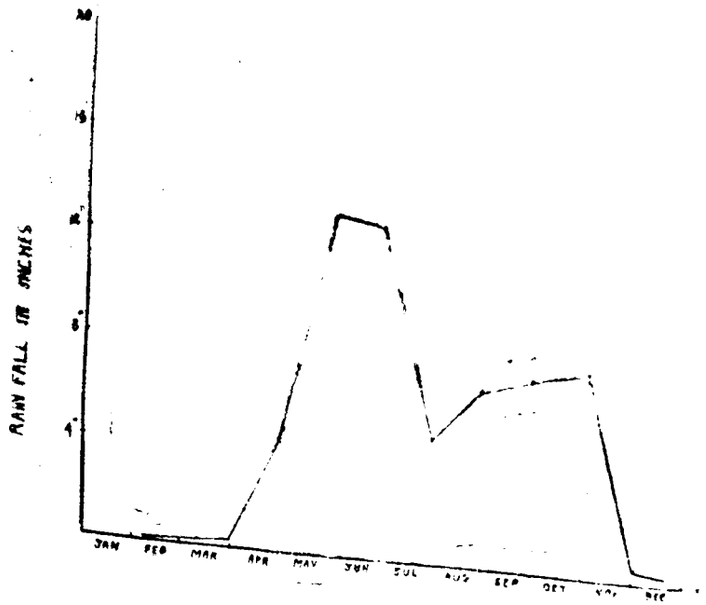
Months.	July.	August.	September.	October.	November.	December.	Total rain-fall.
(8)	(9)	(10)	(11)	(12)	(13)	(14)
Rain fall in inhes	..	0·15	1·11	7·03	14·42	20·32	43·93
Number of rainy days.	..	1	2	7	3	4	2

Topslip Research Centre.

Climatic factors.—
Months averages.—

Altitude.—1,900 ft.
Longtitude.—77o–78o.
Latitude.—10o–11o—N.

TOPSLIP.



Months.	January.	February.	March.	April.	May.	June.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rain fall in inches ..	1·00	..	..	4·00	12·20	13·20
Number of rainy days.	1	..	..	5	11	10

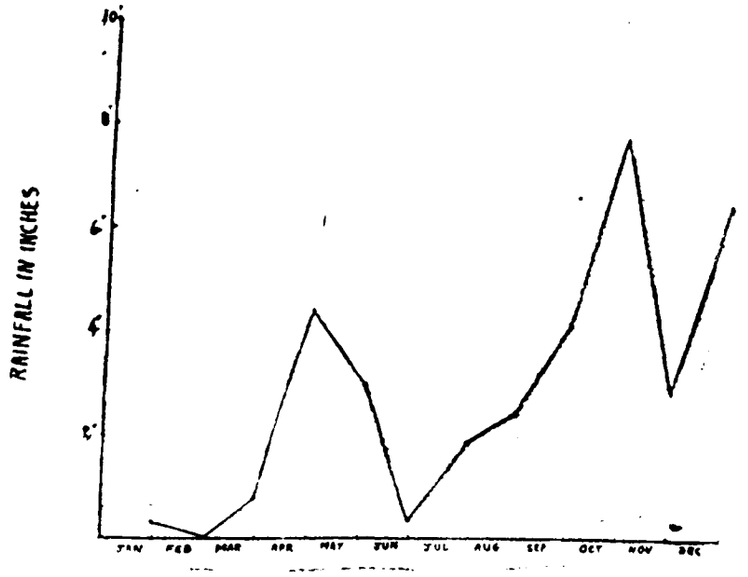
Months.	July.	August.	September.	October.	November.	December.	Total rain-fall.
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Rain fall in inches ..	5·10	6·.0	9·20	5·10	5·60	1·03	60·18
Number of rainy days.	13	17	19	10	8	3	101

Vemburli Research Centre.

Climatic factors.—
Months averages.—

Altitude.—500 ft.
Longtitude. | 78o–79o.
Latitude.—90o–100o.

VEMBURUL



Months.	January.	February.	March.	April.	May.	June.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rain fall in inches ..	3·25	Nil	0·62	7·27	2·96	0·53
Number of rainy days.	1	Nil.	2	3	4	3

Months.	July.	August.	September.	October.	November.	December.	Total rain-fall.
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Rain fall in inches ..	1·99	2·59	4·01	7·62	2·92	6.27	34·93
Number of rainy days.	2	5	7	12	8	7	61

APPENDIX B.

(Referred to in paragraph 7).

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*	To 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.*	To study volume increment.
	2	*E. euginoides*	Do.
	3	*E. propinqua*	Do.
	4	*E. acmenoides* ..	Do.
	5	*E. paniculata* ..	Do.
	8	*Acacia mollissima* ..	Do.
	9	*A. decurrens*	Do.
	10	*A. mollissima* ..	To find out the yield of bark at different age.
Coimbatore, South.	1	*Tectona grandis* ..	To ascertain data for yield table for teak at Mount Stuart.
	2 to 17	*Do.* ..	To 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.
Nilambur ..	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.* ..	Do.
	7	*Do.* ..	To study volume increment and development of plantation I quality fairly severely thinned

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.	8	*Tectona grandis* ..	To study volume increment and development of plantation I quality very severely thinned.
	9	*Do.* ..	To find out girth increment.
	10	*Do.* ..	Do.
	11	*Do.* ..	Do.
	12	*Do.* ..	Do.
	13	*Do.* ..	Do.
	14	*Do.* ..	Do.
	15	*Do.* ..	Do.
	16	*Do.* ..	Do.
	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.* ..	
	19 (a)	*Do.* ..	
	27	*Do.* ..	To find out girth increment.
	29 to 31	*Do.* ..	Do.
	35	*Do.* ..	Do.
	49	*Do.* ..	Do.
	51 & 52	*Xylia xylocarpa* ..	To find out the rate of growth of natural Xylia.
	54	*Lagerstroemia lanceolata.*	To determine volume increment.
	55	*L. flos reginæ* ..	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.
	69 to 77	*Do.* ..	To study the best intensity of thinning.
	80 to 86		
	96 to 115		Comparison of growth from different origins.
	116 to 119	*Do.* ..	(North Burma origin). To compare height, diameter and volume growth teak of five other origins for which sample plots No. 96 to 115 have been opened.
	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.

APPENDIX B.

(Referred to in paragraph 7).

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.*	To 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.*	To study volume increment.
	2	*E. euginoides*	Do.
	3	*E. propinqua*	Do.
	4	*E. acmenoides* ..	Do.
	5	*E. paniculata* ..	Do.
	8	*Acacia mollissima* ..	Do.
	9	*A. decurrens*	Do.
	10	*A. mollissima* ..	To find out the yield of bark at different age.
Coimbatore, South.	1	*Tectona grandis* ..	To ascertain data for yield table for teak at Mount Stuart.
	2 to 17	*Do.* ..	To 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.
Nilambur ..	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.* ..	Do.
	7	*Do.* ..	To study volume increment and development of plantation I quality fairly severely thinned.

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.*	8	*Tectona grandis* ..	To study volume increment and development of plantation I quality very severely thinned.
	9	*Do.* ..	To find out girth increment.
	10	*Do.* ..	Do.
	11	*Do.* ..	Do.
	12	*Do.* ..	Do.
	13	*Do.* ..	Do.
	14	*Do.* ..	Do.
	15	*Do.* ..	Do.
	16	*Do.* ..	Do.
	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.* ..	
	19 (*a*)	*Do.* ..	
	27	*Do.* ..	To find out girth increment.
	29 to 31	*Do.* ..	Do.
	35	*Do.* ..	Do.
	49	*Do.* ..	Do.
	51 & 52	*Xylia xylocarpa* ..	To find out the rate of growth of natural Xylia.
	54	*Lagerstroemia lanceolata.*	To determine volume increment.
	55	*L. flos reginæ* ..	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.
	69 to 77	*Do.* ..	To study the best intensity of thinning.
	80 to 86	*Do.* ..	
	96 to 115	*Do.* ..	Comparison of growth from different origins.
	116 to 119	*Do.* ..	(North Burma origin). To compare height, diameter and volume growth teak of five other origins for which sample plots No. 96 to 115 have been opened.
	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.

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.*	126 and 127	*Tectona grandis* ..	To determine the height, diameter and volume increment of I quality teak plantation approching the end of the rotation (when maintained beyond normal rotation age).
	131	*Swietenia macrophylla.*	To determine height, diameter and volume increment.
	132	*Do.* ..	Do.
	133 and 134	*Do.* ..	To determine the best size of transplants and the best espacement for regeneration of Mahogany after clearfelling.
	135	*Pericopsis mooniana* ..	Under planting.
	136 to 141	*Tectona grandis* ..	Repetition of Dr. Crabib's theory of thinning (similar to sample plots Nos. 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 tending.
	42 and 43	*Do.* ..	To determine whether Lantana has a retarding effect on the growth of teak.
	44	*Pterocarpusmarsupium*	To find out the effect of size and condition of of seed bearers.
	45	*Tectona grandis* ..	
	46	*Terminali crenulata* ..	
	47	*Swietenia macrophylla.*	
	48	*Vitex peduncularis* ..	
	49	*Lagerstroemia flos reginae.*	To find out the height, diameter and volume increments.
	50	*Hopea parviflo*	
	51	*Pterocarpus dalbergioodes.* ..	
	52	*Chlorophora excelsa.* ..	
	53	*Hopea parviflora* ..	
	54	*Ailanthes malabaricum.*	
	55	*Stericuia companulata.*	
South Kanara ..	1	*Hopea parviflora*	

Division.	*Sample plot number.*	*Species.*	*Particulars.*
		I. SAMPLE PLOTS—*cont.*	
	2	*Hopea parviflora* ..	To study volume increment (moderate thinning).
	3	*Do.* ..	To study volume increment (heavy thinning).
Coimbatore North.	1	*Tictona grandis* ..	To study the diameter and volume increment of irrigated teak.
	2	*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 teak.

Division.	*Permanent Preservation plot number.*	*Species.*	*Particulars.*
		II. PERMANENT PRESERVATION PLOTS.	
Nilambur ..	1	*Swietenia macrophylla.*	Demarcation 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.*	
	4	*S. Mahagoni*	
	6	*Tectona grandis* ..	
Wynaad ..	1.	(1) *Tectona grandis* ..	To preserve permanently and to find out the normal development.
		(2) *Lagerstroemia lanceolata*	
		(3) *Grewia tiliafolia* ..	
		(4) *Lagerstroemia lanceolata.*	
		(5) *Dalbergia latifolia.*	
		(6) *Pterocarpus marsupium.*	
		(7) *Bombax malabaricum.*	
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.*	To prevent the groups of trees of the species from all forms of injury and to permit the normal development.
Coimbatore, South.	1	*Tectona grandis* ..	Preservation of a big tree near Tellikal. To preserve the tree from all forms of injury and to permit the normal

Division.	Tree increment plot number.	Species.	Particulars.
		III. TREE INCREMENT PLOTS.	
Coimbatore, South.	1	*Mesua ferrea.*	
	2	*Hopea parviflora.*	
	3	*Calophyllum elatum.*	
	4	Miscellaneous evergreen species	(New Linear Tree Increment Plots.).
Palghat	1	*Mesua ferrea.*	
	2	*Palaquium ellipticum.*	
	3	Miscellaneous evegreen species	(New Linear Trees Increment Plots).
South Kanara ..	1	*Hopea parviflora.*	
	1	*Acacia catechu.*	
	3	*Do.*	
Nilgiris	1	*Eucalyptus globulus.*	
	2	*Shola species.*	
Wynaad ..	1	*Mesua ferrea.*	
	2	*Palaquium ellipticum.*	
	3	*Tectona grandis.*	
	4	*Dalbergia latifolia.*	
	5	*Pterocarpus marsupium.*	
	6	*Terminalia crenulata.*	
	7	*Lagerstroemia lanceolata.*	
	8	*Grewia latifolia.*	
	9	*Artocarpus hirsuta.*	
	10	Miscellaneous evergreen species.	
	11	*Mahogany.*	
Salem, North ..	1	*Santalum album.*	
Salem, South ..	1	*Santalum album.*	
Vellore, East ..	1	*Santalum album.*	

APPENDIX C.

APPENDIX C.

Statement showing seeds and seedlings collected and supplied to various indentors during 1955-56—Indigenous seeds.

Serial number.	Species.	Supplied to whom	Seed origin.	Supplied by	Quantity.	
(1)	(2)	(3)	(4)	(5)	(6)	
					LB.	OZ.
1	*Acacia mollissima*	Silviculturist, Assam	Research Centre, Ootacamund.	Research Forester, Ootacamund.	550	0
2	*Do.*	Damodar Valley Corporation	Do.	Do.	1	0
3	*Do.*	Deputy Conservator of Forests, Mercara.	Do.	Do.	50	0
4	*Do.*	Silviculturist, Orissa	Do.	Do.	¼	0
5	*Do.*	Divisional Forest Officer, Kalimpong.	Do.	Do.	4	8
6	*Do.*	Do. Parlakimedi.	Do.	Do.	¼	0
7	*Do.*	Do. Balliguda	Do.	Do.	¼	0
8	*Do.*	District Forest Officer, Visakhapatnam South.	Do.	Do.	1½	0
9	*Do.*	Range Forest Officer, Abu Road	Do.	Do.	0	3
10	*Do.*	Divisional Forest Officer, Srinagar	Do.	Do.	1	0
11	*Do.*	Silviculturist, Bombay State	Do.	Do.	0	4
12	*Do.*	Forest Officer, Manipur	Do.	Do.	100	0
13	*Do.*	Superintendent, Cinchona Plantations, Anamalais.	Do.	Do.	1	0
14	*Do.*	Silviculturist, Travancore-Cochin State.	Do.	Do.	0	8
15	*Do.*	Kunjimayan Hajee, North Malabar.	Do.	Do.	2	0
16	*Do.*	District Forest Officer, Chittoor East.	Do.	Do.	0	2
17	*Do.*	Do. Nellore North.	Do.	Do.	0	15
18	*Do.*	Do. Chittoor West.	Do.	Do.	2	0
19	*Do.*	Chief Forest Officer, North East Frontier Agency.	Do.	Do.	161	8
20	*Do.*	Divisional Forest Officer, K. & J. Hills, Shillong.	Do.	Do.	80	0
21	*Do.*	Silviculturist, Madhya Bharat	Do.	Do.	1	0
22	*Do.*	District Forest Officer, Coimbatore North.	Do.	Do.	10	0
23	*Do.*	District Forest Officer, Godavari Upper.	Do.	Do.	1	8
					970	8
1	*Acacia decurrens*	Silviculturist, Orissa	Ootacamund	Research Forester, Ootacamund.	0	8
2	*Do.*	Divisional Forest Officer, Kalimpong.	Do.	Do.	0	4
3	*Do.*	Do. Balliguda	Do.	Do.	0	8
4	*Do.*	Range Forest Officer, Abu Road	Do.	Do.	0	3
5	*Do.*	Manager, Ceylon Produce Agency, Matale.	Do.	Do.	10	0
6	*Do.*	Silviculturist, Travancore-Cochin State.	Do.	Do.	2	0
7	*Do.*	District Forest Officer, Visakhapatnam North.	Do.	Do.	1	8
8	*Do.*	Chief Forest Officer, North East Frontier Agency.	Do.	Do.	1	8
9	*Do.*	Divisional Forest Officer, Satara Division.	Do.	Do.	0	2½
10	*Do.*	Research Forester, Topslip	Do.	Do.	0	8
11	*Do.*	Divisional Forest Officer, Parlakimedi.	Do.	Do.	0	8
					17	9½
1	*Acacia dealbata*	Divisional Forest Officer, Satara	Ootacamund	Research Forester, Ootacamund.	0	10
2	*Do.*	Range Officer, Palghar, Thana	Do.	Do.	5	0
3	*Do.*	Silviculturist, Bombay State	Do.	Do.	0	4
					5	14
1	*Acacia melanoxylon*	Divisional Forest Officer, Sahabad	Ootacamund	Research Forester, Ootacamund.	0	8
2	*Do.*	Silviculturist, Bombay State	Do.	Do.	0	4
					0	12

Statement showing seeds and seedlings Collected and supplied to various Indentors during 1955—56 *Indigenous seeds*—cont.

Serial number.	Species.	Supplied to whome.	Seed origin.	Supplied by	Quantity.
(1)	(2)	(3)	(4)	(5)	(6)
					LB. OZ.
4	*Aleurites*	Research Ranger, Wynaad	Tirunelvely	Research Forester, Ootacamund.	1 4
5	*Do.*	Research Forester, Topslip ..	Do.	Do.	1 4
					2 8
6	*Acacia farnesiana* ..	Reserch Forester, Rameshwaram	Denkanikota ..	Research Ranger, Denkanikota,	0 10
7	*Do.*	Do. Markanum ..	Do.	Do.	0 10
					1 4
1	*Acacia planifrons* ..	Silviculturist, Bombay	Madurai	District Forest Officer, Madurai West.	1 0
2	*Do.*	District Forest Officer, Palghat ..	Do.	Do.	5 0
3	*Do.*	State Silviculturist, Andhra ..	Do.	Do.	3 0
					9 0
1	*Acacia sundra* ..	Silviculturist, Bombay State ..	Salem	District Forest Officer, Salem North.	5 0
1	*Albizzia lebbeck* ..	Research Forester, Rameshvaram	Nilambur	Research Ranger, Nilambur	10 0
2	*Do.*	Do. Markanum ..	Do.	Do.	10 0
					20 0
1	*Albizzia amara* ..	Damodar Valley Corporation ..	Coimbatore	District Forest Officer, Coimbatore North.	10 0
1	*Albizzia odoratissima.*	Officer-in-charge, Botany Branch, Forest Range Inspector, Dehra Dun.	Wynaad	District Forest Officer, Wynaad ..	2 0
8	*Ailanthus malabarica.*	Silviculturist, Assam	Do.	Research Ranger, Wynaad ..	5 0
9	*Do.*	Central Silviculturist, Forest Range Inspector.	Dhoni	Research Forester, Olavakkot ..	1 0
					6 0
1	*Artocarpus hirsuta* ..	Silviculturist, Assam	Wynaad ..	Research Ranger, Wynaad	3 0
1	*Balsa*	Conservator of Forests, Bhopal ..	Do.	Research Forester, Ootacamund.	0 1
2	*Do.*	The Tile Factory, Calicut	Do.	Do.	0 8
3	*Do.*	Silviculturist, Assam	Do.	Do.	0 8
4	*Do.*	District Forest Officer, Godavari Lower.	Do.	Do.	0 1
5	*Do.*	Manager, Dolo Estate	Do.	Do.	1 0
6	*Do.*	District Forest Officer, Chittoor West.	Do.	Do.	2 4
7	*Do.*	Do. Nellore North.	Do.	Do.	0 7
8	*Do.*	Forest Range Officer, West Bengal ..	Do.	Do.	0 1
9	*Do.*	District Forest Officer, Visakhapatnam South.	Do.	Do.	0 4
10	*Do.*	District Forest Officer, Cuddapah South.	Do.	Do.	0 8
11	*Do.*	District Forest Officer, Kurnool West.	Do.	Do.	1 ½
12	*Do.*	Do. Kurdool East.	Do.	Do.	2 ½
13	*Do.*	Do. Godavari Upper.	Do.	Do.	0 1
14	*Do.*	Do. Chittoor East.	Do.	Do.	0 8
15	*Do.*	Do. Cuddapah North.	Do.	Do.	0 10
16	*Do.*	Do. Adoni ..	Do.	Do.	0 ½
17	*Do.*	Do. Anantapur ..	Do.	Do.	2 ½
18	*Do.*	Do. Vizagapatnam North.	Do.	Do.	0 4
19	*Do.*	Divisional Forest Officer, Banda Division.	Do.	Do.	0 2
20	*Do.*	Divisional Forest Officer, Bilaspur ..	Do.	Do.	0 ½
21	*Do.*	Silviculturist, Orissa	Do.	Do.	1 0

Statement showing seeds and seedings Collected and supplied to various Indentors during 1955—56 *Indigenous seeds*—cont.

Serial number.	*Species.*	*Supplied to whom*	*Seed origin.*	*Supplied by*	*Quantity.* LB.	OZ.
(1)	(2)	(3)	(4)	(5)	(6)	
22	Balsa	Silviculturist, Andhra	Wynaad	Research Forester, Cotacamund ..	0	2
23	*Do.*	Botanical Forest Officer, Assam ..	Do.	Do.	0	3
24	*Do.*	Silviculturist, Bombay State	Nilambur	Research Ranger, Nilambur ..	0	1
25	*Do.*	Do. Travancore Cochin State.	Do.	Do.	0	1¼
26	*Do.*	Divisional Forest Officer, Kolhapur ..	Do.	Do.	0	¼
					22	14¼
1	*Bambusa arundinacea.*	District Forest Officer, Salem North ..	South Kanara ..	District Forest Officer, South Kanara.	6	0
1	*Casurina equisetifolia.*	Superintendent, Delhi Zoological Garden, New Delhi.	Markanum	Research Forester, Markanum ..	0	2
2	*Do.*	Research Forester, Rameshwaram ..	Tiruchirappalli ..	District Forest Officer, Tiruchirapalli.	1	0
3	*Do.*	Forest Officer, Damodar Valley Corporation.	Do.	Do.	1	0
4	*Do.*	Silviculturist, Travancore Cochin State.	Markanum	Research Forester, Markanum ..	0	8
6	*Do.*	Divisional Forest Officer, Kutch ..	Do.	Do. ..	1	0
					3	10
1	*Casurina auriculata*	Divisional Forest Officer, Panna Division, United Province.	Donkanikota	Research Ranger, Denkanikota ..	5	0
2	*Do.*	Silviculturist, Assam	Vemburuli	Research Forester, Vemburuli ..	1	0
					6	0

8	*Cardamom*	Divisional Forest Officer, North Andamans.	Wynaad	Research Ranger, Wynaad ..	1	0
1	*Cane seeds*	Officer-in-charge, M.F.P. Branch, Forest Research Institute.	Do.	Do. ..	40	0
1	*Cochlospermum gossypium.*	Honorary Horticultural Adviser, Bangalore.	Denkanikota	Research Ranger, Denkanikota ..	0	1
1	*Caesalpinia bonducella.*	Silviculturist, Assam	Vellore	District Forest Officer, Vellore West.	1	8
1	*Cashew* seeds	Forest Range Officer, Haldwani ..	Nilambur	Research Ranger, Nilambur ..	20	0
2	*Do.*	Range Officer, Clutterbuckanj ..	Do.	Do. ..	10	0
3	*Do.*	Divisional Forest Officer, Rohilkhand.	Markanum	Research Forester, Markanum ..	2	0
4	*Do.*	Divisional Forest Officer, Ramnagar ..	Chingleput	District Forest Officer, Chingleput.	40	0
5	*Do.*	Divisional Forest Officer, South Doab.	Markanum	Research Forester, Markanum ..	40	10
6	*Do.*	Divisional Forest Officer, Avadah ..	Do.	Do. ..	40	0
7	*Do.*	Divisional Forest Officer, North Doab.	Do.	Do. ..	20	0
8	*Do.*	Silviculturist, Madhya Bharat ..	Chingleput	District Forest Officer, Chingleput.	250	0
9	*Do.*	Silviculturist, Hyderabad	Do.	Do.	200	0
10	*Do.*	Silviculturist, Assam	Do.	Do.	184	0
11	*Do.* ..	Divisional Forest Officer, Vyara Division.	Nilambur	Research Ranger, Nilambur ..	10	0
12	*Do.*	Silviculturist, Orissa	Do.	Do. ..	127	0
13	*Do.*	Divisional Forest Officer, Karnal Division.	Do.	Do. ..	2	0
14	*Do.*	Divisional Forest Officer, Landowne.	South Kanara ..	District Forest Officer, South Kanara.	10	0
15	*Do.*	Divisional Forest Officer, Ambala Division.	Do. ..	Do.	20	0
16	*Do.*	Special Forest Officer, Tiral Bhatar Forest Division.	Do. ..	Do.	4	0
					979	0
1	*Cassia siamea*	Research Forester, Markanum ..	Denkanikota	Research Ranger, Denkanikota ..	10	0
2	*Do.*	Research Forester, Rameshwaram ..	Do.	Do. ..	10	0

Statement Showing seeds and Seedlings Collected Act supplied to various indentors during 1955-56 Indigenous seeds—cont.

Serial number.	Species.	Supplied to whom	Seed origin.	Supplied by	Quantity.	
(1)	(2)	(3)	(4)	(5)	(6)	
					LB.	OZ.
3	Cassia siamea	Senior Assistant in-charge, Assistant Agricltural Engineer, Coimbatore.	Andhra	Research Forester, Ootacamund	10	0
4	Do.	Tea Estate, Limited, Devali	Denkanikota	Research Ranger, Denkanikota ..	1	0
5	Do.	Divisional Forest Officer, Panna Division.	Do.	Do. ..	5	0
					36	0
1	Dalbergia sissoo ..	Research Forester, Markanum ..	Denkanikota	Research Ranger, Denkanikota ..	5	0
2	Do.	Research Forester, Rameshwaram ..	Do.	Do. ..	5	0
					10	0
1	Dalbergia latifolia ..	Divisional Forest Officer, Bankara ..	Nilambur	Research Ranger, Nilambur ..	42	0
2	Do. ..	Divisional Forest Officer, Bandwa ..	Do.	Do. ..	80	0
3	Do. ..	Divisional Forest Officer, Alipore ..	Do.	Do. ..	5	0
4	Do. ..	Soil Conservation Officer, Kota, Rajasthan.	Do.	District Forest Officer, Nilambur.	15	0
5	Do. ..	Divisional Forest Officer, Saranda ..	Do.	Research Ranger, Nilambur ..	10	0
6	Do. ..	Divisional Forest Officer, Bankara ..	Do.	Do. ..	165	0
7	Do. ..	Divisional Forest Officer, Burdwan ..	Do.	Do. ..	123	0
8	Do. ..	Silviculturist, Hyderabad	Do.	Do. ..	50	0
9	Do. ..	Silviculturist, Uttar Pradesh	Do.	Do. ..	185	0
10	Do. ..	Divisional Forest Officer, Gorkhpur ..	Do.	Do. ..	303	0
11	Do. ..	Divisional Forest Officer, Pilibhit Division.	Do.	District Forest Officer, Nilambur.	125	0
12	Do. ..	Divisional Forest Officer, Bahriach ..	Wynad	Research Ranger, Wynaad ..	18	0
13	Do. ..	Divisional Forest Officer, Saharanpur.	Do.	District Forest Officer, Wynaad.	315	0
14	Do. ..	Divisional Forest Officer, Bundalkhand.	Do.	Do. ..	320	0
15	Do. ..	Divisional Forest Officer, Saharanpur.	Coimbatore	District Forest Officer, Coimbatore South.	40	0
16	Do. ..	Divisional Forest Officer, Bundelkhand.	Do.	Do. ..	7	0
17	Do. ..	Divisional Forest Officer, Kohilkhand.	Do.	Do. ..	80	0
18	Do. ..	Divisional Forest Officer, Bahraich ..	Do.	Do. ..	62	0
19	Do. ..	Divisional Forest Officer, Dehra Dun.	Do.	District Forest Officer, Coimbatore North.	20	0
20	Do. ..	Divisional Forest Officer, Bijana and Forest Dnk. Kotawara	Wynaad	Research Ranger, Wynaad ..	82	0
21	Do. ..	Silviculturist, Hyderabad	Do.	Do. ..	50	0
22	Do. ..	Divisional Forest Officer, Pilibhit ..	Tirunelveli	District Forest Officer, Tirunelveli.	50	0
23	Do. ..	Divisional Forest Officer, Rohilkhand.	Nilgiris	District Forest Officer, Nilgiris ..	130	0
					2,277	0
1	Dysoxylum malabaricum.	Silviculturist, Assam	Wynaad	Research Ranger, Wynaad ..	3	0
1	Eucalyptus hybrid ..	Research Forester, Rameswaram ..	Ootacamund	Research Forester, Ootacamund.	0	2
2	Do. ..	Research Forester, Vemburuli ..	Do.	Do.	0	2
3	Do. ..	Research Forester, Markanum ..	Do.	Do.	0	2
					0	6
1	Eucalyptus citriodora.	Research Forester, Markanum ..	Ootacamund	Research Forester, Ootacamund	0	1
2	Do. ..	Research Forester, Rameswaram ..	Do.	Do.	0	1
3	Do. ..	Research Forester, Vemburuli ..	Do.	Do.	0	1
4	Do. ..	Forest Officer, Bihar	Do.	Do.	0	4
5	Do. ..	Divisional Forest Officer, Damodar Valley Corporation.	Do.	Do.	1	0
6	Do. ..	Superintendent, Government Cinchona Plantation.	Do.	Do.	1	0

Statement showing seeds and seedlings collected and supplied to various indentors during 1955—56

Indigenous seeds—cont.

Serial number.	Species.	Supplied to whom	Seed origin	Supplied by	Quantity.	
(1)	(2)	(3)	(4)	(5)	(6)	
					LB.	OZ.
7	Eucalyptus citriodora ..	Propagation Superintendent, Government Cinchona Plantation.	Ootacamund	Research Forester, Ootacamund.	0	4
8	*Do.* ..	Silviculturist, Travancore Cochin State.	Do.	Do.	0	4
9	*Do.* ..	Divisional Forest Officer, Bharapur ..	Do.	Do.	1	6
10	*Do.* ..	District Forest Officer, The Nilgiri ..	Do.	Do.	0	4
11	*Do.* ..	A. K. Kunhimayan Hajee, Palaparamba.	Do.	Do.	2	0
					6	8
1	*Eucalyptus rostrata* ..	Research Forester, Vemburuli ..	Ootacamund	Research Forester, Ootacamund.	0	1
2	*Do.* ..	Research Forester, Rameswaram ..	Do.	Do.	0	1
3	*Do.* ..	Research Forester, Markanum ..	Do.	Do.	0	1
4	*Do.* ..	Silviculturist, Bombay State	Do.	Do.	0	4
5	*Do.* ..	Divisional Forest Officer, Afforestation Division, Bihar.	Do.	Do.	7	0
6	*Do.* ..	Forest Research Officer, Bihar ..	Do.	Do.	0	4
7	*Do.* ..	Silviculturist, Assam	Do.	Do.	0	2
8	*Do.* ..	Divisional Forest Officer, Hoshiarpur.	Do.	Do.	0	1
9	*Do.* ..	Forest Officer, Damodar Valley Corporation.	Do.	Do.	1	0
10	*Do.* ..	Divisional Forest Officer, Afforestation Division, Hazaribag.	Do.	Do.	6	0
11	*Do.* ..	Research Ranger, Denkanikota ..	Do.	Do.	0	1
12	*Do.* ..	Divisional Forest Officer, Afforestation North Bihar, Muzaffarpur.	Do.	Do.	2	0
13	*Do.* ..	Divisional Forest Officer, Bundi, Rajasthan.	Do.	Do.	1	0
14	*Do.* ..	District Forest Officer, Chittoor West.	Do.	Do.	2	0
15	*Do.* ..	District Forest Officer, Nellore North.	Do.	Do.	0	14
16	*Do.* ..	District Forest Officer, The Nilgiris ..	Do.	Do.	0	12
17	*Do.* ..	Silviculturist, Bombay State	Do.	Do.	1	1
18	*Do.* ..	Silviculturist, Madhya Bharat, Indore.	Do.	Do.	2	0
19	*Do.* ..	District Forest Officer, Nellore North.	Do.	Do.	1	0
20	*Do.* ..	Forest Range Officer, Haldwani ..	Do.	Do.	0	8
21	*Do.* ..	Forest Range Officer, Clutterbuckgang.	Do.	Do.	0	4
22	*Do.* ..	Research Ranger, Nellore	Do.	Do.	5	0
23	*Do.* ..	Divisional Officer, Surendranagar ..	Do.	Do.	0	4
24	*Do.* ..	Divisional Forest Officer, Jannagar, Porbander.	Do.	Do.	0	8
					31	2
1	*Eucalyptus globulus* ..	Officer-in-charge, Botany Branch Forest Research Institute, Dehra Dun.	Ootacamund	Research Forester, Ootacamund	0	4
2	*Do.* ..	Sub-divisional Forest Officer, Jangira Forest Division, Kolab.	Do.	Do.	0	3
3	*Do.* ..	Silviculturist, Orissa	Do.	Do.	0	4
4	*Do.* ..	Superintendent, Ordnance Factory, Kanpur.	Do.	Do.	0	8
5	*Do.* ..	Divisional Forest Officer, Nahan Division, Nahan.	Do.	Do.	0	4
6	*Do.* ..	Divisional Forest Officer, Nainital ..	Do.	Do.	1	0
7	*Do.* ..	Divisional Forest Officer, Dehra Dun.	Do.	Do.	0	2
8	*Do.* ..	Conservator of Forests, Shimoga ..	Do.	Do.	0	4
9	*Do.* ..	Divisional Forest Officer, Bijnoor ..	Do.	Do.	2	0
10	*Do.* ..	Divisional Forest Officer, Garhwal Division.	Do.	Do.	4	0
11	*Do.* ..	Divisional Forest Officer, Sharanpur ..	Do.	Do.	5	0
12	*Do.* ..	Divisional Forest Officer, Panna Division.	Do.	Do.	5	0
13	*Do.* ..	Divisional Forest Officer, East Almora.	Do.	Do.	2	0
14	*Do.* ..	Divisional Forest Officer, South Kheri.	Do.	Do.	3	0

Statement showing seeds and seedlings collected and supplied to various indentors during 1955—56

Indigenous seeds—cont.

Serial number.	Species.	Supplied to whom.	Seed origin.	Supplied by.	Quantity.	
(1)	(2)	(3)	(4)	(5)	(6)	
					LB.	OZ.
15	Eucalyptus globulus	Divisional Forest Officer, Sunagur	Ootacamund	Research Forester, Ootacamund.	1	0
16	Do.	Range Officer, Mettupalayam	Do.	Do.	4	0
17	Do.	Silviculturist, Travancore-Cochin State.	Do.	Do.	0	2
18	Do.	District Forest Officer, Visakhapatnam North.	Do.	Do.	0	4
19	Do.	Divisional Forest Officer, Bharatpur.	Do.	Do.	2	0
20	Do.	Conservator of Forests, Sikkim	Do.	Do.	0	4
21	Do.	Divisional Forest Officer, Kalimpong.	Do.	Do.	0	2
22	Do.	District Forest Officer, Visakhapatnam North.	Do.	Do.	0	10
23	Do.	District Forest Officer, Chittoor West.	Do.	Do.	1	0
24	Do.	Silviculturist, Bombay State	Do.	Do.	1	0
25	Do.	Forest Range Officer, Silviculture Division, Cutterbuckgang	Do.	Do.	0	4
					32	7
1	*Eucalyptus teriticornis*	Divisional Forest Officer, Jamnagar.	Ootacamund	Research Forester, Ootacamund.	0	8
1	Do.	Silviculturist, Assam	Do.	Do.	0	2
					0	10
1	*Evodia roxburghiana*	Silviculturist, Bombay State	Wynaad	Research Ranger, Wynaad	6	0
1	*Grewia tillaefolia*	Principal, Agricultural College, Bapatla.	Do.	Do.	2	0
1	*Glyricidia maculata*	District Forest Officer, The Nilgiris.	Denkanikota	Research Ranger, Denkanikota.	2	0
1	*Leucaena glauca*	Research Forester, Rameshwaram.	Do.	Do.	1	0
2	Do.	Research Forester, Markanurm	Do.	Do.	1	0
3	Do.	District Forest Officer, Cuddapah North.	Do.	Do.	2	0
					4	0
1	*Lagerstroemia flos reginae*	Comptroller, Governor's House-hold, Madras.	Nilambur	Research Ranger, Nilambur	0	8
2	*Do.*	Divisional Forest Officer, Shadol Division.	Do.	Do.	0	4
					0	12
1	*Lophopetalum wightianum*	Siviculturists, Assam	Wynaad	Research Ranger, Wynaad	5	0
1	*Melia dubia*	Research Forester, Markanum	Denkanikota	Research Renger, Denkanikota	10	0
2	*Do.*	Research Forester, Rameshwaram.	Do.	Do.	10	0
					20	0
1	*Mundulea suberosa*	Head of Department of Pharmacy, Andhra University.	Denkanikota	Research Ranger, Denkanikota.	44	0
1	Neem	District Forest Officer, South Kanara.	Coimbatore	District Forest Officer, Coimbatore (South).	15	0
1	*Ocimum campora*	Silviculturist, Hyderabad	Topslip	Research Forester, Topslip	0	4

Statement showing seeds and seedlings collected and supplied to various indentors during 1955–56 Indigenous seeds—cont:

Serial number.	Species.	Supplied to whom.	Seed origin.	Supplied by.	Quantity.
(1)	(2)	(3)	(4)	(5)	(6)
					LB. OZ.
1	*Prosopis juliflora* ..	Research Forester, Rameshwaram ..	Tiruchirappalli ..	District Forest Officer, Tiruchirappalli.	5 0
2	*Do.* ..	Conservator of Forests, Ceylon ..	Dankanikota	Research Ranger, Dankanikota ..	1 0
					6 0
1	Paper mulberry ..	District Forest Officer, Vizagapatam North.	Nilambur	Research Ranger, Nilambur ..	0 6
2	Do. ..	District Forest Officer, Coimbatore South.	Do.	Do. ..	1 0
3	Do. ..	District Forest Officer, Godavari Upper.	Wynaad	Research Ranger, Wynaad ..	1 0
					2 6
1	Pepper	District Forest Officer, North Andamans.	Wynaad	Research Ranger, Wynaad ..	1 0
1	*Pongamia glabra* ..	Research Forester, Markanum ..	Dankanikota	Research Ranger, Dankanikota ..	3 0
2	*Do.* ..	Research Forester, Rameshwaram ..	Do.	Do. ..	3 0
					6 0
1	*Pithecolobium dulce* ..	Research Forester, Rameshwaram ..	Vellore East	Range Officer, Vellore	5 0
2	*Do.* ..	District Forest Officer, South Kanara.	Do.	District Forest Officer, Vellore ..	£0 0
3	*Do.* ..	Central Silviculturist, F. R. I. ..	Do.	Do. ..	10 0
4	*Do.* ..	Divisional Forest Officer, Bunde ..	Do.	Do. ..	10 0
					105 0
1	Pyrethrum	Silviculturist, Hyderabad	Ootacamund	District Forest Officer, The Nilgiris.	1 0
2	Do.	Do. Bangalore	Do.	Do.	0 2
3	Do.	Do. Andhra	Do.	Do.	1 0
4	Do.	Do. Assam	Do.	Do.	1 0
5	Do.	Do. Bombay	Do.	Do.	0 4
6	Do.	District Forest Officer, Visagapatnam North.	Do.	Do.	0 4
					3 10
1	*Rauwolfia serpentina.*	Silviculturist, Andhra	Nilambur	Research Ranger, Nilambur ..	0 ½
1	*Swietenia mahogany* ..	Divisional Forest Officer, Sahabad ..	Do.	Do. ..	3 0
1	*Swietenia macrophylla.*	Do. North Khori.	Do.	Do. ..	20 0
2	*Do.*	Do. Shadol ..	Do.	Do. ..	0 4
3	*Do.*	Do. Dangs Division.	Do.	Do. ..	40 0
4	*Do.*	Do. Kolaba ..	Do.	Do. ..	8 0
					68 4
1	*Spinifex squarrosum* ..	Research Forester, Rameshwaram ..	Chingleput	District Forest Officer, Chingleput.	One bag.
1	*Sterculia companulata.*	Silviculturist, Bombay	Do, ...	Do.	10 0
1	*Schleichera trijuga* ..	Curator, Industrial Museum, Calcutta.	Ootacamund	District Forest Officer, The Nilgiris.	5 0
1	*Santalum album* ..	Divisional Forest Officer, Uttar Kasi.	Dankanikota	Research Ranger, Dankanikota ..	0 1
2	*Do.* ..	District Forest Officer, Chittoor West.	Do.	Do. ..	60 0
3	*Do.* ..	Divisional Forest Officer, Shadol ..	Do.	Do. ..	0 4
					60 5

Statement showing seeds and seedlings collected and supplied to various indetors during 1955–56 Indigenouss seeds—cont.

Serial number.	Species.	Supplied to whom.	Seed origin.	Supplied by	Quantity.	
(1)	(2)	(3)	(4)	(5)	(6)	
					LB.	OZ.
1	*Terminalia catappa* ..	Research Forester, Rameshwaram ..	Madurai	Range Officer, Bodinayakam ..	7	8
1	*Tribulus terrestris* ..	Silviculturist, Assam	Chingleput	District Forest Officer, Chingleput.	0	8
1	*Trewia nudiflora* ..	Divisional Forest Officer, Shadol ..	Nilambur	Research Ranger, Nilambur ..	0	4
1	*Tetrameles nudiflora.*	Central Silviculturist, F.R.I. ..	Do.	Do. ..	0	1
1	*Tectona grandis* ..	Divisional Forest Officer, Halda Division.	Do.	Do. ..	82	0
2	*Do.* ..	Forest Research Officer, Bihar ..	Do.	Do. ..	20	0
3	*Do.* ..	Silviculturist, Bangalore	Do.	Do. ..	25	0
4	*Do.* ..	Central Silviculturist, F.R.I.	Do.	Do. ..	1	8
5	*Do.* ..	Divisional Forest Officer, Dehra Dun.	Do.	Do. ..	82	0
6	*Do.* ..	Silviculturist, Hyderabad	Do.	Do. ..	200	0
7	*Do.* ..	Do.	Topslip	Research Forester, Topslip ..	200	0
8	*Do.* ..	District Forest Officer, Salem North	Nilambur	District Forest Officer, Nilambur.	400	0
9	*Do.* ..	Divisional Forest Officer, Sarandu ..	Wynaad	Research Ranger, Wynaad ..	320	0
10	*Do.* ..	Botanical Forest Officer, Assam ..	Topslip	Research Forester, Topslip ..	60	0
11	*Do.* ..	Divisional Forest Officer, Garo ..	Do.	Do. ..	80	0
12	*Do.* ..	Range Officer, Subansori	Do.	Do. ..	80	0
13	*Do.* ..	Do. Sola Range	Do.	Do. ..	80	0
14	*Do.* ..	Divisional Forest Officer, Dehra Dun.	Do.	Do. ..	80	0
15	*Do.* ..	Range Officer, Didwana	Do.	Do. ..	110	0
16	*Do.* ..	Divisional Forest Officer, Banaras ..	Do.	Do. ..	110	0
17	*Do.* ..	Do. West Thana.	Do.	Do. ..	300	0
18	*Do.* ..	Do. Tirap ..	Do.	Do. ..	150	0
19	*Do.* ..	Do. Balipara ..	Do.	Do. ..	150	0
20	*Do.* ..	Officer-in-charge, Andamans	Do.	Do. ..	1,000	0
21	*Do.* ..	Range Officer, Upper Tondu	Nilgiris	District Forest Officer, Nilgiris ..	1,100	0
22	*Do.* ..	Do.	Tonslip	Research Forester, Topslip ..	200	0
23	*Do.* ..	Divisional Forest Officer, Surat ..	Do.	Do. ..	150	0
24	*Do.* ..	Do. Satara ..	Do.	Do. ..	600	0
25	*Do.* ..	Do. Durgs Division.	Do.	Do. ..	150	0
26	*Do.* ..	Do. Sarjan ..	Do.	Do. ..	150	0
27	*Do.* ..	District Forest Officer, Palghat ..	Do.	Do. ..	150	0
28	*Do.* ..	Divisional Forest Officer, Dharmi ..	Do.	Do. ..	150	0
29	*Do.* ..	Do. Kolhapur ..	Do.	Do. ..	250	0
30	*Do.* ..	Do. Kolaba ..	Do.	Do. ..	500	0
31	*Do.* ..	Do. Siliguri Division.	Do.	Do. ..	800	0
32	*Do.* ..	Forest Store Keeper, Ramnagar ..	Do.	Do. ..	200	0
33	*Do.* ..	Divisional Forest Officer, Barie, Deogad.	Do.	Do. ..	2,500	0
34	*Do.* ..	Do. Jungadh ..	Do.	Research Ranger, Wynaad ..	1,200	0
35	*Do.* ..	Forest Store Keeper, 28, Civil Lines Barracks, Bareilly.	Wynaad	Research Ranger, Nilambur ..	200	0
36	*Do.* ..	Silviculturist, Hyderabad	Nilambur	Forester, Topslip ..	1,000	0
37	*Do.* ..	Do. Andhra	Topslip		12,830	8
1	*Xylia xylocarpa* ..	Divisional Forest Officer, Birbhum Division, Suri.	Nilambur	Research Ranger, Nilambur ..	3	8

Total quantities of various seeds supplied.

Serial number and name of species. (1)	Quantity supplied. (2) lb.	oz.
1 *Acacia mollissima*	970	8
2 *Acacia decurrens*	17	9½
3 *Acacia dealbata*	5	14
4 *Acacia melanoxylon*	..	12
5 *Aleurites*	2	8
6 *Acacia farnesiana*	1	4
7 *Acacia planifrons*	9	0
8 *Acacia sundra*	5	0
9 *Albizzia lebbeck*	20	0
10 *Albizzia amara*	10	0
11 *Albizzia odoratissima*	2	0
12 *Ailanthus malabarica*	6	0
13 *Artocarpus hirsuta*	2	0
14 *Balsa*	22	14½
15 *Bambusa arundinacea*	6	0
16 *Casuarina equisetifolia*	2	10
17 *Casuarina auriculata*	6	0
18 *Cardamon*	1	0
19 *Cane* seeds	40	0
20 *Cochlospermum gossypium*	..	1
21 *Caesalpinia bonducella*	1	8
22 *Cashew* seeds	979	0
23 *Cassia siamea*	36	0
24 *Dalbergia sissoo*	10	0
25 *Dalbergia latifolia*	2,277	0
26 *Dysoxylum malabaricum*	3	0
27 *Eucalyptus hybrid*	..	6
28 *Eucalyptus citriodora*	6	3
29 *Eucalyptus rostrata*	31	2
30 *Eucalyptus globulus*	32	7
31 *Eucalyptus teriticornis*	..	10
32 *Evodia roxburghiana*	6	0
33 *Grewia tiliaefolia*	2	0
34 *Glyricidia maculata*	2	0
35 *Leucaena glauca*	4	0
36 *Lagerstroemia flos reginae*	..	12
37 *Lophopetalum wightianum*	5	3
38 *Melia dubia*	20	0
39 *Mundulea suberosa*	44	0
40 *Neem*	15	0
41 *Ocimum camphora*	..	4
42 *Prosopis Juliflora*	6	0
43 *Paper mulberry*	2	6
44 *Pepper*	1	0
45 *Pongamia glabra*	6	0
46 *Pithecolobium dulce*	111	
47 *Pyrethrum*	3	10
48 *Rauwolfia serpentina*	0	½
49 *Swietenia mahogany*	3	
50 *Swietenia macrophylla*	68	4
51 *Spinifex squarrosum*	One bag.	
52 *Sterculia companulata*	10	
53 *Schleichera trijuga*	5	
54 *Sentalum album*	60	5
55 *Terminalia catappa*	7	8
56 *Tribulus terrestris*	—	8
57 *Trewia nudiflora*	—	4
58 *Tetremeles nudiflora*	—	1
59 *Tectona grandis*	12,830	8
60 *Xylia xylocarpa*	3	8

Serial number and name of species. (1)	Quantity supplied. (2)	
Total quantities of various seeds supplied.		
	LB.	OZ.
1 *Acacia mollissima*	970	8
2 *Acacia decurrens*	17	9½
3 *Acacia dealbata*	5	14
4 *Acacia melanoxylon*	..	12
5 *Aleurites*	2	8
6 *Acacia farnesiana*	1	4
7 *Acacia planifrons*	9	0
8 *Acacia sundra*	5	0
9 *Albizzia lebbeck*	20	0
10 *Albizzia amara*	10	0
11 *Albizzia odoratissima*	2	0
12 *Ailanthus malabarica*	6	0
13 *Artocarpus hirsuta*	3	0
14 *Balsa*	22	14½
15 *Bambusa arundinacea*	6	0
16 *Casuarina equisetifolia*	2	10
17 *Casuarina auriculata*	6	0
18 *Cardamon*	1	0
19 *Cane* seeds	40	0
20 *Cochlospermum gossypium*	..	1
21 *Caesalpinia bonducella*	1	8
22 *Cashew* seeds	979	0
23 *Cassia siamea*	36	0
24 *Dalbergia sissoo*	10	0
25 *Dalbergia latifolia*	2,277	0
26 *Dysoxylum malabaricum*	3	0
27 *Eucalyptus hybrid*	..	8
28 *Eucalyptus citriodora*	6	1
29 *Eucalyptus rostrata*	31	2
30 *Eucalyptus globulus*	32	1
31 *Eucalyptus teriticornis*	..	1
32 *Evodia roxburghiana*	6	
33 *Grewia tiliaefolia*	2	
34 *Glyricidia maculata*	2	
35 *Leucaena glauca*	4	
36 *Lagerstroemia flos reginae*	..	12
37 *Lophopetalum wightianum*	5	3
38 *Melia dubia*	20	0
39 *Mundulea suberosa*	44	0
40 *Neem*	15	0
41 *Ocimum camphora*	..	4
42 *Prosopis Juliflora*	6	0
43 *Paper mulberry*	2	6
44 *Pepper*	1	0
45 *Pongamia glabra*	6	0

Statament showing the details of seeds of exolie species received and despatched to various centres for trial during 1958–59.

(Referred to in para. 23t)

Serial number and Species. (1)	Seeds received from whom and country of origin. (2)	Quantity received. (3)	Despatched to. (4)
12 *E. camphora* ..	Central Silviculturist, Forest Research Institute, Dehra Dun.	Small quantity.	Research Forester, Ootacamund.
13 *E. triantha* ..	Do.	Do.	Do.
14 *E. tindleyana* ..	Do.	Do.	Do.
15 *E. Ovata* ..	Do.	Do.	Do.
16 *E polybractea.*	Do.	Do.	Do.
17 *E. pauciflora* ..	Do.	Do.	Do.
18 *E. stellulata* ..	Do.	Do.	Do.
19 *E. longifolia* ..	Do.	Do.	Do.
20 *Casuarina glauca*	Do.	Do.	Do.
21 *Melaleuca leucadeidra.*	Do.	Do.	Do.
22 *Syncaepia laurifolia.*	Do.	Do.	Do.
23 *Cinnamomum camphora.*	Vilmorin-Andrieux, Paris, France.	Do.	District Forest Officers, Palghat, Wynaad, and Nilambur; Research Rangers, Wynaad and Nilambur; Research Forester, Topslip.
24 *Ceratonia siliqua.*	Cyprus origin obtained from Silviculturist, Bombay State.	½ LB.	Research Foresters, Markanum, Vemburili, Rameswaram and Tanjore.
25 *Eucalyptus saligna.*	Belgian Congo	18 tolas.	Central Silviculturist, Forest, Research Institute, Dehra Dun.
	Argentina	5 ,,	Reserach Ranger, Wynaad; Research Foresters, Toplip, Markanum, Tanjore and Ootacamund.
	Australia	½ LB.	Research Forester, Ootacamund; District Forest Officers, Salem South, Coimbatore North; Madura West, Tiruchirappalli, Cingleput, Coimbatore South, Nilgiris and Kollegal.
			Silviculturists, Mysore, Bombay, Hyderabad, Uttar Pradesh, West-Bengal, Bihar, T.C. State;
			Kanan Devan Tea Estate, Munnar, T.C. State.
26 *Prosopis juliflora.*	Kappagal Nabi Saheb, Bellary.	1,050 ,,	District Forest Officers, Vellore-East, Palghat, Chingleput, Salem North and Vellore West.
27 Do.	Shri G. C. Veerabadra Goud, Bellary.	150 ,,	District Forest Officer, Chingleput.

Details of various seedings Supplied,

Serial number.	*Species.*	*Supplied to whom*	*Seed origin.*	*Supplied by*	*Quantity.*
(1)	(2)	(3)	(4)	(5)	(6)
					Numbers.
1	*Albizzia lebbeck* ..	Executive Officer, Panchayat Officer, Rameswaram.	Rameswaram ..	Research Forester, Rameswaram.	200
2	*Acacia ferruginea* ..	Do.	Do. ..	Do.	100
3	*Acacia leucophloea* ..	Do.	Do. ..	Do.	100
4	*Artocarpus hirsuta* ..	Assistant Engineer, No. 1 Colony Sub-division, Palghat.	Olavakkot	Research Forester, Olavakkot ..	800
5	*Casuarina*	Executive Officer, Panchayat Office, Rameswaram.	Rameswaram ..	Research Forester, Rameswaram.	200
6	*Casuarina cunninghamii*	Plant Physiologist, Coimbatore ..	Olavakkot	Research Forester, Olavakkot ..	340
7	*Dalbergia sissoo* ..	Executive Engineer, Panchayat Office, Rameswaram.	Rameswaram ..	Research Forester, Rameswaram.	200
8	*Eucalyptus rudis* ..	Permanent Way Inspector, Mandapam.	Do. ..	Do.	50
9	*Eucalyptus citriodora.*	Assistant Engineer, No. 1 Colony Sub-division, Palghat.	Olavakkot	Research Forester, Olavakkot ..	50
10	*Eucalyptus rostrata* ..	Do.	Do.	Do. ..	50
11	*Leucaena glauca* ..	Executive Engineer, Panchayat Office, Rameswaram.	Rameswaram ..	Research Forester, Rameswaram.	100
12	*Morus alba*	Assistant Engineer, No. 1 Colony Sub-division, Palghat. ..	Olavakkot	Research Forester, Olavakkot ..	300
13	*Prosopis juliflora* ..	Executive Engineer, Panchayat Office, Rameswaram.	Rameswaram ..	Research Forester, Rameswaram.	200
14	*Pithecolobium dulce.*	Do.	Do. ..	Do.	400
15	*Salix tetrasperma* ..	Silviculturist, Madhya Pradesh ..	Ootacamund ..	Research Forester, Ootacamund	250 (cuttings).
16	*Teak stumps*	Assistant Engineer, No. 1 Colony Sub-division, Palghat.	Olavakkot	Research Forester, Olavakkot ..	1,800
17	*Do.*	District Agricultural Officer, Pattukkottai.	Wynaad	District Forest Officer, Wynaad.	3,000
18	*Do.*	Executive Engineer, Lower Bhavani Project.	Coimbatore	District Forest Officer, Coimbatore South.	4,000
19	*Do.*	Assistant Engineer, Manimuthar ..	Nilambur	District Forest Officer, Nilambur.	1,000
20	*Do.*	Executive Engineer, Lower Bhavani Project.	Wynaad	District Forest Officer, Wynaad.	1,500
21	*Do.*	District Forest Officer, Tiruchirappalli.	Nilambur	Do. Nilambur.	2,000
22	*Do.*	Do. Palghat ..	Do.	Do. Do.	1,000
23	*Do.*	Do. Salem North.	Do.	Do. Do.	4,000
24	*Do.*	Do. Madura west.	Wynaad	Do. Wynaad.	10,00
25	*Do.*	Do. Kollegal ..	Do.	Do. Do.	8,00
26	*Do.*	Do. Salem South.	Do.	Do. Do.	0,8,000
27	*Do.*	Do. Vellore West.	Do.	Do. Do.	08,000
28	*Do.*	Do. Coimbatore North.	Do. ..	Do. Do.	016,00
					68 304

APPENDIX D.

Statements howing the details of seeds of exotic species rece ved and despatched to various centres for trial during 1958-59.

(Referred to in para 23.)

Serial number and Species.	*Seeds recejved from whom and country of origin.*	*Quantity received.*	*To whom. Despatched.*
(1)	(2)	(3)	(4)
		LB.	
1 *Bixaorellana* ..	Kallar Fruit Station ..	½	Sent to the Chief Conservator of Forests, Madras.
2 *Bombax malabaricum.*	Ramaswamy and Sons, Bangalore.	1	Research Rangers, Nilambur and Wynaad; Research Foresters, Topslip, Markanum and Vemburili.
3 *Broussonetia papyrifera.*	Contral Silviculturist, Forest Research Institute, Dehra Dun.	15	District Forest Officers, Kollegal, Vellore West, Tirunelveli, Godavari--Lower and Research Foresters, Rameswaram and Vemburili.
4 *Calamus caesius*	Officer-in-chargo Botany Branch, Forest Research Institute, Dehra Dun.	46 seeds. LB.	Research Rangers, Nilambur, Wynaad and Research Forester, Topslip.
5 *Cassia javanica.*	Ramaswamy and Sons, Bangalore.	4	Research Ranger, Nilambur; and Research Foresters, Vemburili and Markanum.
6 *Hill Cotton seeds.*	Botanical Assistant, Cotton Research, Tura, Assam.	1	District Forest Officers, Nilambur and Wynaad; Research Forestor, Tosplip; and Research Rangers, Nilambur and Wynaad.
7 *Dalbergia sissoo.*	Superintendent, Livestock Research Station, Hosur Cattle Farm, Salem District.	8,715 LB.	District Forest Officers, Vellore East, Nilgiris, Tiruchirappalli, Salem South, Palghat, Kollegal, Chingleput, Tirunelveli, Madura-West, Madura-East, Coimbatore-North; Coimbatore South and Salem North.
8 *Eucalyptus hybrid.*	Silviculturist, Mysore	22	District Forest Officers, Tirunelveli, Salem South, Vellore-West, Vellore-East, Coimbatore-South, Madurai West, Chingleput, Kollegal, and Coimbatore-North.
9 *Eucalyptus marginata.*	Central Silviculturist, Forest Research Institute, Dehra Dun.	Small quantity.	Rosorach Forester, Ootacamund.
10 *E. botryoidea* ..	Do.	Do.	Do.
11 *E. bridgesiana*	Do.	Do.	Do.

Statament showiug the details of seeds of exolie species received and despatchcd to various centres for trial during 1958-59.

(Referred to in para. 23t)

Serial number and Sp cies.	*Se ds received from who m and country of or gia.*	*Quar tity received.*	*Despatched to.*
(1)	(2)	(3)	(4)
12 *E. camphora* ..	Cen'ra' Si vicu'turist, Forest Research institute, Dehra Dun.	Small quantity.	Research Forester, Ootacamund.
13 *E. triantha* ..	Do.	Do.	Do.
14 *E. lindleyana* ..	Do.	Do.	Do.
15 *E. Ovata* ..	Do.	Do.	Do.
16 *E. polybractea.*	Do.	Do.	Do.
17 *E. pauciflora* ..	Do.	Do.	Do.
18 *E. stellulata* ..	Do.	Do.	Do.
19 *E. longifolia* ..	Do.	Do.	Do.
20 *Casuarina glauca*	Do.	Do.	Do.
21 *Melaleuca leucadeidra.*	Do.	Do.	Do.
22 *Syncaepia laurifolia.*	Do.	Do.	Do.
23 *Cinnamomum camphora.*	Vilmorin-Andrieux, Paris, France.	Do.	District Forest Officers, Palghat, Wynaad, and Nilambur; Research Rangers, Wynaad and Nilambur; Research Forestor, Topslip.
24 *Ceratonia siliquon.*	Cyprus origin obtained from Silviculturist, Bombay State	½ LB.	Research Foresters, Markanum, Vemburili, Rameswaram and Tranjore.
25 *Eucalyptus saligna.*	Belgian Congo	18 tolas.	Central Silviculturist, Forest, Research Institute, Dehra Dun.
	Argentina	5 ,,	Reserach Ranger, Wynaad; Research Foresters, Toplip, Markanum, Tanjore and Ootacamund.
	Australia	1 LB.	Research Forester, Ootacamund; District Forest Officers, Salem South, Coimbatore North; Madura West, Tiruchirappalli, Cingleput, Coimbatore South, Nilgiris and Kollegal.
			Silviculturists, Mysore, Bombay, Hyderabad, Uttar Pradesh, West-Bengal, Bihar, T.C. State;
			Kanan Devan Tea Estate, Munnar, T.C. State.
26 *Prosopis juliflora.*	Kappagal Nabi Saheb, Bellary	1,050 ,,	District Forest Officers, Vellore-East, Palghat, Chingleput, Salem North and Vellore West.
27 *Do.*	Shri G. C. Veerabadra Goud, Bellary.	150 ,,	District Forest Officer, Chingleput.

APPENDIX E.

Statement showing seed weighment with germinative capacity, plant per cent and best method of raising.
(Referred to in paragraph 34.)

Species.	Number. Seeds. Per oz.	Number. Seeds. Per lb.	Number. Fruits. Per oz.	Number. Fruits. Per lb.	Germinative capacity.	Plant per cent.	Plants per lb.	Best method of raising. Artificially. Direct sowing.	Entire transplanting.	Stump planting.	Vegetative propagation. Stem cutting.	Air layering.	Month to collect seeds.
(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
A. aureuliformis	1,213	19,408	..	..	80	65	12,615	..	1	..	..	..	III—IV
A. baileyana	966	15,456	..	..	53	14	2,164	..	1	..	..	..	VIII
A. cyarophylla	2,010	32,160	..	..	94	93	29,909	..	1	2	..	..	IV
A. cyclopis	735	11.760	..	..	47	46	5,410	..	..	..	..	..	XII—I
A. delbata	2,340	37,440	..	..	45	33	12,335	..	1	2	..	..	XII—IV
A. decurrens	1,740	27,840	..	..	53	19	5,290	..	1	..	..	..	XII—I
A. pernesiana	290	4,640	..	..	22	7	305	..	..	..	..	..	...
A. Ferruginea	167	2,672	..	..	90	80	2,138	1	..	..	..	..	XII—IV
A. leucophloea	1,076	17,216	..	..	42	30	5,165	1	..	..	..	..	XII—IV
A. melanoxylon	2,034	32,544	..	..	83	78	25,384	..	1	..	..	..	IV
A. mollissima	1,785	28,560	..	..	57	15	4,284	..	1	..	..	..	XII—II
A. planifrons	722	11,552	..	..	42	35	4,043	..	..	..	..	..	VI—VIII
A. saligna	1,364	21,824	..	..	9	8	1,746	..	..	..	..	..	XII—I
A. sundra	750	12,000	..	..	90	90	10,800	1	..	..	..	..	XI—V
Acrocarpus fraxinifolius	876	14,016	..	..	49	38	5,326	2	1	..	..	..	III —IV
Adausonia digitata	44	704	..	..	58	50	..	..	..	..	..	..	Seed collected from Rameswaran.
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
A. grandis	40	..	..	..	51	34	215	..	..	..	..	..	..
A. malabarica (Begur)	266	..	..	..	14	5	221	..	..	..	..	..	..
A. malabarica (Kannoth)	204	..	..	..	18	18	601	..	..	..	..	..	..
Alangium lamarckii	49	784	..	..	47	47	368	..	..	..	..	..	V and VII
Albizzia amara	400	6,400	..	..	83	74	4,736	..	..	..	..	..	II and V
A. lebbek	314	5,024	..	..	65	49	2,462	2	..	1	..	..	XII—I and VI
A. stipulata	1,997	31,952	..	..	8	1	320	..	1	..	1	..	II—IV
Aleurites fordii	16	256	..	..	25	..	..	..	..	..	..	..	..
A. montana	2	192	..	..	..	..	..	..	..	..	..	..	..
Alnus nepalensis	66,308	1,060,928	..	..	2	1	10,609	..	..	..	..	..	I and II
Alstonia scholaris	3,501	56,016	..	..	30	28	15,684	..	..	..	..	..	I and IV.
Anacardium occidentale	5·3	85	..	..	98	98	83	1	2	..	..	..	III—V
Anogeissus latifolia	2,265	36,240	..	..	2	1	362	..	..	..	..	..	III, and IV
Antiaris toxicaria	18	288	..	..	39	35	101	..	..	..	..	..	..
Araucaria excelsa	16	256	..	..	..	..	..	..	..	..	..	..	..
Artocarpus hirsuta	61	976	..	..	97	81	791	2	1	..	..	..	IV—V
A. integrifolia	3	82	..	..	59	59	48	..	..	..	..	..	VI—VII
Azadirachta indica	130	2,080	..	..	90	89	1,851	2	1	..	..	..	V—X
Balanocarpus utilis	7	110	..	..	72	69	76	..	1	..	..	..	X
Bambusa arundinacea	2,277	36,432	..	..	38	37	13,480	..	..	..	..	..	II—IV
B. gigantea	3,475	..	..	..	2	1	555	..	..	..	..	..	..
B. polymorpha	1,396	22,336	..	..	40	32	7,148	..	..	..	..	..	III
B. tulda	455	7,280	..	..	2	1	73	..	..	..	..	..	..
Bauhinia purpurea	55	880	..	..	98	95	836	2	..	1	..	..	II—III
B racemosa	224	3,584	..	..	27	23	824	2	..	1	..	..	II—IV
B. variegata	44	704	..	..	50	45	317	..	1	..	..	..	IV
Bombax insigne	332	5,312	..	..	0·4	0·4	21	..	..	..	..	..	IV
B. malabaricum	778	12,448	..	..	22	16	1,992	..	1	2	..	..	III—V
Broussonetia payrifera	17,455	279,280	..	..	47	28	78,198	..	1	2	..	..	VI
Calamnus caesius	25	400	..	..	Seed lost viability.								
C. pseudotenis	70	1,120	..	..	6	6	..	..	..	..	..	..	..
C. scipionum	96	1,536	..	..	..	..	..	..	..	..	..	..	..
C. Reedhi (Topslip)	170	2,720	..	..	..	..	..	..	..	..	..	..	..
C. rotang	37	592	..	..	50	50	..	..	..	..	..	..	..

Statement showing seed weighment with germinative capacity, plant per cent and best method of raising—cont.

Species.	Number. Seeds. Per oz.	Number. Seeds. Per lb.	Number. Fruits. Per oz.	Number. Fruits. Per lb.	Germinative capacity.	Plant per cent.	Plants per lb.	Best method of raising. Artificially. Direct sowing.	Artificially. Entire transplanting.	Artificially. 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)
Callitris rhomboidea ..	4,855	77,680	..	..	45	18	13,982	..	..	..	..	..	IV—VI
Calophyllum elatum ..	4	64	..	..	89	67	43	..	1	..	..	..	V—IX
Canarium euphyllum ..	14	224	..	..	1·6	1·6	..	..	1	..	..	..	Germ 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
C. fistula	177	2,832	..	..	55	47	1,331	1	..	..	..	..	II—IV
C. Javanica	182	2,912	..	..	13	13	..	..	..	..	..	..	..
C. marginata	128	2,048	..	..	65	47	1,331	1	..	..	..	..	II—IV
C. siamea	1,033	16,528	..	..	98	87	14,379	1	..	..	..	..	II—IV
C. tomentosa	1,033	16,528	..	..	13	8	1,322	1	..	..	..	..	II—IV
Castenospermum australe ..	1	16	..	..	56	53	8	1	..	..	..	..	IV
Casuarina montana ..	32,778	5,24,448	..	..	15	5	26,222	..	1	..	..	..	I
C. equisetifolia	9,600	..	..	..	27	27	..	..	1	..	..	..	IX—I
Cedrela odorata	3,192	51,072	..	..	27	15	7,661	..	1	..	..	..	III
C. odorata (Jamaica) ..	1,626	..	..	..	..	..	..	..	..	..	..	..	....
C. 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	..	..	..	..	..	Germ period 10 to 40 days.
Chukrasia tabularis ..	2,296	36,736	..	..	38	34	12,490	2	1	..	..	..	XII
Chlorophora excelsa ..	1,283	196,528	..	..	33	29	56,993	..	2	1	..	..	....
Chloroxylon swietenia ..	2,288	35,648	..	..	95	69	24,597	..	1	..	..	..	III—VIII
C. swietenia (Ceylon) ..	1,406	22,496	..	..	78	58	13,048	..	..	..	..	..	III—X
Cinnamomum camphora ..	249	3,884	..	..	69	47	1,812	..	1	2	..	..	....
C. zeylanicum	105	1,680	..	..	1	1	17	..	..	1	..	..	....
C. zeylanicum (Begur 1955). ..	116	..	..	..	0·4 to 6.	0.4 to 5.	..	..	..	1	..	..	....
Cytissus scoparius ..	3,188	51,008	..	..	30	24	12,242	..	..	..	..	..	III—IV
Commiphora caudata ..	386	6,176	..	..	18	11	679	..	..	..	..	..	I
Cryptmerijaponica ..	9,691	155,056	..	..	0·2	..	..	..	..	..	..	..	IV
Cupressus macrocarpa ..	4,384	70,144	..	..	13	12	8,417	..	1 (pots).	..	..	..	IV—VI
C. torulosa	4,693	75,088	..	..	9	5	3,754	..	..	..	..	..	V—VI
Dalbergia latifolia	..	..	525	8,400	65	55	4,620	..	2	1	..	..	I—VI
D. sissoo	560	89,600	..	..	14	5	4,480	1	1	1	..	..	XI—I
D. sissoides	..	..	454	7,264	70	51	3,705	..	..	..	..	..	XII—III.
Daphniphyllum glaucescens	137	2,192	..	..	10	5	110	..	..	..	..	..	V—VI
Dendrocalamus brandisii ..	3,475	55,600	..	..	2	1	556	..	1	..	..	..	II
D. longispathus	2,367	37,872	..	..	2	1	379	..	..	..	..	..	III—IV.
D. strictus	1,245	19,920	..	..	48	64	12,749	..	1	..	..	..	III—IV
Dipterocarpus bourdillonii.	..	..	..	78	41	20	16	..	1	2	..	..	V
D. indicus	..	..	5	78	41	26	20	..	1 (basket).	..	..	..	III—VIII
Dodonaea viscosa	3,220	51,520	..	..	12	12	1,182	..	..	..	..	..	I—IV
Dolichandrone crispa ..	852	13,632	..	..	54	48	6,543	1	..	..	..	..	I—IV
D. falcata	725	11,600	..	..	13	1	116	..	..	..	..	..	III—V
Dysoxylum malabaricum ..	6	65	..	..	85	85	55	..	1	..	..	..	VII—VIII
Eleocarpus 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. Germ. period 12 to 116 days.
E. citriodora (Nilgiris seed).	4,670	..	..	..	6·9	6·2	4,530	..	..	..	..	..	....
E. eugenioides	76,800	1228,800	..	..	..	..	..	..	..	..	..	..	VI
E. floifolia	2,170	34,720	..	..	53	4	1,389	..	..	..		..	V
E. globulus	8,676	138,816	..	..	32	20	27,763	..	1 (mossed).	..	..	..	III

Statement showing seed weighment with germinative capacity, plant per cent and best methad of raising—cont.

Species.	Number. Seeds. Per oz.	Number. Seeds. Per lb.	Number. Fruits. Per oz.	Number. Fruits. Per lb.	Germinative capacity.	Plant per cent.	Plants per lb.	Best method of raising. Artificially. Direct sowing.	Entire transplanting.	Stump planting.	Vegetative propagation. Stem cutting.	Air layering.	Month to collect seeds.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Eucalyptus grandis ..	3,00,960	..	..	..	10	8·3	..	..	..	..	..	..	....
E. maculata	6,112	97,792	..	..	13	12	11,735	..	1 (mossed).	..	..	..	....
E. marginata	12,760	..	..	..	0·6	0·2	..	..	..	..	..	..	
E. pillularis	35,200	5,63,200	..	..	0·1	0·1	563	..	..	..	..	..	
E. propinqua	26,176	4,18,816	..	..	0·7	0·6	2,513	..	..	..	..	..	
E. rostrata	22,500	..	..	..	13·5	13·5	..	..	..	..	..	..	....
Eugenia aruottiana ..	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 roxburghiana ..	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 rotleriformis ..	11	176	..	..	43	40	70	..	1	2	..	..	X, V
Glochidion neilgherrense ..	1,298	20,7 8	..	..	29	4	831	..	..	..	..	..	III—IV
Gluta travancorica ..	2	32	..	..	96	90	29	..	1	..	..	..	IV—VIII
G. travancorica (Wynaad 1954).	4	64	..	..	70	70	45	..	..	..	..	..	..
Gmelina arborea	42	672	..	..	64	56	376	..	1	2	..	..	III—IV
G. arborea (Wynaad 1954).	48	..	..	..	49	44	338	..	..	..	..	..	..
Gossypium (Assam hill cotton).	455	7,280	..	..	28	23	1,674	..	..	..	..	..	..
Grewia tiliaefolia	291	4,496	..	..	64	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	..	..	..	..	..	III—VII
H. Pinnata	7	116	..	..	85	80	93	2	1	2	..	..	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	1,312	68	54	708	2	1	..	..	..	V—VII
Hypheenithebaica (Dum nut) (from Cairo).	..	5	..	..	50	50	2·5	..	..	..	..	..	Period of germination—six months.
Hymenodictyon excelsum ..	8,506	136,096	..	..	13	13	16,331	..	..	..	..	..	III
Indigofera endecaphylla ..	4,674	..	..	..	56	52	39,187	..	..	..	..	..	....
I. 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
Khaya grandifoliola ..	..	..	..	..	35	30	..	..	..	..	..	..	....
Khaya senegalensis ..	..	..	..	..	10	10	..	..	..	..	..	..	....
Lagerstraemia flos reginae ..	3,887	62,192	..	..	60	55	34,205	..	2	1	..	..	XII—II
L. lanceolata	5,173	82,768	..	..	20	13	10,760	..	1	2	..	..	XII—III
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
Lophopetalum wightianum.	421	6,736	..	..	10	10	606	..	..	..	..	..	IV
Mimusops 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 ..	383	5,808	..	..	24	23	1,336	..	..	..	..	..	IV—VI
Morus alba	26,015	416,240	..	..	13	5	20,812	..	..	..	1	..	....
M. alba (Meerut)	15,100	..	..	..	6	5	12,080	..	..	..	..	..	Period of germination—8—25 days.

Statement showing seed weighment with germinative capacity, plant percent and best method of raising—cont.

Species.	Number. Seeds. Per oz.	Number. Seeds. Per lb.	Number. Fruits. Per oz.	Number. Fruits. Per lb.	Germinative capacity.	Plant per cent.	Plant per lb.	Best method of raising. Artificially. Direct sowing.	Entire transplanting.	Stump planting.	Vegetative propagation. Stem cutting.	Air layering.	Month to collect seeds.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Mundulea suberosa ..	958	15,328	..	..	54	35	5,365	..	..	..	..	..	IV
Ravanea wightiana ..	1,296	20,736	..	..	20	20	4,147	..	..	..	..	..	IV—VI
Neoliteseo zeylanica ..	190	3,040	..	..	53	53	1,671	..	..	..	..	..	V—VIII
Ochroma lagopus	4,240	67,840	..	..	0·7	0·1	68	..	1	..	..	..	....
Ocimum kilimandscharicum ..	46,000	..	..	..	..	..	..	..	..	..	..	..	....
Palaquium ellipticum ..	7	112	..	..	69	68	76	..	1	..	..	..	V—VIII
Phoebe goalparensis ..	28	448	..	..	9	9	40	..	..	..	..	..	....
P. Goalparensis (Wynaad)..	28	448	..	..	15	14	60	..	..	..	..	..	....
Photinia notoniana ..	10,830	173,280	..	..	21	..	..	..	..	..	..	..	V—VIII
Pinus caribaea (Honduras) (Begur 1954).	1,804	..	..	..	34	23	6,569	..	..	..	..	..	....
Pinus caribaea (Honduras) (Chandanathode 1954).	1,804	..	..	..	63	63	18,184	..	..	..	..	..	....
P. insignis	1,807	28,912	..	..	8	4	1,156	..	..	..	..	..	V—VI
P. inmbrie	3,680	58,880	..	..	3	1	589	..	..	..	..	..	II.
P. longifolia	234	3,744	..	..	80	46	1,722	1	..	..	..	..	IV
Pithecolobium dulce ..	183	2,928	..	..	79	50	1,464	1	..	..	..	..	II—V
Pleurostylia wightii ..	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
P. regia	62	992	..	..	28	19	188	..	..	..	..	..	IV
Polyalthia fragrans ..	9	140	..	..	17	16	82	..	..	..	..	..	V.
P. longifolia	21	336	..	..	3	2	7	..	..	..	..	..	IV—IX.
Pongamia glabra	..	..	17	272	15	12	33	..	..	..	..	..	III—V and X.
Premna tomentosa	1,759	28,144	..	..	1	1	281	..	..	..	..	..	IV.
Prinsepia utilis	171	2,736	..	..	..	..	..	..	..	..	..	..	IV.
Prosopis juliflora	924	14,784	..	..	89	78	10,792	1	..	..	..	..	V.
P. spicigera	753	12,048	..	..	88	88	10,602	..	..	..	..	..	II—VIII.
Pterocarpus dalbergioides ..	..	..	52	832	49	29	241	..	1	..	..	..	II—VII.
Pterocarpus marsupium ..	..	..	60	960	97	90	864	3	2	1	..	..	I—VI.
Pt. santalinus	..	..	29	467	88	65	303	..	..	1	..	..	II—VII.
Pterospermum rubiginosum	1,911	30,576	..	..	14	8	2,446	..	..	..	..	..	I.
Pueraria javanica	1,025	16,400	..	..	37	36	..	..	..	..	..	..	
P. phaseoloides	1,650	26,400	..	..	45	38	10,138	..	..	..	..	..	..
P. thumbergiana	2,012	32,192	..	..	27	25	..	..	..	..	..	..	..
Pyrethrum	21,445	343,120	..	..	..	..	..	..	..	..	..	..	..
Quercus incana	14	228	..	..	80	51	116	..	..	..	..	..	II.
Rauwolfia canescens (with pulp dried).	650	..	..	..	..	..	..	..	..	..	..	..	..
Rauwolfia canescens (without pulp dried).	350	..	..	..	..	..	..	..	..	..	..	..	..
Rauwolfia serpentina (with pulp dried).	735	..	..	..	17	12	1,210	..	..	..	..	..	..
Rhodomyrtus tomentosa ..	3,686	58,976	..	..	9	1	590	..	..	..	..	..	IV
Samadara indica	11	176	..	..	33	32	66	..	..	..	..	..	II, IV, VI, VII.
Sapindus emarginatus ..	75	1,200	..	..	67	62	744	..	..	..	..	..	II—IV.
S. 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.
Soumida febrifuga	378	6,048	..	..	28	25	1,512	..	1	..	..	..	II—VII.
Sterculia companulata ..	110	..	..	..	51	44	767	..	..	..	..	..	..
S. urens	179	2,864	..	..	82	18	515	..	2	1	..	..	V.
Stipa senasima	13,200	211,200	..	..	3	2	4,224	..	..	..	..	..	..

***Statement showing seed weighment with germinative capacity, plant per cent and best method of raising*—Cont.**

Species.	Number. Seeds Per oz.	Seeds Per lb.	Fruits. Per oz.	Fruits. Per lb.	Germinative capacity.	Plant per cent.	Plants per lb.	Best method of raising. Artificially. Direct sowing.	Artificially. Entire transplanting.	Artificially. 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)
Strychnos nux vomica ..	17	272	..	..	52	52	141	..	..	..	..	..	XII—V.
S. potatorum	46	736	..	..	62	62	456	..	..	..	..	..	III—VII.
Tylosanthes gracilis ..	8,890	142,240	..	..	33	32	47,000	..	..	..	..	..	Soaking in hot water gives better germination.
S. gracilis (Nilambur Centre).	3,520	..	..	..	15·7	15·2	19,130	..	..	..	..		Period of germination—25 days.
S. gracilis (Begur) ..	9,530	..	..	..	6	4	6,100	..	..	..	..	..	..
Swietenia macrophylla ..	65	1,040	..	..	78	73	759	2	1	..	..	..	XII—III
S. mahogani	95	1,520	..	..	74	73	1,100	..	..	..	..	..	XI—XII.
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 and IV—VII.
Terminalia belerica ..	..	..	6	96	52	53	51	..	1	..	..	..	II
Terminalia catappa ..	..	..	5	80	25	25	20	..	..	..	..	..	..
T. chebula	..	..	18	294	60	50	147	..	1	..	..	..	XI—IV.
T. crenulata	..	..	22	352	72	58	204	..	..	1	..	..	I—VI.
T. myriocarpa (Dhoni) ..	..	..	16,000	..	10	7	17,920	..	..	..	..	..	Germination period—12—30 days
T. myriocarpa (Topslip) ..	..	..	16,000	..	1·1	1·0	2,560	..	..	..	..	..	..
T. paniculata	..	..	1,014	16,224	16	9	1,460	..	..	1	..	..	XI—IV.
T. tomentosa	..	..	30	480	5	2	9	..	..	..	..	..	II
Ternstroemia japonica ..	200	3,200	..	..	4	..	..	..	..	..	..	..	II—VII.
Tetrameles nudiflora ..	12,284	196,544	..	..	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	160,000	..	..	4	4	6,400	..	..	..	..	..	..
Vateria indica	..	..	1·6	26	80	76	20	..	1	..	..	..	VII—VIII.
Viburnum coriaceum ..	566	9,056	..	..	4	4	362	..	..	..	..	..	VII.
V. erubescens	1,005	16,080	..	..	7	7	1,126	..	..	..	..	..	VII.
Vitex altissima	353	5,648	..	..	8	3	169	..	..	..	..	..	XI—IV.
V. littoralis	88	1,408	..	..	30	..	..	..	..	..	..	..	VI—VII.
V. pelunculuris	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.
Zanthoxylum rhetsa ..	383	7,728	..	..	0·2	..	..	..	..	..	..	..	I—IV.
Zizyphus glabrata	207	3,312	..	..	19	12	397	..	..	..	..	..	X—II.
Zizyphus incurva	114	1,824	..	..	69	38	693	..	..	..	..	..	I.
Z. jujuba	56	896	..	..	95	82	735	..	..	..	..	..	I—VII.
Z. spinachrista (Cypress) ..	..	..	..	..	100	62·5	..	..	..	..	..	..	Germination period—35 days.
E. stylopyrus	612	9,792	..	..	52	40	3,917	..	..	..	..	..	III.

APPENDIX F.

Statement showing results of seed pre-treatment tests.

Referred to in paragraph 41.

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
A. baileyana	4	2	3	19	42
A. cyanophylla	9	11	14	17	35
A. ceylonsis.	4	8	8	7	4
A. dealbata	6	45	68	60	87
A. decurrens	4	1	1	8	24
A. ferruginea	11	48	42	47	33
A. leucophloea	14	21	12	17	23
A. melanoxylon	1	83	81	91	90
A. mollissima	5	5	2	11	29
A. planifrons	6	18	16	18	13
A. saligna	4	6	5	5	3
A. sundra	10	34	28	30	25
Acrocarpus fraxinifolius	25	8	8	9	6
Adenathera pavoniana	6	31	31	13	1
Ailanthes excelsa	1	0	1	0	Not done.
Alangium lamarckii	2	8	13	11	1
Albizzia amara	22	41	35	30	34
A. lebbek	4	20	18	19	15
Alnus nepalensis	4	1	1	0	Not done.
Alstonia scholaris	1	1	1	1	Not done.
Anacardium occidentale	6	70	58	54	24
Anogeissus latifolia	2	1	1	1	0
Azadirachta indica	10	41	37	29	6
Balanocarpus utilis	2	42	35	39	20
Bauhinia purpurea	11	23	25	27	13
B. racemosa.	5	13	13	15	16
Bischofia javanica	3	14	17	1	Not done.
Berberis tinctoria	2	56	0	0	0
Bombax malabaricum	4	17	19	18	6
Calophyllum elatum	7	15	14	13	0
Canthium didymum	2	2	3	3	0
Cassia auriculata.	14	12	9	11	5
C. fistula	17	11	11	8	7
C. marginata	12	17	22	13	5
C. siamea	16	50	37	47	5
Cedrela odorata	1	1	..	..	Not done.
Ceratonia siliqua (Carob tree) (Cyprus.)	1	49	49	Nil.	Nil.
Chukrasia tabularis	2	31	25	0	Not done.
Chlorophora excelsa	16	18	15	12	0
Chloroxylon swietenia	15	16	15	14	1
Chorisia speciosa	2	46	0	0	0
Cinnamomum camphora	1	1	1	0	Not done.
Commiphora caudata	1	3	1	2	0
Cupressus torulosa	2	7	0	0	0
Dalbergia latifolia	22	31	26	29	5
D. sissoides	30	26	26	32	5

Statement showing results of seed pretreatment tests.—Cont.

Species.	Number of tests made.	Average germinative capacity with			
		Untreated.	Cold water.	Hot water.	Boiling water.
(1)	(2)	(3)	(4)	(5)	(6)
Dendrocalamus strictus	7	28	19	18	0
Dolichandrone crispa	6	12	10	10	1
D. falcata	5	6	5	4	1
Elaeocarpus oblongus	2	5	0	0	0
Erythroxylon monogynum	3	13	14	11	1
Eugenia arnottiana	3	53	51	40	42
Evodia roxburghiana	9	6	6	1	0
Feronia elephantum	5	13	14	13	1
Givotia rottleriformis	9	4	3	3	2
Glochidion neilgherrense	2	3	0	0	0
Gluta travancorica	10	44	48	42	21
Gmelina arborea	25	20	19	18	6
Grewia tiliaefolia	4	7	5	7	5
Hakea saligna	2	45	0	0	0
Hardwickia binata	1	38	25	27	1
H. pinnata	1	..	..	..	..
Holoptelia integrifolia	1	1	0	1	0
Hymenodictyon excelsum	1	8	9	10	Not done.
Juniperus procersa	4	2	4	5	1
Lagerstroemia flos reginae	1	5	3	3	0
L. lanceolata	31	5	4	4	0
Leucaena glauca	12	24	26	31	32
Ligustrum neilgherrense	2	66	21	13	2
Litsea zeylanica	2	15	9	7	0
Lophopetalum wightianum	1	1	1	0	Not done.
Machilus macrantha	1	0	0	0	Not done
Mahonia leschenaultii	4	51	6	2	0
Mangifera indica	3	34	43	42	3
Markhamia platycalyx	1	1	1	0	0
Melia dubia	2	1	0	0	0
Meliosma wightii	1	14	8	0	0
Michelia neilgherrense	1	5	0	0	0
Morus alba	1	45	45	..	..
Myrsine wightiana (Rapanea)	2	10	14	11	20
Neolitsea zeylanica	2	16	18	0	0
Phlagurium ellipticum	15	38	48	40	0
Phoebe goalparensis	1	1	1	0	0
Pinus longifolia	4	34	54	27	49
P. insignis	3	4	9	2	0
Pithecolobium dulce	9	47	20	42	5
Pleurostylia wightii	1	13	20	2	0
Poinciana elata	3	17	21	19	21
Poinciana regia	1	28	28	26	68
Polyalthia fragrans	3	5	4	2	1
Premna tomentosa	1	1	1	1	1
Prosopis juliflora	6	61	62	53	46
Prosopis spicigera	1	10	12	8	9
Pterocarpus dalbergioides	6	13	16	11	5
Pt. santalinus	15	21	50	29	16
Pt. santalinus *	3	14	18	17	4
Pt. marsupium	96	39	31	32	12

Statement showing result of seed pre-treatment tests—cont.

Species.	Number of tests made.	Average germinative capacity with.			
		Untreated.	Cold water.	Hot water.	Boiling water.
(1)	(2)	(3)	(4)	(5)	(6)
Pterospermum rubiginosum	1	11	11	0	Not done.
Quercus incana	2	81	0	0	0
Sapindus emarginata	5	17	7	11	10
Schleichera trijuga	22	27	25	23	0
Shorea talura	1	68	54	54	1
Sterculia fabrifuga	10	1	3	1	0
Sterculia urens	5	18	15	16	0
Strychnos nux vomica	5	12	19	18	3
S potatorum	3	5	6	4	0
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) Kernal	4	6	1	2	0
Terminalia crenulata—					
(1) fresh seed	83	28	30	24	6
(2) Stored 14 months	10	9	8	7	8
T myriocarpa	1	10	..	..	..
T paniculata	29	10	8	8	..
T tomentosa	1	1	1	1	0
Tetrameles nudiflora	1	1	1	1	Not done.
Thyrsostachys oliveri	1	10	11	4	2
Trema orientalis	7	3	2	2	1
Veteria indica	3	58	57	58	0
Vitex altissima	2	3	3	4	0
Vitex littoralis	2	39	38	11	0
V negundo	3	7	8	3	0
Wrightia tinctoria	4	21	30	24	2
Xylia xylocarpa	42	20	26	25	13
Zanthoxylon rhetsa	1	0	0	0	..
Zizyphus glabrata	3	6	4	4	4
Z jujuba	5	31	24	24	22
Z xylopyrus	14	22	26	17	19
	3	11	13	13	11

APPENDIX G.

District Experiments—1955–56.

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 Division.

2. *Casuarina equisetifolia—Planting 1 seedling compared with planting 2 seedlings in the same pit.*—An interesting experiment was started during 1954–55 to compare the survival percentage and height growth of the following two treatments :—

(i) planting 1 casuarina seedling at each planting site ;

(ii) planting 2 casuarina seedlings simultaneously at each planting site.

The experimen is based on the promise that if 2 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. All the plants were subjected to severe shoot borers in the year of planting ; they have not established themselves properly. However the second annual measurements have been recorded. Further observations will be made.

During 1955–56, the same experiment was repeated in an area in Pudupet nreserve. The first annual measurements were recorded in January 1956. It is proposed to repeat the experiment in 1956–57 also—conclusions will be drawn after comparison of the figures obtained for three seasons in each of the above experimental plots.

II. Coimbatore North Division.

3. *Trial of Eucalyptus hybrid in Geddesal.*—In April 1955, in Geddesal locality, one year old Eucalyptus hybrid seedlings were planted in 1 foot cube pits in 10 acres. In one acre the grass was uprooted over the whole area. Casualties were replaced in November 1955 and weeding around the plants was also done. There was an accidental fire burning the grass and scorching the young plants in 9 acres where grass was not cut. This fire scorched the seedlings which were cut back. In the one acre, uprooted of grass, there was no fire damage and the seedlings are 2 feet to 5 feet high at the end of the first year.

The indications are that *Eucalyptus hybrid* can be successfully established in Geddesal locality.

III. Coimbatore South Division.

4. *Introduction of Anacardium occidentale (Cashew).*—Four hundred Cashew seeds were dibbled in Gudiravalli Kumri Coupe No. III. The seedlings at the end of the year were 2½ feet high. Seeds were also dibbled in Sathyamudi Bungalow compound in 45 pits and there are plants in all pits of an average height of 1 foot.

5. *Introduction of Willows* (*Salix babylonica*).—Twenty-five Willow cuttings obtained from the Nilgiris were planted near Erumaiparai in Tunacadavu Range. 21·25 cuttings sprouted and the mean height at the end of one year was 2 feet.

6. *Raising teak* (*Teli variety*).—During 1955-56, 50 lb. of seeds of teak of the Teli variety were obtained from Bombay and sown in two nursery beds. They have germinated and are growing well. About 500 seedlings will be planted separately in the 1956 regeneration area and the growth and development of these will be observed.

IV. Kollegal Division.

7. *Introduction of Mulberry* (*Morus alba*) *in Kollegal Range.*—Two hundred nursery seedlings of *Morus alba* (ordinary), 4,850 seedlings of Birhampore variety, and 300 of Kashmir variety raised in nursery in 1954, were planted out during July-August 1955 and the results are furnished in the following table :—

Experiment.	Size of pits.	Number planted.	Number survived.	Survival percent.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)
1	3′×3′×3′	2 5	3 0	..	Good.
2	6′×6′	1′×1′×1½′	523	3 0	55	Good.
3	5′×5′	1′×1′×1½′	900	100	11	Good.
4	3′×3′	1′×1′×1½′	426	403	16	Good.

In addition, 500 mulberry seeds received from the Range Officer, Kollegal were planted at 3 feet by 3 feet espacement. The survivals were only 10 out of 500.

It is observed that damage by deer and Sambhur to mulburry plants is heavy and there is therefore much difficulty in protecting them. Due to drought, the seedlings were withering during the hot weather of 1956.

8. *Introduction of Kolukattai grass* (*Pennesetum cenchroides*) *in 2 acres Grass Plot of Ramapuram Range.*—In Hanur Reserved Forest .. 60 lb. of Kolukattai grass seeds were sown on 29th October 1955 after clearfelling the existing thorny jungle growth, and after ploughing the soil twice. Germination was noticed on 4th November 1955, i.e., after a week. The seedlings died subsequently after flowering on 18th February 1956.

V. Nilambur Division.

9. *Underplanting of Swietenia macrophylla in teak plantations.*—During the year, Swietenia macrophylla was underplanted at an espacement of 25′ to 35′, i.e, about 40 plants per acre in 1924 teak plantation of Nilambur and Amarampalam Ranges when the plantations were 31 years old. The Mahogany plants were introduced in quincunx with the teak plants. There were 80 per cent and 20 per cent survivals respectively in Nilambur and Amarampalam Ranges The seedlings were 3 feet to5 feet high. Further observations are necessary.

10. *Underplanting of rubber in teak regeneration area.*—Two-year Rubber plants (Hevea *braziliensis*) obtained from Nilambur Rubber Company, Edakkara, were transplanted in pits of 2′ × 2′ × 2′ at an espacement of 20′ × 20′ over 25 acres in Walluvasseri Compt. 388 of 1924 regeneration area in June-July 1955. On account of damage by porcupines, Sambhur and deer casualties over 100 stakes were replaced. A ground fire swept over the area in April 1956 and damaged the survivals. The plants are now leafless though they are green. They may put out new shoots after rains.

11. *Coppice regeneration of teak* (*Tectona grandis*).—In Nilambur Range in Pakkode 1955 regeneration area, an area of 4 acres in 3 bits was left out without burning after coppicing the teak plantation of the previous rotation at the age of 65 years, to observe the growth and development of the coppice shoots. Multiple shoots were noticed on all teak stools and they were reduced to 1 to 2 shoots per stool during the cleaning operations of undergrowth in the surrounding areas. The shoots on these stools are taller than the teak plants raised in the adjoining area by stump planting and some of them are as high as 25 feet. The experiment is under further observation.

12. *Raising of Albizzia stipulata and Tetrameles nudiflora for catamarans.*—In Edacode 1955 regeneration area, 190 nursery raised seedlings of *Albizzia stipulata* and 360 natural *Tetrameles nudiflora* seedlings were planted over an area of 3 acres at an espacement of 22′ × 11′ The Tetrameles seedlings died; but were replaced by fresh natural seedlings. Elephants damaged many of the plants. Enumeration done in February 1956 showed the following survivals :—

Albizzia stipulata .. .. .. 57 out of 190 or 30 per cent.

Tetrameles nudiflora .. .. 153 out of 360 or 42 per cent.

13. *Raising teak in unburnt plots.*—In the 1955 regeneration area of Amarampalam Range, Teak was introduced in 4 patches which were not burnt after clear-felling. Four hundred and ninety-two stumps were planted at 8½′ × 8½ espacement, in all. The survivals at the end of one year in the above 4 patches vary from 74 per cent to 93 per cent. The plants are of a mean height of 3 feet 3 inches, while in the adjacent burnt area, the height of the teak plants is 5 feet 4 inches. This shows that burning does increase the height growth of teak.

14. *Bambusa arundinacea.*—Dryage conversion factors were required in order to convert the yield of green Bamboos into weight of dry Bamboos for purpose of a survey of Bamboo resources, in order to start a paper factory. The dryage was of the order of 23·4 per cent at the butt end and 20·5 per cent at the top end.

15. *Miscellaneous experiments.*—Attempts at introduction of *Bombax malabaricum* in swampy areas proved a failure during the year under report.

Similarly sowing seeds of *Broussonetia papyrifera* on mounds in 1910 teak plantation after the final thinning was a failure during the year under report, on account of drip, even though there was profuse germination of seeds in the mounds.

VI. Nilgiris.

16. *Introduction of Eucalyptus speccies in Segur Range.*—During the year under report *Eucalyptus citriodora, E. rostrata* and *E. hybrid* experimental plots were opened in Segur Range.

Four ounces of seeds in each of the above species were sown in three nursery beds of 20 '×4 '×1' in February 1955. Germination commenced in a week and was over in a fortnight. The seedlings were pricked into 2,000 Bamboo tubes besides direct sowing of *Eucalyptus citriodora* seeds in some tubes.

Two plots were opened. In one plot of 3 acres, selected near Harlattikotta in the treeless part of Avarahalla Reserved Forest, one foot cube pits were dug a 11 '× 11 ' in June 1955. Four hundred and twenty-two *Eucalyptus rostrata* seedlings with Bamboo tubes and 150 naked transplants of the same species and also 375 *Eucalyptus hybrid* seedlings with Bamboo tubes were planted out in the last week of June 1955. In another plot of 5 acres with jungle growth selected near Masinigudy Electricity Camp in Avarahalla Reserved Forest, one foot cube pits were dug 11 feet apart in lines spaced 22 feet apart, after clearing only the bushes in the lines to a width of 3 feet. No trees were cut. One hundred and fifty three *Eucalyptus citriodora* seedlings in Bamboo tubes and 311 *Eucalyptus rostrata* seedlings in Bamboo tubes were planted in the last week of June 1955 in pits.

Enumeration carried out on 9th September 1955 i.,e., two months after planting gave the following survivals.—

	Number of survivals.
(i) 3 acres plot—	
(*a*) *Eucalyptus rostrata*	222/572
(*b*) *E. hybrid*	167/375
(ii) 5 acres plot—	
(*a*) *Eucalyptus citriodora*	51/153
(*b*) *E. rostrata*	81/311

The heavy mortality was due to the extreme drought conditions that prevailed during the above tow months of July and August 1955 (total rainfall 2·27") besides the complete absence of rains for the fortnight following planting. On 13th September 1944, 520 *Eucalyptus rostrata* seedlings and 20 *Eucalyptus hybrid* seedlings were re-planted in the 3 acres plot while in the 5 acres plot 435 *E. rostrata* and 28 *E.citriodora* seedlings were planted.

Survivals in May 1956 are 20 per cent for the 3 acres plot and 10 per ent for the 5 acres plot. The maximum height of the seedling is 2½ feet in the above plots. All the 3 species are browsed by Sambur-hand deer and hares cut the plants at a height of 3 to 4 inches from ground level.

Watering of the seedlings for 30 non-rainy days following planting at ½ gallon per day per plant may ensure success in planting.

VII. Salem North Division.

17. *Control of Lantana camara.*—As an experiment to control Lanatana, a 5 acres plot was selected in Ubrani and Jowlagairi Reserve Forests, and planted with bamboo rhizomes at an expenditure of Rs. 209 and Rs. 379 respectively. Further observations are awaited.

18. *Fuel Regeneration Area in Chicckayapuram of Noganur Reserve Forest.*—The area under regeneration is 30 acres. This had been cleared of Lantana growth and cultivated with food crops for the last two years. Sunken mounds of size 11′ × 1′ × 1′ were dug along the contours at the rate of 60 mounds per acre (espacement : 22′ × 33′) and a mixture of sseed was dibbled in them. Also in the centre of each sunken mound, basket plants of *Dalbergia sissoo* were planted. Casualities have been replaced by entire transplants during rains. There is cent per cent stocking of basketed plants in the sunken mound with an average height of 3 feet while seedlings resulting from direct sowing are only one foot in height. Further observations will be continued to find out the number of survivals after the hot summer is over. In the adjoining area lines 6′ wide have been cleared in which Lantana growth and the same techenique of affroestation was tried thereto. But the results were a failure. This shows that the method of eradicating Lantana by clearing strips 6 feet wide and planting seedlings will not be successful. The Lantana growth with its prolific root system, absorbs the moisture in the soil and there is no accumulation of water in the water traps at either end of the sunken mounds. Panting by the sunken mound technique will be successful in Lantana areas, only if Lantana is completely cleared and uprooted.

VIII. Tiruchirappalli Division.

19. *Introduction of Swietenia macrophylla.*—In the Mahadanapuram Padugais one acre was planted with 500 nursery raised, one year old, seedlings of *Swietenia macrophylla* obtained from Topslip Research Centre at an espacement of 8′ × 8′ in the last week of September 1955. Watering of the plants was done as per the following schedule. First 30 days ½ pot or 2 gallons per plant per day and for the remaining period up to the end of December, ⅓ pot of water per plant on alternate days. About 40 per cent of casualities were replaced with natural seedlings obtained from Topsengattupatti. By end of January 1956 there were 90 per cent survivals and the plants have not thrown out new shoots and did not look very healthy. The future is to be watched.

20. *Introduction of Albizzia stipulata.*—One acre was planted with nursery transplants of 3 inches high in the last week of September 1955. There is no appreciable height growth since planting though there was 90 per cent survival at the end of January 1956. Watering is done in the same way as for Mahogany above.

21. *Introduction of teak in padugais.*—In Mahadanapuram padugais one acre has been planted with teak stumps obtained from Nilambur Division at an espacement of 8½′ × 8½′ in July 1955. The plants were watered as per following schedule:—

First 10 days with half pot of water equivalent to 2 gallons per stump daily. Next 20 days with half pot or 2 gallon of water on alternate days. Subsequently up to the end of December 1955, half pot or 2 gallons of

water once in a week; with no watering beyond December. There was 40 per cent casualities which were replaced by stumps obtained from Nilambur in October 1955. There were 90 per cent survivals in January 1956. The seedlings are only 6 inches to 9 inches high.

Similarly in Mananthatti Reserved Forest a teak plantation was raised in July 1955. There were 90 per cent survivals in January 1956 with a height growth of 9 inches to 15 inches. The plants are healthier here than in the Mahadanapuram Padugais.

22. *Marudur Padagais Prosopis Seed Farm,—Prosopis juliflora* has regenerated itself naturally and is found as a thick impenetrable mass of height of 20 feet to 25 feet. In view of the great demand for this species in afforestation of dry fuel forests and as 5,000 to 7,000 lb. of seeds are required every year, this locality can be developed into an ideal seed-farm for *Prosopis juliflora*.

23. *Introduction of Eucalyptus hybrid in Tiruchirappalli padugais.—Eucalyptus hybrid* transplanted in January 1955 when 3 inches to 4 inches high around a well in a Casuarina plantation nursery in Manathattai has grown to a height of 10 feet in one year. The height growth is quite good. The question of extended introduction of Eucalyptus species in the Padugais deserves consideration.

IX. Tirunelveli Division.

24. *Cutting back teak plantation at age 4 years.*—In obedience to the directions of the Chief Conservator of Forests in his No. 15881/54-D 3, dated 28-6-1954 an experiment was started in the 1950 teak plantation of Kuttalam Beat. Over an area of 9 square chains, distributed at random in 9 sub-plots of one square chain, the teak saplings which were 4 years old 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 uncit area around. Subsequent observations show that the coppice stems are definitely inferior to that of the uncoppiced stems.

The results at the end of two years after coppicing shoots have grown to the same height as the adjacent teak in the uncoppiced area and they are having clean and straight shoots. These are definitely much better than the crooked and brachy stems in the uncoppiced plot. Each stum is having two or three shoots and it is considered that reducing the shoots to one on each stool is desirable now.

In this connection attention is invited to paragraph 58 wherein a comparison experiment was done with teak plants cut back when they were one year old (vide E.P. No. 174/1953 of Nilambur).

APPENDIX H.

Statement showing rank, designation and address of Forest Officers employed exclusively on research work in Madras State during the year 1955–56.

(Referred to paragraph 12).

I. Shri P. Venkataramany, M.A., I.F.S., State Silviculturist, Ootacamund.

II. Shri G.J. Rajasingh, B.Sc. (Hons.), A.I.F.C., Assistant Silviculturist, Ootacamund. From 1st April 1955 to 5th November 1955. Post vacant from 6th November 1955 to 31st March 1956.

III. (i) Shri K. R. Rajagopalan, B.Sc., Research Ranger, Nilambur.

(ii) Shri S. Tharakaraman, Research Ranger, Wynaad, from 1st April 1955 to 21st July 1955.

(a) Shri G. Ananthatheertha Rao, Research Ranger, Wynaad, from 22nd July 1955 to 31st March 1956.

(iii) Shri N. P. Chirukandan, Research Ranger, Denkanikota.

IV. (1) Shri A. Velukunhan, Research Forester, Begur.

(2) Shri S. T. P. Mammoo, Research Forester, Manantoddy.

(3) Shri K. V. Vijayaraghavan, Research Forester, Chandanati, from 1st April to 28th June 1955.

(4) Shri P. Balakrishnan, Research Forester, Ootacamund.

(5) Shri A.V. Nair, Research Forester, Rameswaram.

(6) Shri M. P. Subbiah, Research Forester, Topslip, from 1st April 1955 to 22nd December 1955.

(7) Shri P. Govindan Nair, Research Forester, Nilambur, from 1st April 1955 to 14th December 1955. Research Forester, Topslip, from 22nd December 1955 to 31st March 1956.

(8) Shri A. A. Victor, Research Forester, Ootacamund.

(9) Shri N. Thangappan Nair, Research Forester, Dhoni.

(10) Shri S. Krishnamurthy, Research Forester, Ootacamund, from 1st April to 18th May 1955. Research Forester, Denkanikota, from 26th September to 15th November 1955; Research Forester, Markanam, from 25th November 1955; to 31st March 1956.

(11) Shri R. S. Lingam, Research Forester, Denkanikota.

(12) Shri S. S. Srinivasarathnam, Research Forester, Vemburili Centre, from 7th July 1955 to 7th January 1956 and Research Forester, Tanjore Centre, from 13th January to 31st March 1956.

(a) Sri S. Velayudhan, Research Forester, Vemburili Centre, from 7th January 1956 to 12th March 1956.

(13) Shri O. Madhavan Nambiar, Research Forester, Markanam Centre, from 1st April 1955 to 25th November 1955; and Research Forester, Nilambur Centre from 2nd December 1955 to 31st March 1956.

(14) Shri K. Velayudhan Nair, Statistical Forester, from 1st April 1955 to 8th February 1956.

APPENDIX I.

Utilisation and Economic Research Effort for 1955–56, Utilisation Division, Madras.

I. General work of Administration.

1. The Forest Utilisation Division, Madras, continued to function during the year under review. Shri M. Anser Badshah, Personal Assistant to the Chief Conservator of Forests, Madras, held additional chargl of this division from 4th March 1955 forenoon until the present incumbent Sri T. B. Jambulingam, M.A., A.I.F.C., took charge of the division on 18th April 1955 forenoon and the latter held charge of the division for the rest of the period.

2. The main activities of the utilization Division during the year were practically the same as was mentioned in last year's report.

(*a*) Organizing supply of timber to State Government departments which consume timber, Co-operative building societies, Government sponsored industrial and other institutions.

(*b*) Arranging supply of timber to Railways against purchase orders issued by the Director-General of Supplies and Disposals, New Delhi.

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

(*d*) Organizing supply of electric transmission poles to the Electricity Department.

(*e*) Inspection of ascu and creosote treated poles of the Elecrticity Department on field tests.

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

(*g*) Liason with the Forest Research Institute, Dehra Dun, by arranging supply of timber and minor forest produce for test purposes and furnishing them all information required by them.

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

(*i*) Maintenance of library and ledger files.

(*j*) Answering enquiries and participating in exhibitions.

II. Experimental and commercial activities.

1. (*a*) In the previous year, the Superintendent, Technical Development Establishment Laboratories, Kanpur, required the following species of timber specimens 2' in length and 36 inches-47 inches girth for purpose of studying the dynamic elastic properties:—

1. *Artocarpus hirsuta.*
2. *Adina cordifolia.*
3. *Artocarpus intrigrifolia.*
4. *Cedrella toona.*
5. *Tectone grandis.*
6. *Dalbergia latifolia.*
7. *Dysoxylum malabaricum.*
8. *Terminalia paniculata.*
9. *Terminalia tomentosa.*
10. *Lagerstroemia lanceolata.*
11. *Albizzia lebbek.*

The supply of six species was made from Coimbatore South Division during this period but the Superintendent has since intimated that other species are not required at present..

(*b*) The Director of Technical Development Army Headquarteres Delhi, required as reported in the previous report four billets of Melia azedirach for test purposes to find out its suitability as a substitute for

willow for artificial limbs. The District Forest Officer, Vellore West, has supplied the specimens in August 1953. The results of tests are still awaited [vide paragraph II (1) (b) of previous report].

(*c*) Messrs. Vithaldas Makanji & Sons, Navsari. who required Anogeissus latifolia logs for manufacture of Tex Pins has been supplied with the required size of a sample log from Coimbatore South Division. The result of this trial is awaited.

2. *Timber seasoning.*—Nil.

3. *Timber testing.*—(*a*) The Chief Research Officer, Composite Wood Branch, Forest Research Institute, Dehra Dun, who was supplied in the previous year timber logs of Dysoxylum malabaricum, Canarium strictum, Dichopsis elliptica, Hardwickia binnata, Spondias mangifera and Zanthoxylum rhetsa has been requested to communicate the results of experiment on these species.

(*b*) The Superintendent, Explosive Project Office, Kirkee, Poona, to whom sample logs of Salix tetrasperma were supplied last year in connection with the manufacture of high grade charcoal for gun powder has not yet communicated the results [vide paragraph II 3 (*b*) of previous report]

(*c*) The Superintendent, Explosive Project Office, Kirkee, to whom, 1,800 lb. of wood of *Euphorbia tiracali* were supplied last year for manufacture of gun powder fron charcoal has not yet communicated the results [vide paragraph II (3) (*c*) of previous report].

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 No. 1.)

(*b*) *Inspection of ascu and creosote treated poles.*—The ascu and creosote treated poles erected at various localities in Coimbatore and Madurai districts for field test by the Electricity Department were inspected during the year under review. The results of the inspections made are given in Statement No. 2.

5. *Minor Forest Products.*—(*a*) The Officer-in-Charge, Minor Forest Products Branch, Forest Research Institute, Dehra Dun, to whom the supply of commercial drugs was made for the purposes in previous year of investigation [vide paragrapgh 5 (*a*) of the previous report] has not reported the results of the investigation. He has recently informed it will take considerable time.

(*b*) Lac cultivation is continued in Madurai West, Coimbatore South and Salem North divisions. The cultivation of lac in South Kanara division (introduced in 1954-55) was dropped as last infection was a total failure. All the quantity of scraped lac dust collected in other divisions is disposed of in auction sales by the District Forest Officers concerned and seed lac is used for manufacturing in the Lac Factory at Denkanikota.

(*c*) In the Second Five-Year Plan, it has been proposed to intensify lac cultivation in the Forest divisions of Madurai West and Coimbatore South and place each unit under a lac Supervisor. An up-to-date factory at Cumbum has also been proposed to be set up.

(*d*) As usual honey collected departmentally was supplied to the Bee Keeping Development Officer, Madras, for processing and selling in retail to the public in Madras City. It is understood that he is experiencing difficulty in disposal of processed honey. Originally honey collected departmentally was cured, ripened, bottled and sold in Madras City by the Forest Utilisation Officer. As the post of Forest Utilisation Officer was abolished from 1st October 1953 this scheme was given up under orders of Government and was entrusted to the Bee-keeping Development Officer. Now that the post of Forest Utilisation Officer has been revived, Government have been addressed for continuing the scheme by the Forest Utilization Officer himself orders of Government are awaited. Bees wax is supplied to Jail Departments as usual.

(*e*) The Chief Professor of Chemistry, Presidency College, Madras, in connection with a programme of research on the constitutents of the plant *Toddalea aculeata* (Rutaceae called Milakaranai in Tamil required 200 lb of this material. The District Forest Officer, Vellore west division, supplied 1 0 lb. of the roots. The supply from Chingleput division is awaited.

(*f*) The Chief Professor of Chemistry, Presidency College, required 50 lb. in each of the stem and root bark of Feronia elephanta for a detailed investigation. The Supply was arranged from Vellore West Division. Finding that although the stem bark offers nothing of chemical interest, the root bark appears to hold out promising chemical analysis, he required a further supply of at least 200 lb. of the root bark alone. The supply is in progress. However, even if the investigation will result in a valuable discovery, it is not desirable to fell and more so to uproot a valuable fruit plant.

(*g*) The same Chief Professor of Chemistry also required 100 lb. of roots of *Aristolochia Indica* in connection with a chemical investigation. The supply is being arranged from Tirunelveli and South Kanara divisions.

(*h*) This Chief Professor also desired to have two bags of air-dried leaves of lantana, 100 lb. of whole plants of Strobilanthon species and 20 lb. of seeds of *Terminalia bellerica*, for experimental purposes. Supply of two bags of lantana leaves was arranged by the District Forest Officer, Vellore East. Leaves of Strobilanthus species was supplied by the District Forest Officer, Wynaad. Seeds of *Terminalia bellerica* will be supplied during next season.

The Chief Professor was requested to carry out experiment on the theraupatic value of the plant of Nardostachm Jatamanshi. This plant is useful for curing patients with low blood-pressure. This drug is used as a nerve sedative and to reduce hysterical symptoms. It is used as tonic in combination with other drugs. It is considered to coal and it reduces pitta. It is also an ingredient in approdisiac preparation. The species is stated to occur in Garhwal Forest division, Uttar Pradesh. I have requested the Divisional Forester to arrange for the supply of the plant to the Chief Professor of Chemistry. I have also requested him to send seeds or other suitable material of the above plant for propagation in this State.

(*i*) The President, Forest Research Institute and College, Dehra Dun, required 5 lb. of latex of Holarrhena anti-dysenterica for onward transmission to Mr. P. C. Spensley colonial Products Council, South Kensington, London, for research purposes. The supply is being arranged by the District Forest Officer, Vellore West.

6. *Paper Pulp.*—Nil.

7. *Tans.*—(*a*) The Director, Central Leather Research Institute, Adyar, Madras to whom 2 bags of leaves of Chuckrasia tabularis were supplied in the previous years to determine the chemical and tannin content [vide paragraph 7 (*a*) of previous report] has communicated the results of tests as follows:—

Name of Sample		Chukrasia tabularis (leaves)
Tannin Content		gigibe percentage.
Non Tannin Content		.. .. ..
Moisetre Content		.. .. ..
Insolubles		.. .. ..
Tannin Content Reported in Forest Record	Leaves	22 per cent
	Bark	15 ptr cent
Remarks		Experiment are to be repeated to confirm the results.

The Director desires to carry out further tests with fresh samples of leaves of Chukrasia tabularis and he has requested for a further supply of two railway maunds of the leaves. The supply is being arranged from South Kanara division. Besides the above material he has also indented for two railway maunds in each of the following materials. The supply is in progress.

(1) Garissa carandas leaves.

(2) Dhawa leaves (tender variety).

(3) Dhawa bark.

(4) *Anarcardium occidentale* (leaves).

(5) *Do.* (bark).

He has informed that the analysis on these materials show that there is great variance between the results obtained at his institute and those reported in the Forest records. Hence he has indented for a further quantity of two railway maunds in each for further tests. A report on the analysis of the various samples of tanning material sent by him is given below :—

Serial number and name of sample.	*Tannins content.*	*Non-tannins content.*	*Moisture.*	*Insolubles.*	*Tannins content reported in forest Records.*	*Remarks.*
	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	
1 *Carissa carandus (leaves*	8·56	18	10·80	67·69	11	It is useful for tannin in blend with other tan materials. Experiments are to be repeated to confirm our results.
2 *Phyllanthus emblica*	14·5	14	10·5	61·5	..	Experiments conducted with the leaves in admixture with other materials like goran, etc. gave very promising results.
3 *Dhawa leaves*	14·0		10·6	63·04	30—35 Tender Leaves.	Very useful to produce E.I. Tanned kips alone and in blends with other materials like goran and Karada. Samples of tender leaves may be supplied for our investigation.
4 *Anacardium occidentale leaves*	Negligible amount (about 5·6).	—	—	..	23	Since there is great variance in the results fresh samples may be sent for analysis to confirm our results.
5 *Cassia siamea (leaves).*	Negligible amount.	..	..	..	7	Since the tanning content is below 10 per cent the investigation on the matter does not prove economical.

(*b*) The Principal, Institute of Leather Technology, Madras, to whom tender and mature leaves of Dhawa leaves were supplied in previous years had not communicated the result yet [vide paragraph 7 of 1954-55 report].

(*c*) The Principal, Institute of Leather Technology, Madras, who was supplied with *Cassiamarginata* bark in previous years had not reported the result of test. For further tests he required 25 lb. of this bark and supply has been arranged from the District Forest Officer Tiruchirappalli.

(*d*) Information regarding the market condition and prevailing rate for wattle bark of both imported variety and indigenous bark was being communicated to District Forest Officer, Madurai West and the Niligiris in order to enable them to gauge the reasonableness or otherwise of the offers got in auction for our indigenous wattle bark extracted in these two divisions.

8. *Wood working*—Nil.

9. *Miscellaneous*.—(*a*) This department tried cultivation of Saffron in the Nilgiris, Kodai, and Top slip as an experimental measure. The experiment was not however successful.

(*b*) It has been proposed to raise medicinal farms in suitable localities in order to increase the availability of drugs and aslo reduce the cost of production and supply. At present medicinal plants are scattered over extensive and inaccessible areas in the forests. Consequently the cost of collection is very high and there is possibility of adulteration. Hence it has been suggested to Chief Conservator of Forests to have medicinal farms in two or three places in the State under the control of Forest Utilization Officer. Efforts are being made to push through this scheme.

APPENDIX.

I. *Publications*—Nil.

II. *Statement showing men, designation and address of Forest Officers employed exclusively on research work during the year* – Nil.

STATEMENTS.

STATEMENT NO 1.

Statement showing the results of joint inspection of test length sleepers, 1955—56.

Serial number.	*Numbers laid.*	*Date of laying.*	*Location.*	*Description of sleeper.*	*Date of inspection.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	300	March 1943.	Between Tiruthuraipoondi and Manali. mile 215/12 to 215/9 3/4.	Creosoted test length sleepers of Puli, Pillamarudu and Vayal.	16th May 1955.	The results of the tests indicate that Irumbogam is the most durable among the species tested. Pillamarudu though included in low grade is giving better service than Vayal (a species included in the other species (i.e.) superior to low grade Karimarudu (a species included in other species) is giving better service than Irul (high grade).
2	999	June 1949	Between Tirupathi East and R nigunta Railway Station. 168/13–14 and 149 4 to 5.	Creosoted test length M.G. Mathi sleepers.	11th July 1955.	Out of 999 sleepers laid originally, 37 have been replaced so far. It was found that the durability and service as sleepers in the case of Mathi are very satisfactory.
3	288	March 1943.	Between Tenmalai and Edaman. mile K 434/3 1/4 to 435/4 1/4.	Creosoted test length sleepers of Vayal, Irumbogum, Karimarudu, Nagul. Irul, Pillamarudu and Puli.	6th August 1955.	The performance of the sleepers of various species are almost in consonance with the persent classification as high grade, other species are low grade. In spite of creosoting the service or durability of wooden sleepers are not very satisfactory. This may be due to the alternate wetting and drying with considerable variation in temperature and rainfall during different season and rather unsatisfactory drainage over the enbankment.
4	999	July 1948.	Between Tenmalai and Edaman, mile 435/15 to 463 Rail section on 50 lb. E.F.B.	Creosoted test length M.O. sleepers of Mathi.	8th August. 1955.	It has been observed that creosoted sleepers are not holding nails tightly for long periods and consequently the position of the nails and the sleepers have to be changed frequently. The replacements have also been rather many, due to rather unsatisfactory drainage and prevalence of extremes of climatic conditions.
5	244	March 1943.	Between Gmalur and Mecheri Road SMD 214/16-21-5. Mettur Line.	Creosoted test length sleepers (B.G.) of Pillarmarudu, Pali Karimarudu. Hopea and Vayal.	5th November. 1955.	The sleepers in this locality are subjected to severe condition. Laying in station yards has reduced the normal strain to which they will be subjected if laid outside station limits. The durability of timber in this locality is very satisfactory. From this, it may be seen that Pali, which is at present not accepted by the Railways, does better than Vayal (a species included in other species), Pillamarudu (low grade) has served better that Vayal (other species) and compare-favourably with its sister species (Karimarudu included in other species). Hopea is by far the best species for sleepers.
6	500	1937 ..	Between Cannanore and Azhikkal. mile No. 6 464/15 to 469 2.	Untreated sal B.G. sleepers.	15th February 1956.	The durability of sal in this locality is very sarisfactory
7	329	April 1943.	Between Cannanore and Azikkal mile B. 468/25 to 469/4.	Creosoted test length B.G. sleepers of Vayal, Karimarudu Hopea. Palli, Pillamarudu, Irul and Mesun.	15th February 1956.	The durability of all the species except Pillamarudu is according to the present accepted grades. But performance of of Pillamarudu indicates that it may be safely upgraded from the present low grade to other species. The durability of Pali is very uneconomical even after preservative treatment.
8	220	July 1941.	Between Cannanore and Ahzikkal 549/0 to 549/3 A.	Air seasoned and unseasoned B.G. sleepers.	7th March 1956.	Even Air seasoning increases durability and it is not desirable to use any unseasoned sleepers.

STATEMENT No 2.

Statement showing annual report on the field inspection of ACSU treater poles for the year 1955—56.

Serial number and description of poles. (1)	*Number chisseled in the creosoting depot.* (2)	*District number.* (3)	*Date of treatment.* (4)	*Date of erection or supply to Electricity department.* (5)	*Location.* (6)	*Date of inspection by the Forest Utilisation Officer.* (7)	*Remarks.* (8)
			METTUPALAYAM SECTION.				
1 Pine pole ..	S PL M AS	Not visible.	9th September 1941.	10th November 1941.	Pole No. 3 in Mettupalayam 100 K.V.K. Transformer L.T. Distribution. Avanasi Road on Railway station feeder. line on dry land.	4th June 1955.	Creosoted at the base up to 1' above the ground level. Sound.
2 Pine pole (with many small knots).	4 PL M AS	Do.	Do.	Do.	Do.	Do.	Do.
3 Wynaad teak pole.	6	3567 T W AS	19th October 1941.	29th November 1941.	Do.	Do.	The pole is getting discoloured (i.e.) the green colour of ASCU is disappearing. Slight splits are noticeable on the surface. Sapwood has decayed up to 1½" in depth and deterioration has set in the heartwood also and hence the pole may be replaced soon or line dismantled as it is not essential
4 Hopea pole (with too many small knots).	23 H SK AS	Not visible.	14th August 1941.	10th November 1941.	Pole No. 2 (Lines feeding to S.F. No.) 100 V.A. Transformer, Mettupalayam on Mettupalayam Railway station feeder line on dry land.	Do.	Small cracks noticeable on the surface. Creosoted at the base upto 1 foot above ground level. Sound.
5 Wynaad teak pole 41 WT	T W AS	3548	18th October 1941.	29th November 1941.	Pole No. 10 -Maddampalayam K.V.A. Transformers L.T. Distribution, Coimbatore taluk in cultivated fields.	Do	Sapwood near ground level has decayed up to 1½ inch in depth. Heartwood in sound and the pole may stand for another year. Creosoted at the base up to 1 foot above ground level.
6 Wynaad teak pole 41 WT 13	T W AS	1761	21st October 1941.	29th November 1941.	Pole No. 9. Maddampalayam 10 K.V.A. L.T. Distribution, Coimbatore taluk in cultivated fields.	Do.	Rather deep cracks are noticeable on the surface of the pole. Sapwood has decayed up to 1 foot in depth below the ground level. Can stand for another year.
7 Hopea pole 41 4	H SK AS	Not visible.	14th August 1941.	10th November 1941.	Pole No. 7, Maddampalayam 10 K.V.A. Transformers L.T. Distribution, Coimbatore taluk in cultivated lands.	Do.	The characteristic green colour of Ascu is vanishing in patches. Superficial cracks are noticeable on the surface creosoted at the base. Sound.

Statement showing Annual Report on the field inspection of ASCU treated poles for the year 1955-56—cont.

Serial number and description of poles. (1)	*Number chiselled in the creosoting depot.* (2)	*District number.* (3)	*Date of treatment.* (4)	*Date of erection or supply to Electricity department.* (5)	*Location.* (6)	*Date of inspection by the Forest Utilisation Officer.* (7)	*Remarks.* (8)
8 Hopea pole— 13	H — 13 H SK AS	Not visible.	15th July 1941.	10th November 1941.	Pole No. 13, Maddampalayam K.V.A. Distribution, L.T. Coimbatore taluk in cultivated land beyond the stream in coconut tope.	4th June 1955.	Sound. Creosoted at the base up to 1 foot above the ground level. Two deep cracks 1 inch to 1½ inches deep noticed. (1) 2½ inches long starting 3 feet above ground level. (2) 2 feet long rather deep and gaping starting from the ground level.
9 Hopea pole— 41 H 12	H SK AS	Do.	14th July 1941.	Do.	Pole No. 11, Maddampalayam 10. K.V.A. L.T. Distribution. Coimbatore taluk. in cultivated lands.	Do.	Creosoted at the base. Sound.
10 Hopea pole ..	H 16 H SK AS	Do.	16th July 1941.	Do.	Pole No. 12, Maddampalayam 10 K.V.A. L.T. Distribution, Coimbatore taluk. in cultivated lands.	Do.	Superficial cracks noticed. Sound
11 Hopea pole with knots.	H SK AS H 15	Do.	15th July 1941.	Do.	Pole No. 14, Maddampalayam 10 K.V.A. L.T. Distribution, Coimbatore taluk in cultivated lands beyond the stream by the side of a well.	Do.	Creosoted at the base. Superficial cracks are noticeable on the surface. Sound.
12 Vayal pole .. 41 V 3	3 V P AS PA 14	Do.	5th May 1941	29th November 1941.	Pole No. 8, Maddampalayam 10 K.V.A. L.T. Distribution Coimbatore taluk in cultivated fields.	Do.	It is noted in the Electricity Department register that it is a teak pole from Nilambur. It is creosoted at the base and sound in condition.
NILAKOTTAI-KODAI ROAD (BATLAGUDU SECTION).							
1 Pine pole Electricity pole No. 1, creosoted.	22	PINCE 9-41	16th September 1941. Creosoted.	10th November 1941.	Location No. 1 L.T. North Feeder Kodai Road very near to the Power structure. In Railway station road on the roadside.	13th June 1955.	Sound.
2 Hopea pole (creosoted).	Location No. 27 19 H	HNCR 9-41	11th July 1941.	Do.	In the tank bed near a village situated near third mile on Kodai Road. Nilakkottai road.	Do.	Slightly split over surface. Sound.
3 Do.	30 H 20	HNCR 9-41	14th July 1941.	Do.	Do.	Do.	Do.
4 Hopea pole No. 21.	32	HNCR 9-41	7th July 1941.	Do.	Inside a tank bed near a village near third mile on Nilakkottai Kodai Road.	Do.	Superficial cracks noticed above ground surface Sound.

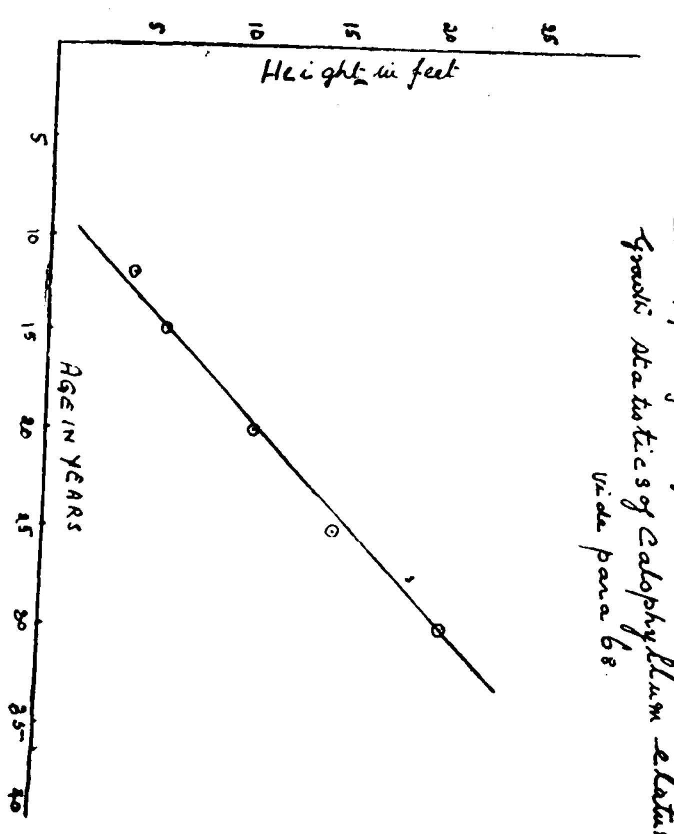
Statement showing Annual Report on the field inspection of ASCU treated poles for the year 1955-56—cont.

Serial number and description of poles. (1)	*Number chiselled in the creosoting depot.* (2)	*District number.* (3)	*Date of treatment.* (4)	*Date of erection or supply to Electricity department.* (5)	*Location.* (6)	*Date of inspection by the Forest Utilisation Officer.* (7)	*Remarks.* (8)
5 Hopea pole ..	10	Not visible.	14th July 1941.	10th November 1941.	Railway station, Kodai road.	..	Not traceable.
6 Hopea pole No. 15.	25	HNCR 9-41	19th August 1941.	Do.	Kodai Road-Madura on South feeder line on cultivated lands.	13th June 1955.	Slight superficial cracks noticed. Sound.
7 Hopea pole No. 3.	10	HNCR 9-41	14th July 1941.	Do.	Location No. 3 Distribution L.T. North feeder of Kodai Road Distribution on the side of the road.	Do.	Sapwood has decayed up to 1/2 inch. Heartwood is sound.
8 Hopea pole No. 5.	Location No. 43	VNCR 9-41	5th August 1941.	29th November 1941.	Location No. 43, Distribution, Nilakkottai Kodai Road 22 K.V. Spur line (on cultivated lands).	Do.	Slight superficial cracks noticeable. Sound.
			PODANUR SECTION.				
1 Pine pole ..	8	Not visible.	11th September 1941.	10th November 1941.	Podanur 100 K.V.A. Transformer L.T. lines feeding to S.C. No. 364.	16th March 1956.	Pole sound; minor surface cracks.
2 Pine pole ..	11	Do.	12th September 1941.	Do.	Do.	Do.	Pole sound: few longitudinal cracks noticed.
3 Do. ..	41	Do.	13th September 1941.	Do.	Do	Do.	Pole sound. Surface long itudinal cracks noticed. Few of them 2 feet in length and half an inch in depth.
4 Do. ..	19	Do.	15th September 1941.	Do.	Do.	Do.	Pole sound. Few surface cracks.
5 Do. ..	21	Do.	16th September 1941.	Do	Do.	Do.	Pole sound surface longitudinal cracks through out the length of the pole.
6 Do. ..	25	Do.	17th September 1941.	Do.	Do.	Do.	Pole sound. Surface cracks all along the length of the pole were found.
7 Do. ..	17	Do.	Do.	Do.	Do.	Do.	Pole sound. Few longitudinal cracks found.
8 Vayal pole.	6	Do.	5th August 1941.	29th November 1941.	Do.	Do.	Pole sound. Few borer holes and minor cracks along the length of the pole noticed.

Statement showing Annual Report on the field inspection of ASCU treated poles for the year 1955–56—cont.

Serial number and description of poles.	*Number chiselled in the creosoting depot.*	*District number.*	*Date of treatment.*	*Date of erection or supply to Electricity department.*	*Location.*	*Date of inspection by the Forest Utilization Officer.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				(x) Kaliadimadai.			
1 Pine pole ..	2 PL 41	Not visible	8th September 1941.	18th November 1941.	S.C. 483 Sowripalayam.	16th March 1956.	Pole sound. Few cracks.
2 Do. ..	10 PL 41	Do.	12th September 1941.	10th November 1941.	Do.	Do.	Pole sound. Few pronounced crackst some two fee. 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	Do.	9th September 1941.	Do.	Do.	Do.	Do.

T. B. JAMBULINGAM,
Forest Utilization Officer.



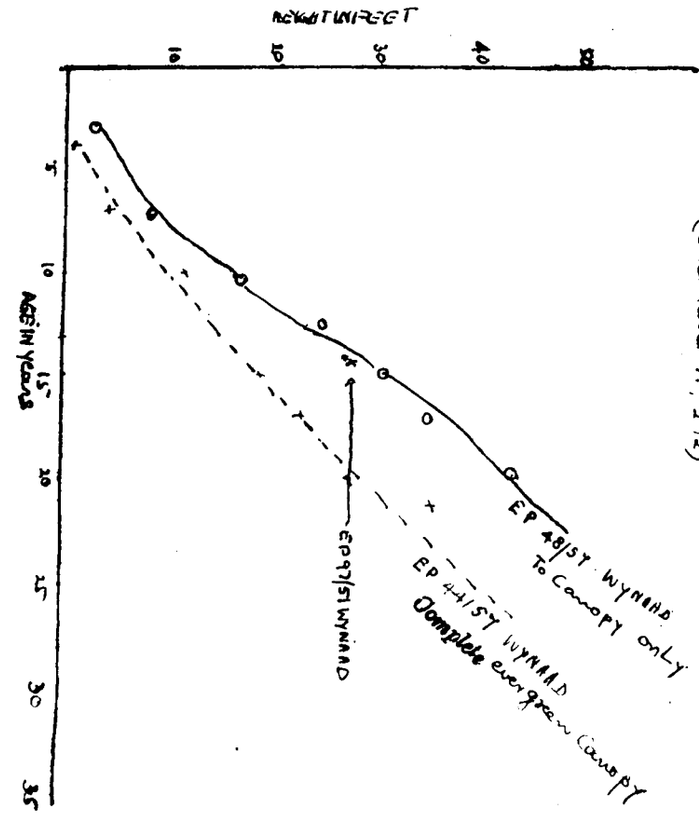


CHART - II A.
GLUTA TRAVANCORIA
(vide Para 71, 272)

CHART II B
GLUTA TRAVANCORIA
(vide Para 71, 272)

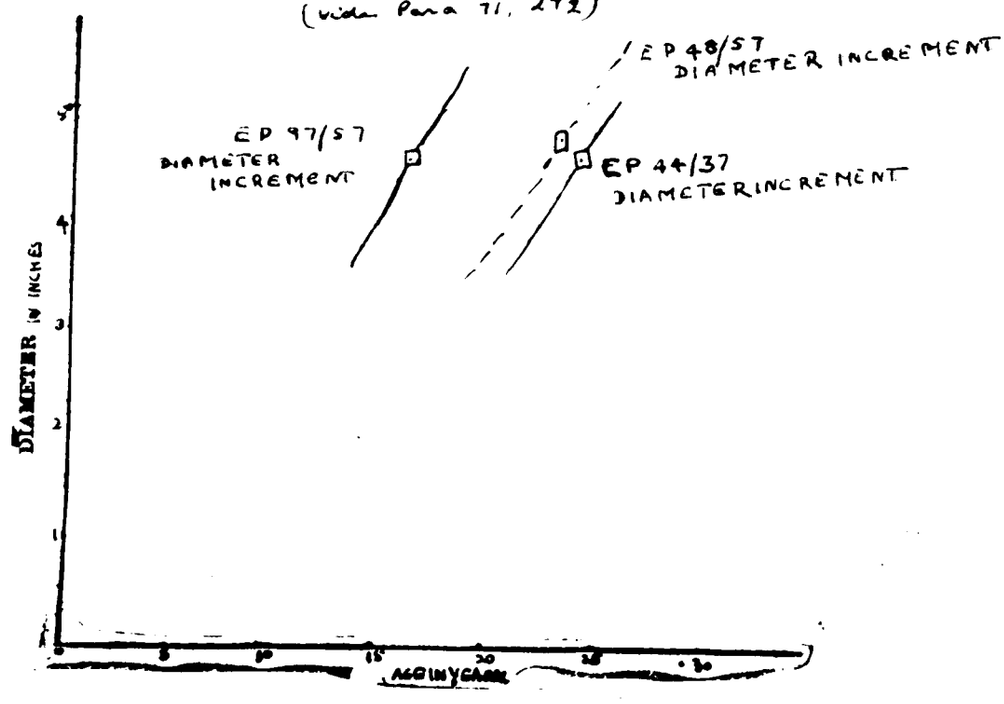


CHART- III
HOPEA PARVIFLORA
(I) EP 76/1937 SOUTH COIMBATORE
(After clear felling overwood)
(II) EP 75/1937 SOUTH COIMBATORE
(under ever green top canopy shade)
vide para 26

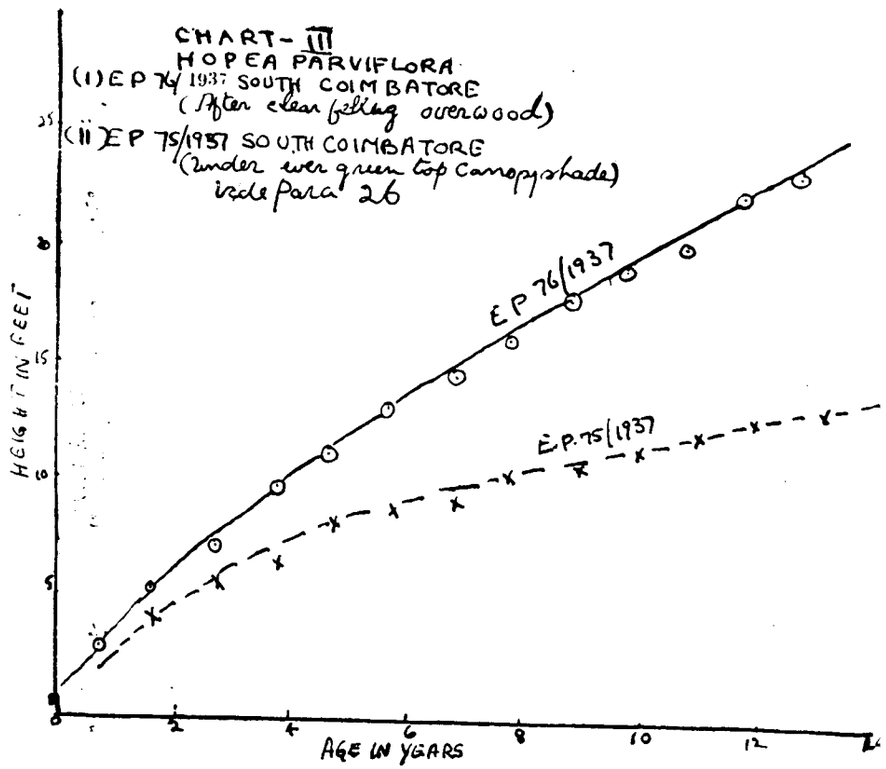


CHART IV
HOPEA PARVIFLORA
E.P. 72/1938 clear felling evergreen forest
EP. 73/1938 Fellup middle storey only
EP. 74/38 Control. No work done

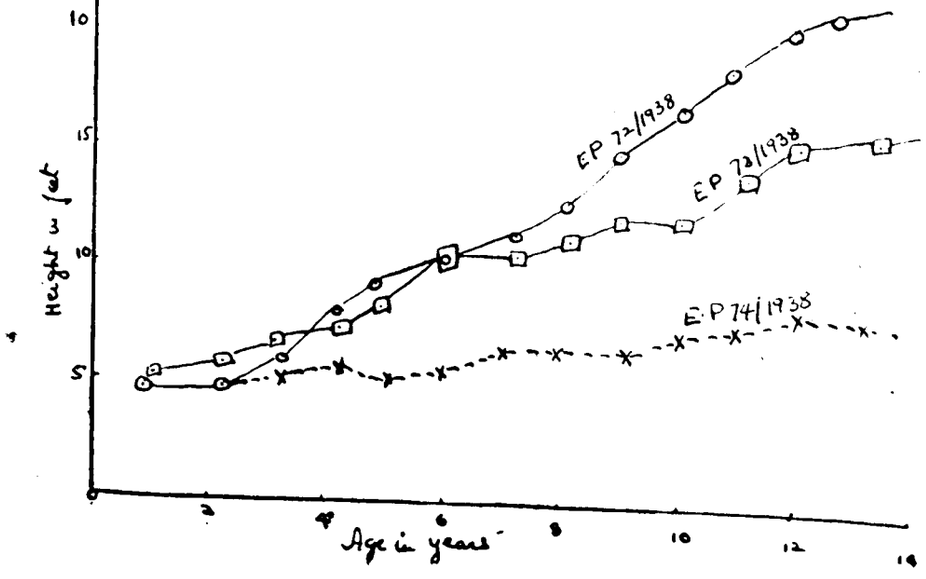


CHART-V

EP. 147/35 · PALGHAT

MESUA FERREA

(Para 80)

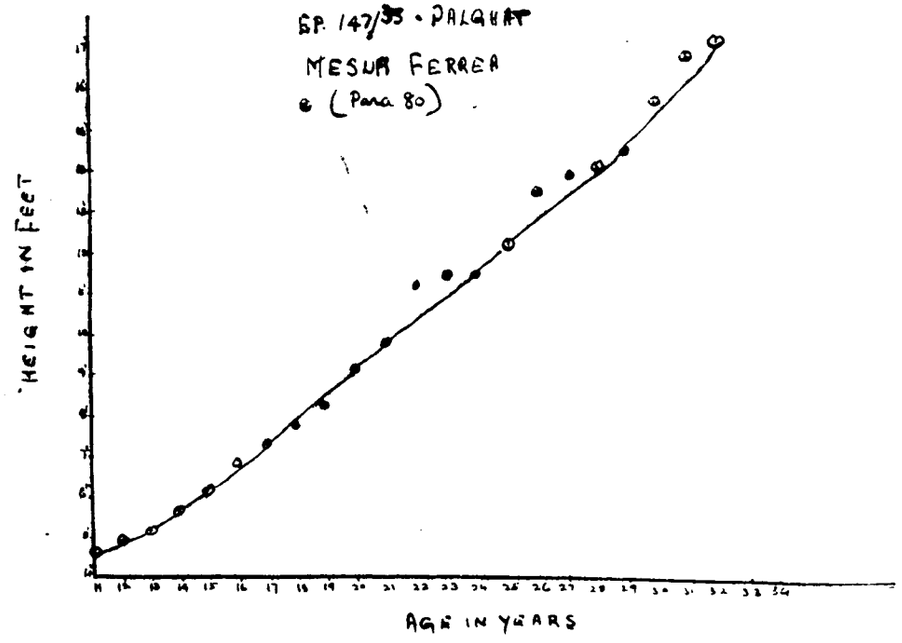


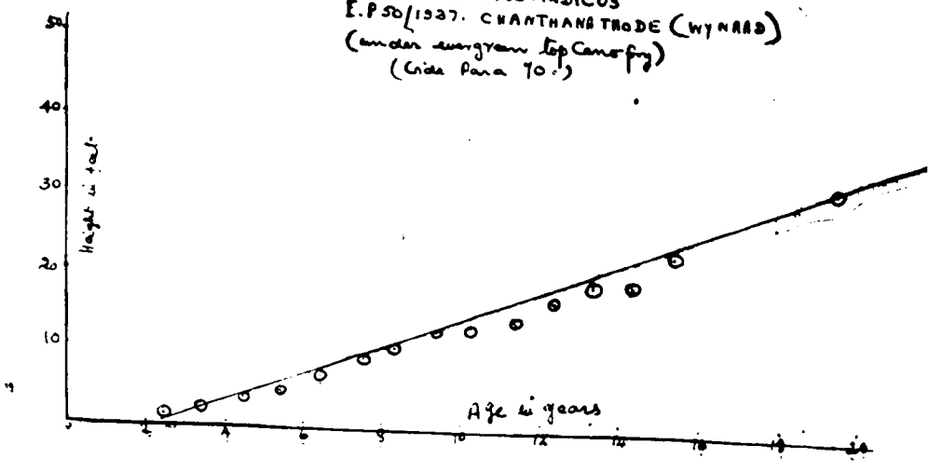
CHART VII A

DIPTEROCARPUS-INDICUS

E.P 50/1937. CHANTHANATHODE (WYNAAD)

(under evergreen top canopy)

(Vide Para 70.)



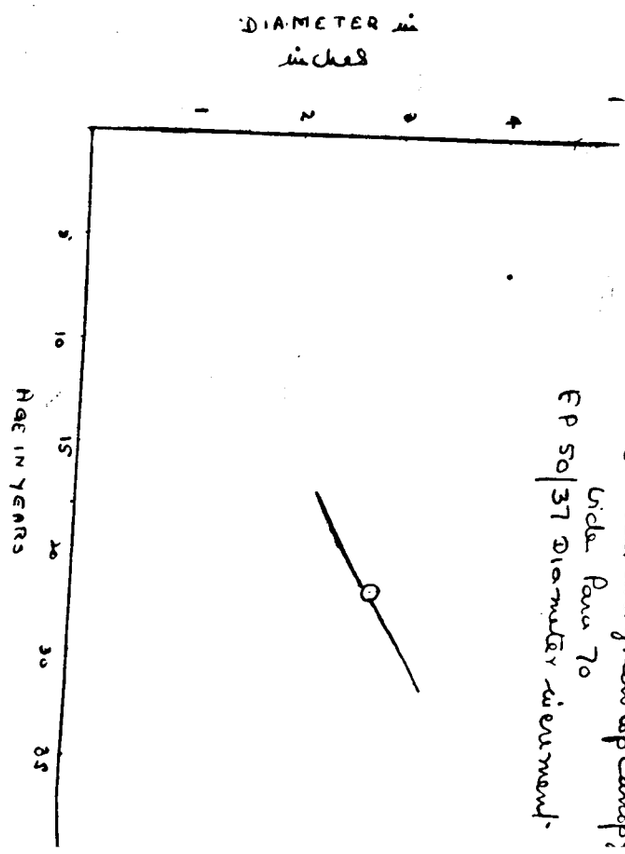


CHART- VI B.
DIPTEROCARPUS INDICUS
EP 50/37. CHANTHANATHODE.
(under evergreen top canopy)
vide Para 70
EP 50/37 Diameter increment.

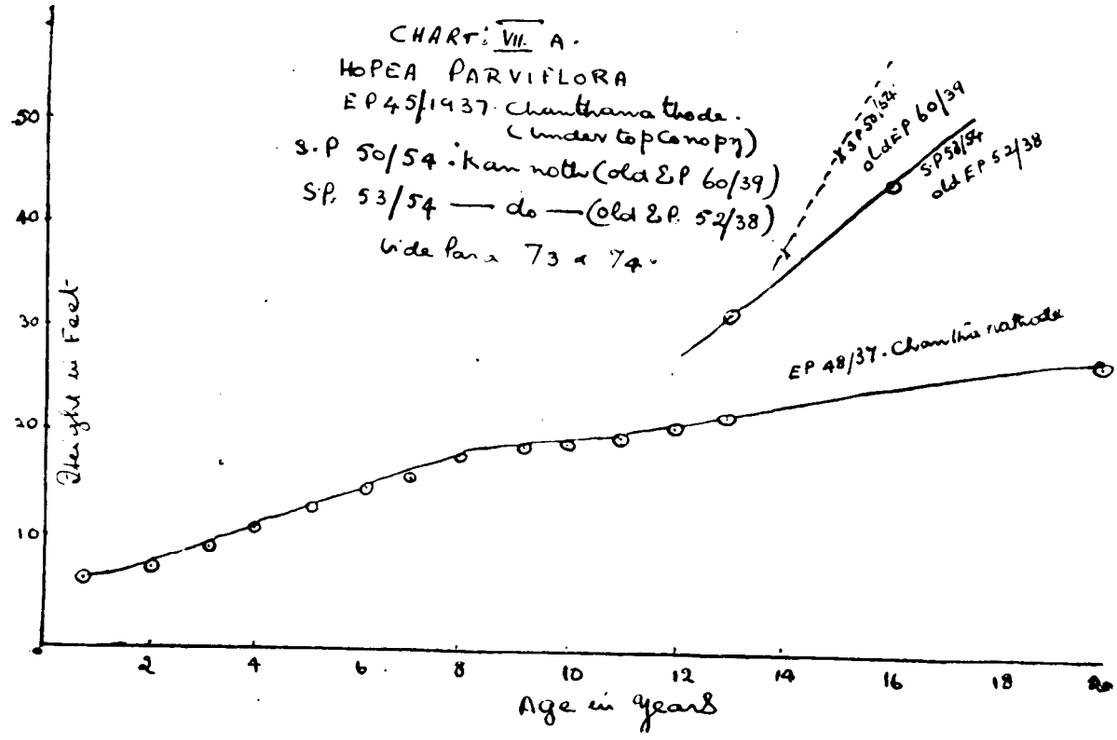


CHART VII B
HOPEA PARVIFLORA
E.P 45/1927 - Chanthaburi to Trodes. (under top para p 73)
Diameter increment
Para 73

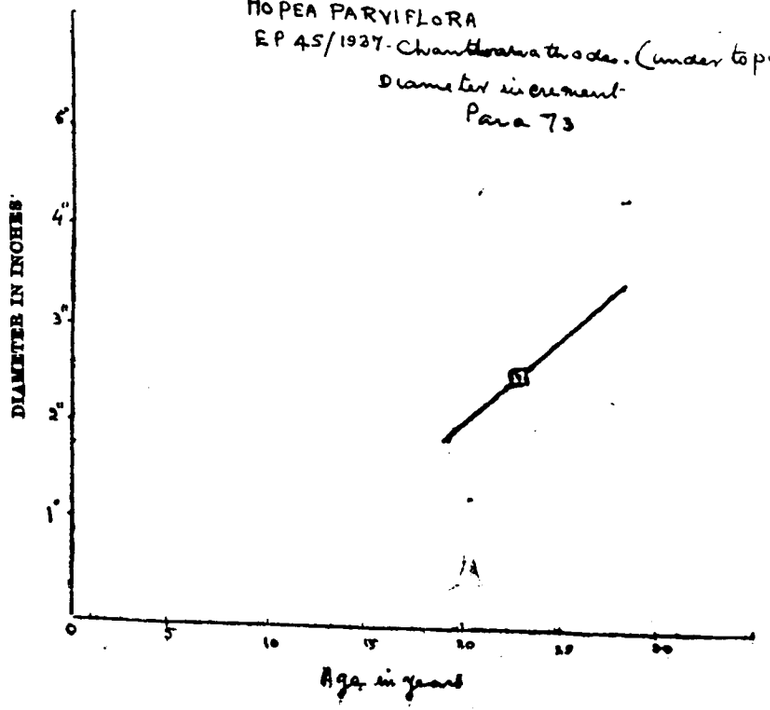
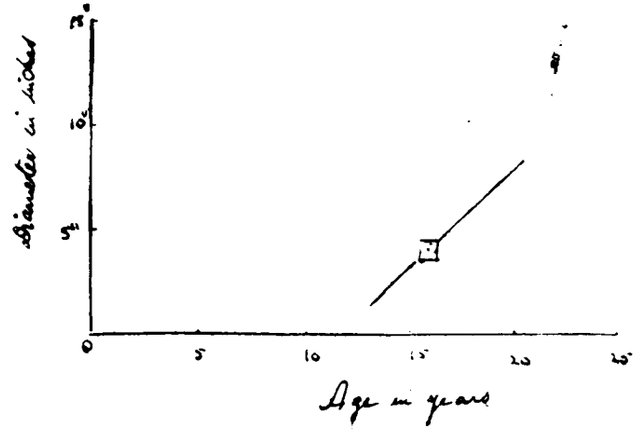


CHART VII C.
Hopea Parviflora.
S.P. 50/54 · Kanniath Cold E.P. 6c/37.
Vide para 74.
Diameter increment



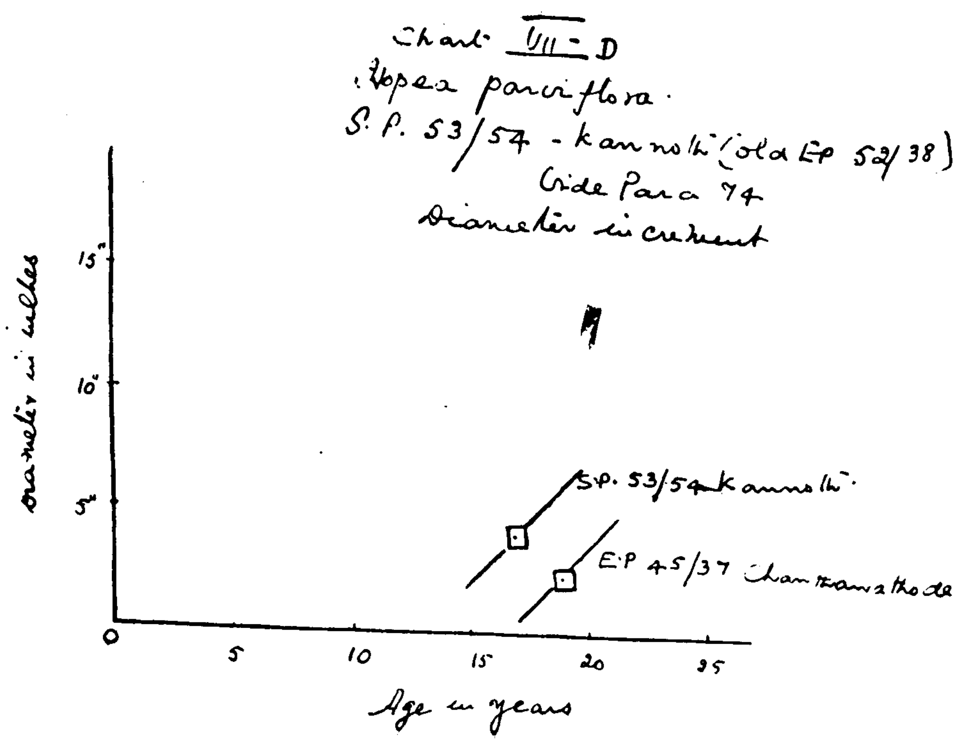


Chart VII - D
Hopea parviflora.
S.P. 53/54 - kannoth (old EP 52/38)
Vide Para 74
Diameter increment
Diameter in inches
15"
10"
5"
0
5
10
15
20
25
Age in years
S.P. 53/54 kannoth
E.P 45/37 Chandanathode

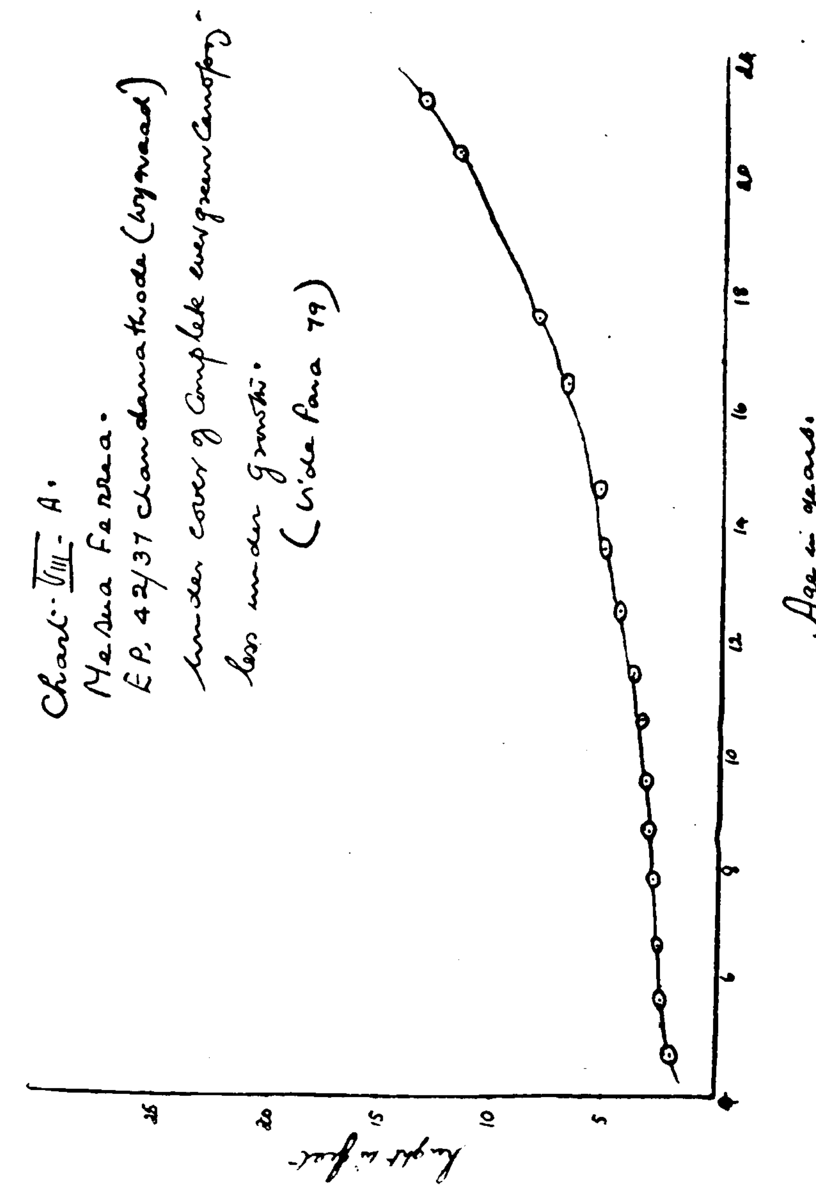


Chart. VIII - A.
Mesua Ferrea.
E.P. 42/37 Chandanathode (Wynaad)
under cover of complete evergreen canopy
less under growth.
(Vide Para 79)
Age in years
Height in feet

Chart VIII - B
Madua Ferrea
E.P. 42/37 Chandanathode (Wynaad)
under cover of complete evergreen canopy
less under growth
Vide Para 79
Diameter in Current.

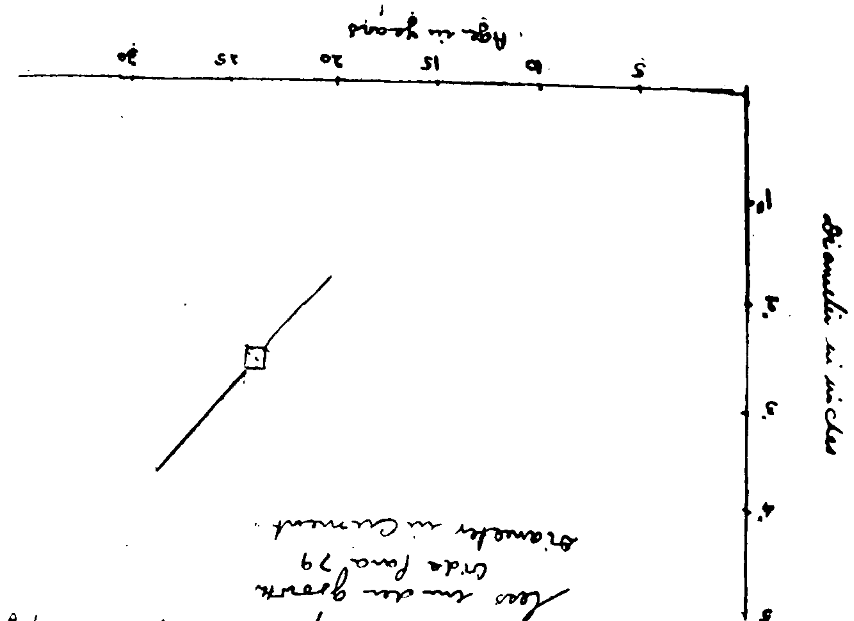


Chart IX-A
Euodia Roxburghiana
(artificially raised)
E.P. 90/43. Kanzuthi
(Vide Para 94)

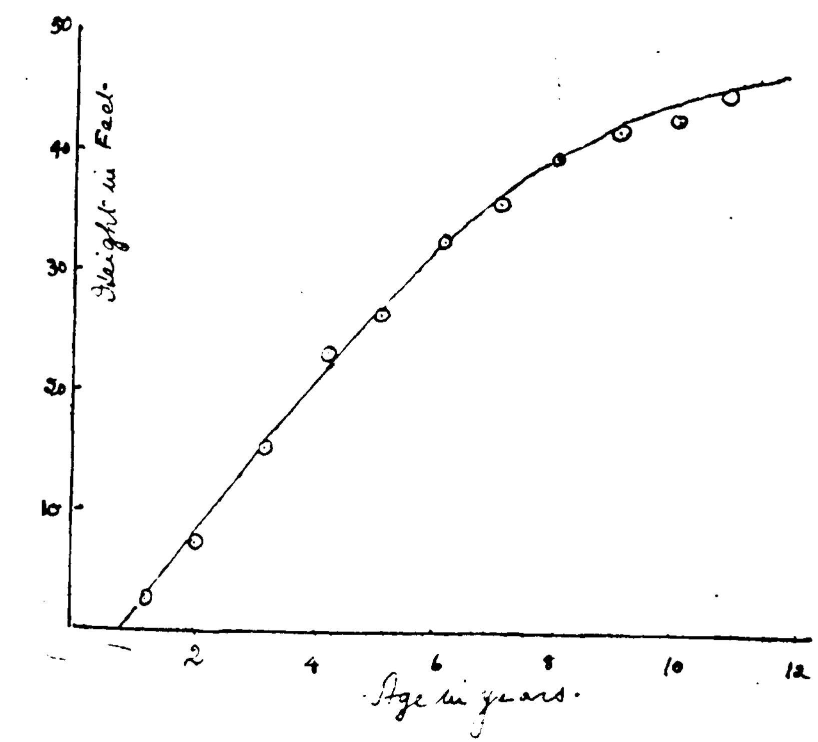


Chart - IX - B
Evodia Roxburghiana
(Artificially raised).
EP 90/43 Kaimoshi
(vide Para 94)
Diameter measurement)

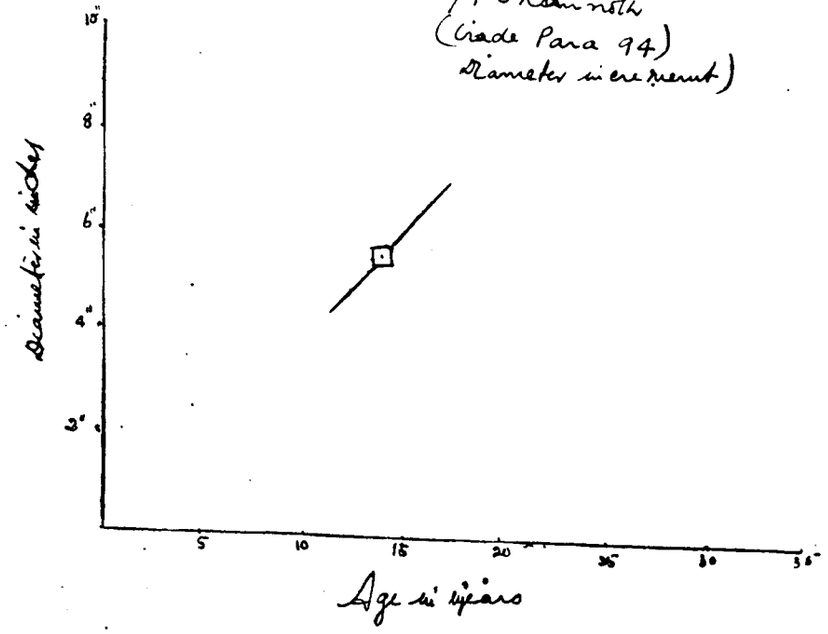


Chart - X - A
Melia dubia.
(raised artificially)
EG 343/49 Wynaad - Reprv.
vide Para 98.

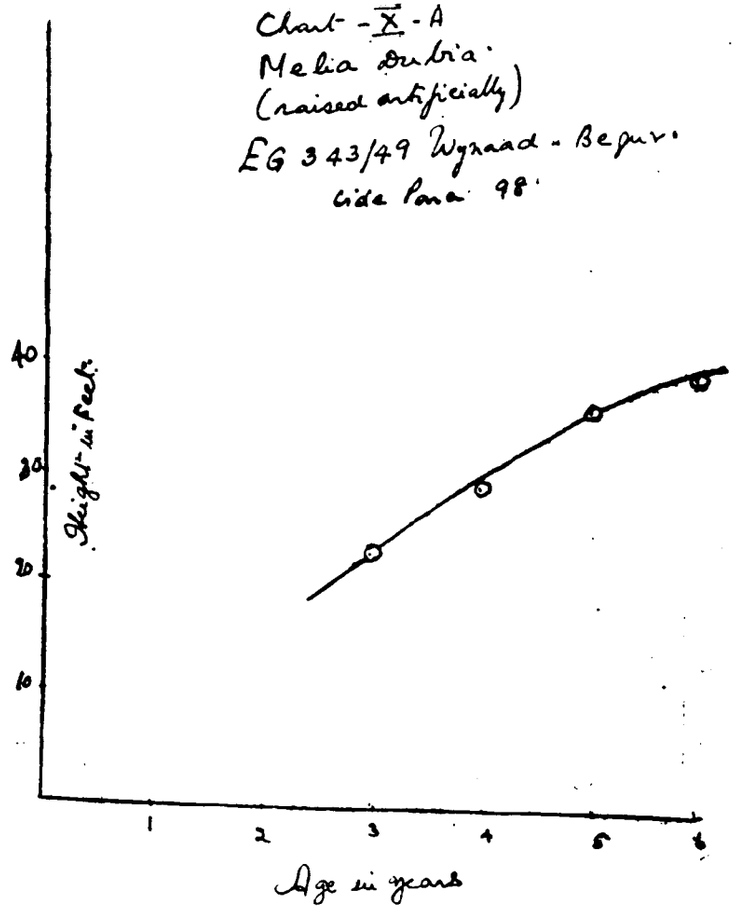


Chart - X - a

Melia dubia
(raised artificially)
EG 343/49. Wynaad - Begur
(Code Para 98)

Diameter increment

Scale 1" = 2" Diameter.

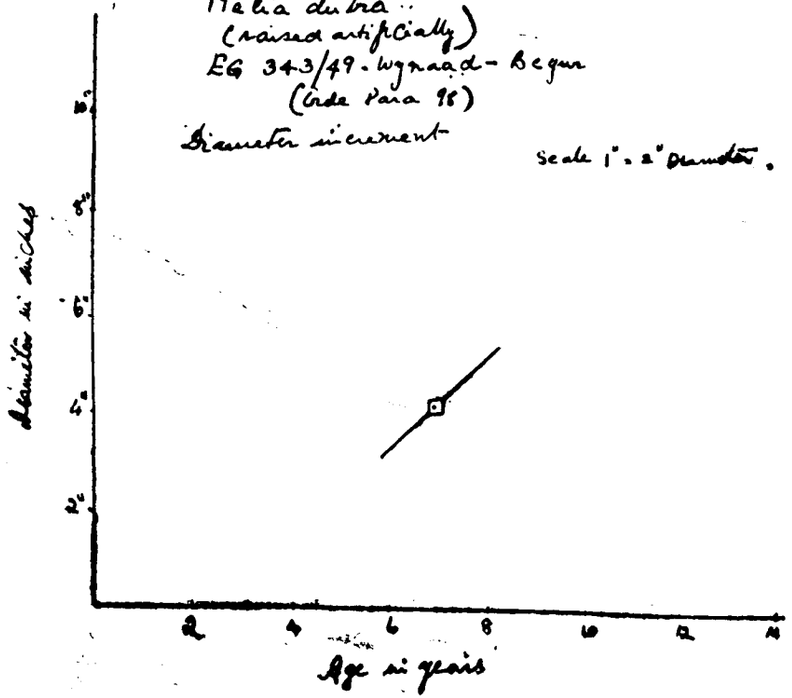


Chart - XI.

SPONDIAS MANGIFERA
(raised artificially)
Eg. 229/49. Kannoth - (Wynaad)
Code Para 99

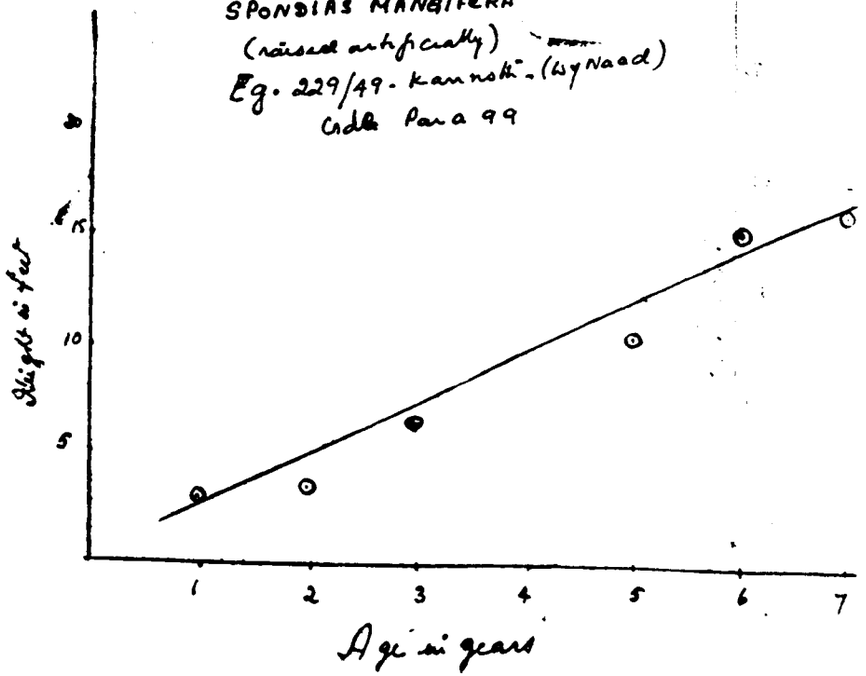


Chart XII
Steraulica Alata
(Raised artificially)
Vide Para 100 & 102

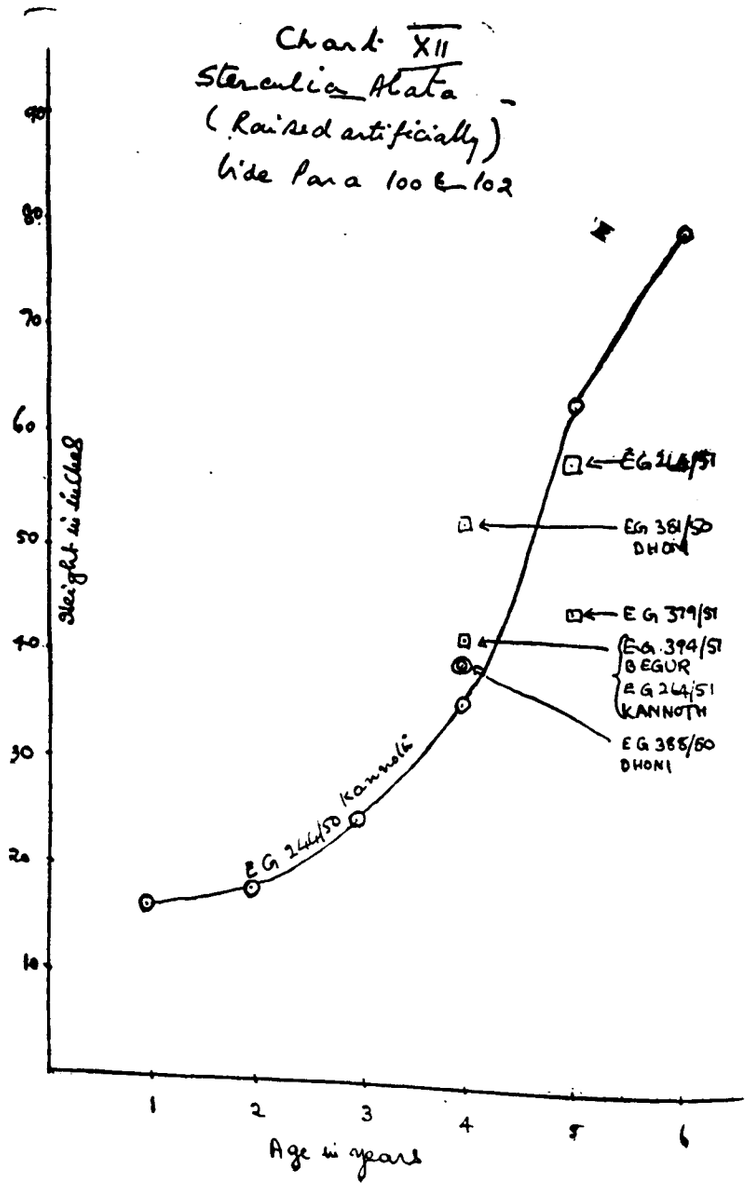


Chart XIII - A
Sterculia Campanulata
EG 125/42 - Kalwatti
EG 219/42 - Begur
Vide Para 103

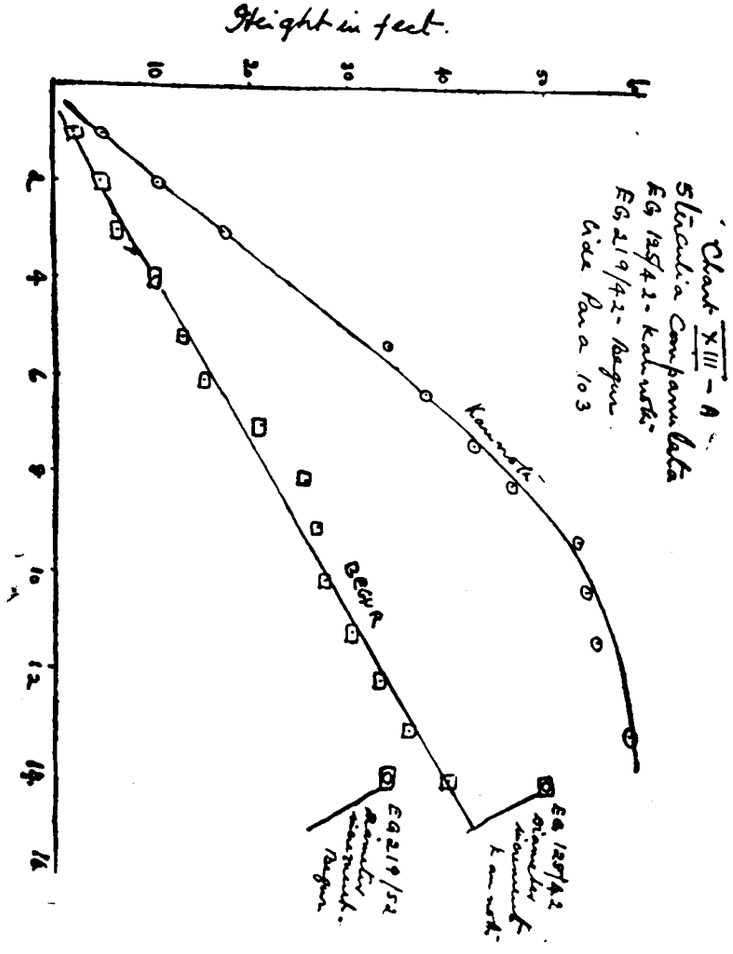


CHART XIII-B

STERCULIA COMPRESSITA
E.G. 135/42 KAMMOTEN
E.G. 219/42 BEGUR "
Vide para 103 -
Diameter increment.

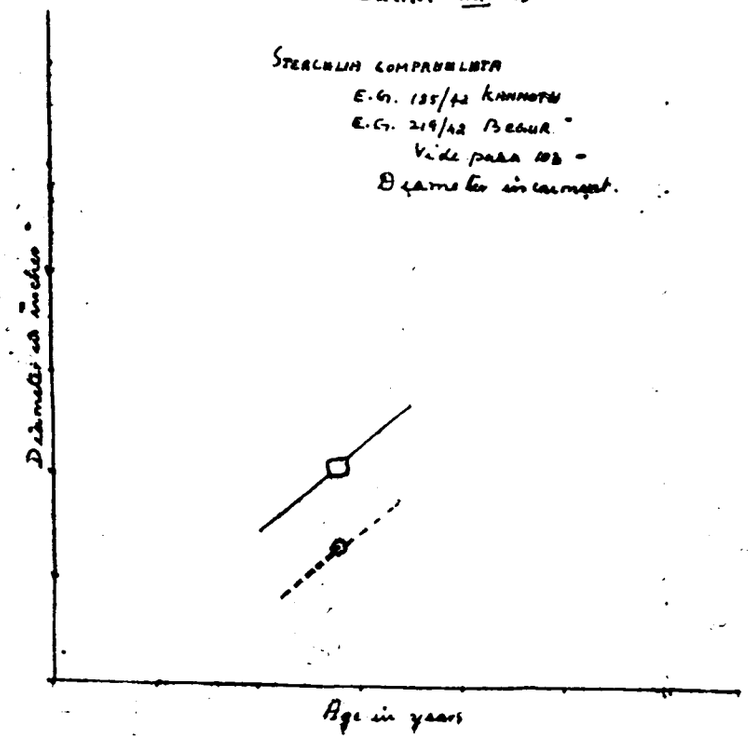


CHART XIV

STERCULIA COMPRESSITA
Vide para 104.

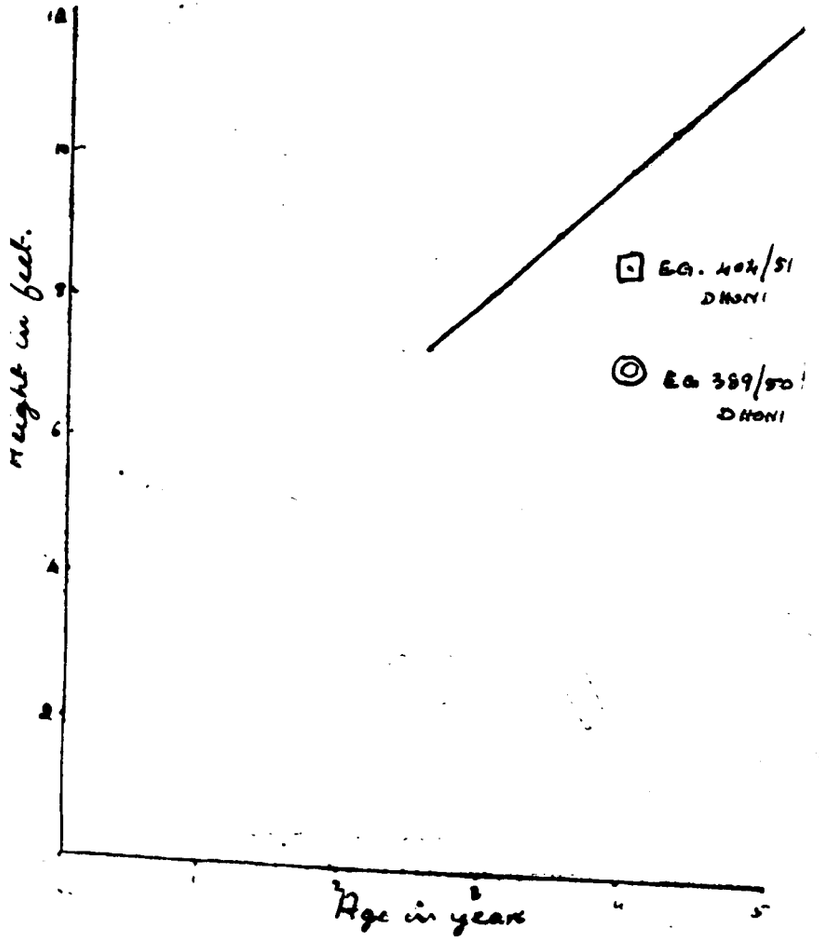


Chart XV
ZANTHOXYLUM RHETSA
Vide Para 107

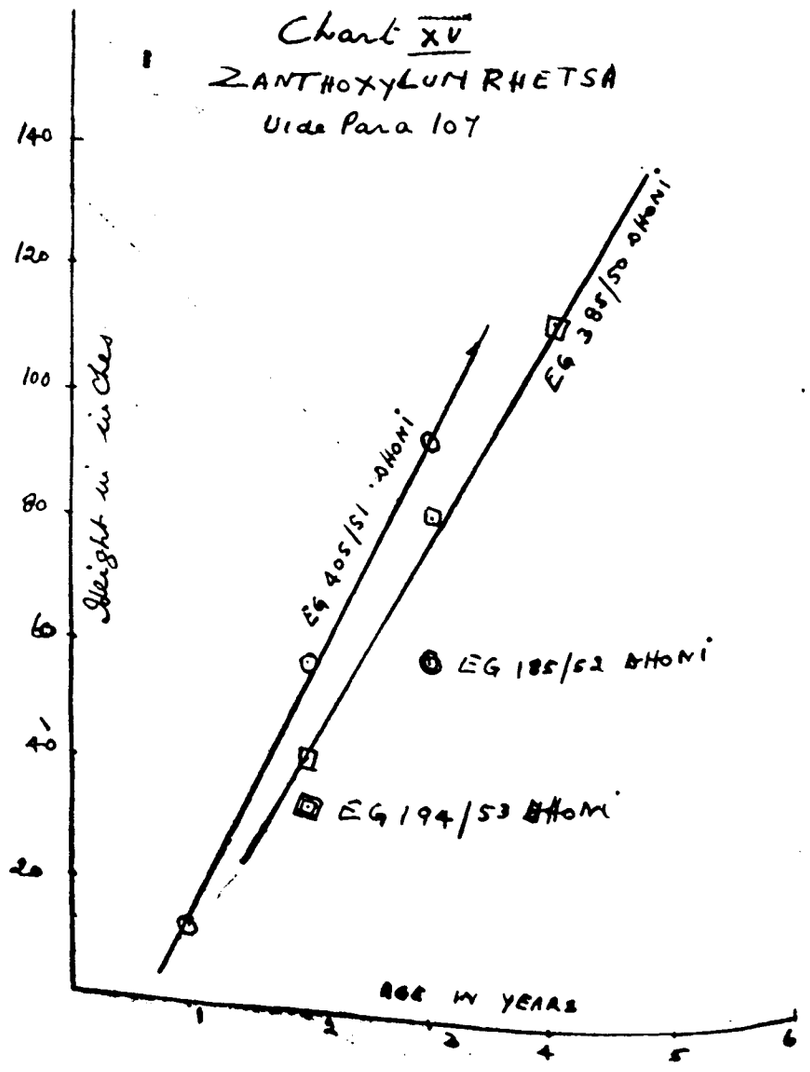


CHART XVI A
DALBERGIA SISSOO
VIDE PARA 136
Ref: ⊙ EG 410/52 DHONI
⊡ · 181/52 "
◎ · 198/53 "
⊡ · 460/53 TOPSLIP
Vide Para 136

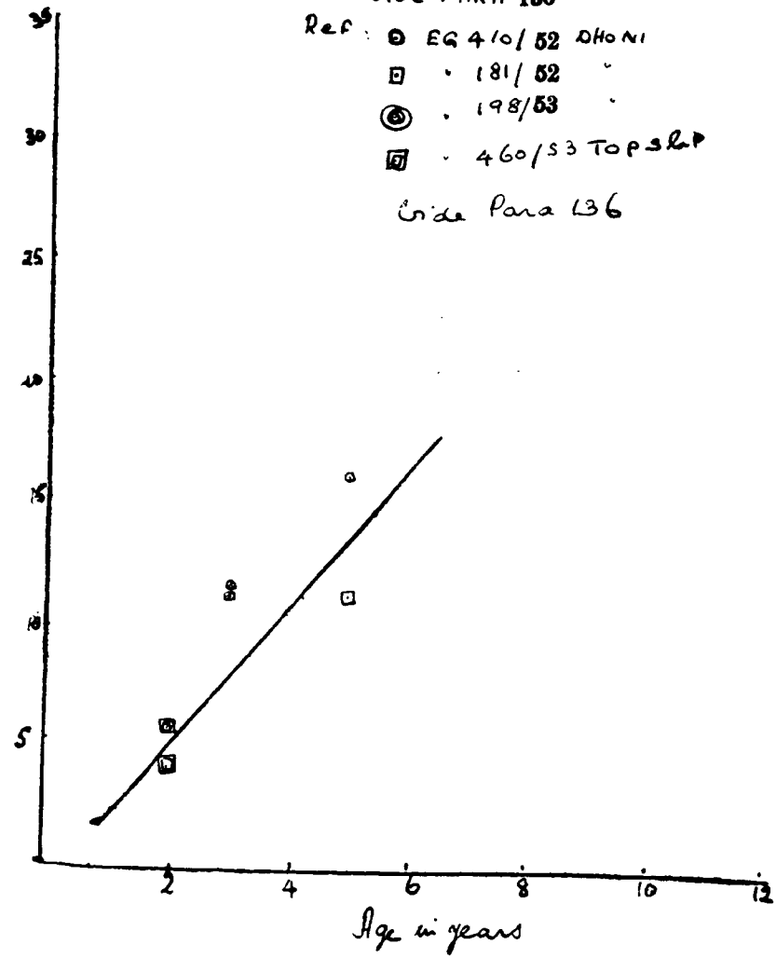


CHART XVI - B

DALBERGIA SISSO

E.G. 61/47 - A & B } Dunkamichalli.
E.G. 62/46 - A & B
para 137

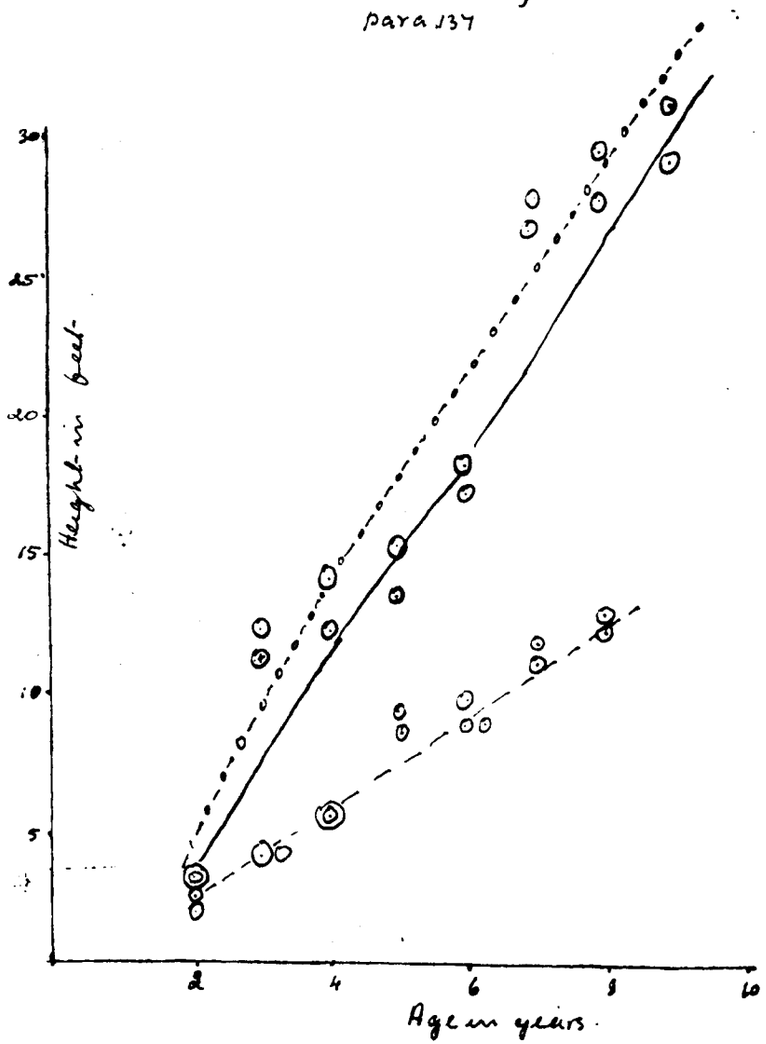


CHART XVII — A
OCHROMA LAGOPUS
E.P. 165/44 - Nilambur
(vide para 150)

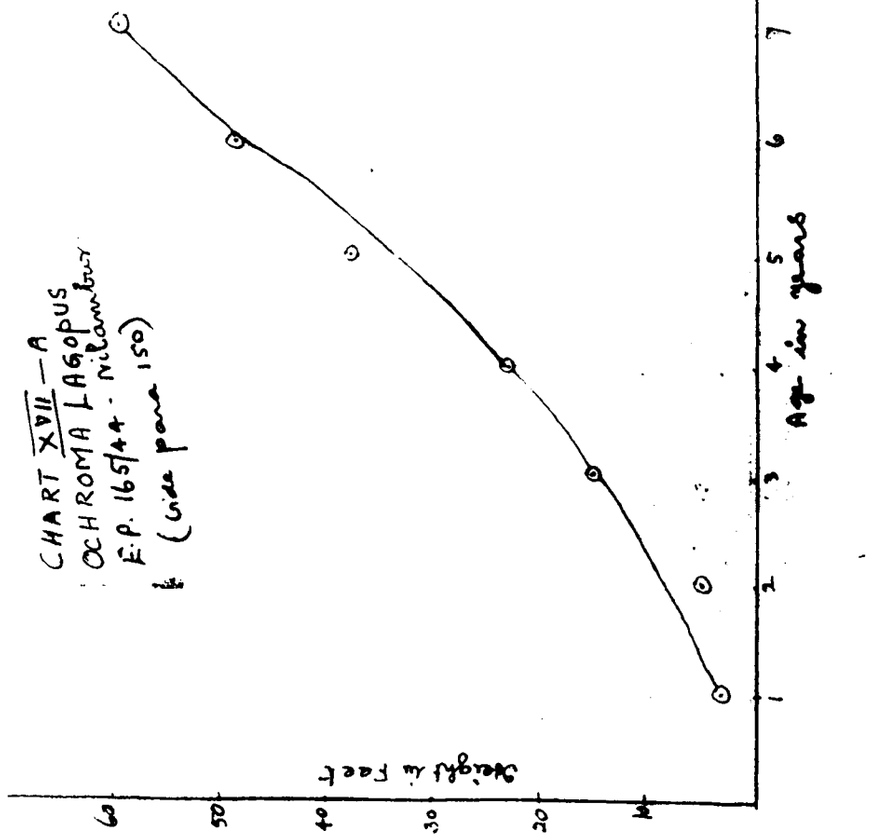


CHART XVII-A

E.P. 165/49 NILAMBUR
E.G. 253/50 KANNOTH
E.G. 348/49 BEGUR
E.G. 384/49 Topslip

TABLE OF REFERENCE

- ○ - NILAMBUR
- □ - BEGUR
- × KANNOTH
- • Topslip

[Note - The curves show rapid height growth in regions of higher rain fall]

OCHROMA LAGOPUS
PARA-158

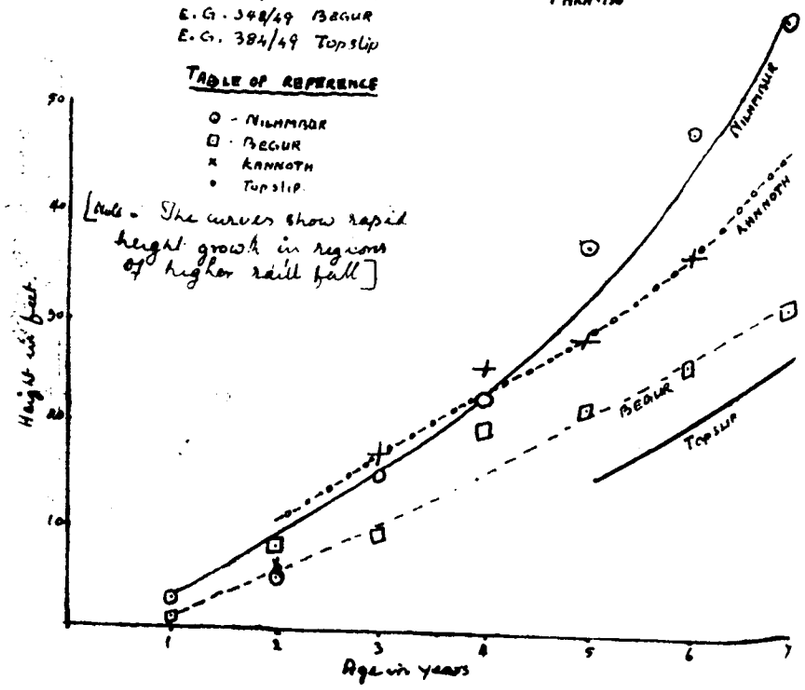


Chart - XVIII - A.
PTEROCARPUS DALBERGIOIDES
S.P. 51 of Kannoth.
(Old E.P. 64/1939.)
Vide Para 154

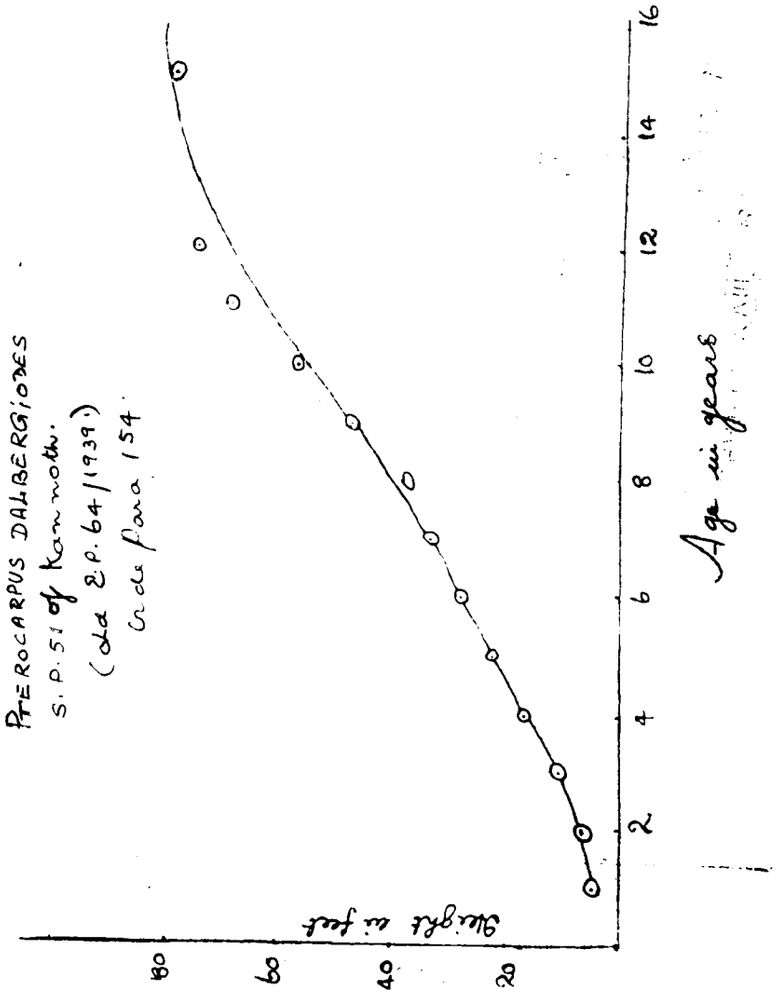


CHART- XVIII - B.
Pterocarpus Dalbergioides.
S.P. 51. Kanmoth.
(old E.P. 64/39.)
vide Para 154.
Diameter increment

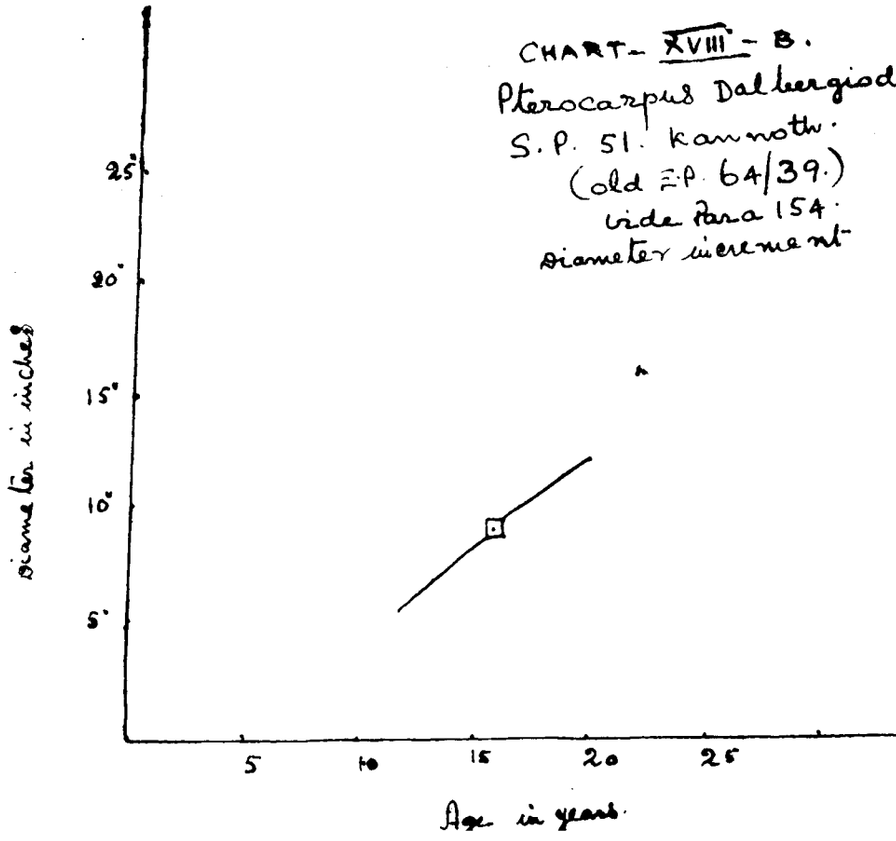


Chart XIX - A
Hopea parviflora - Height increment
E.P 138/36 - Nilambur
(Hopea dubbed in 1929 in fair to
bad plantations)
vide para - 187

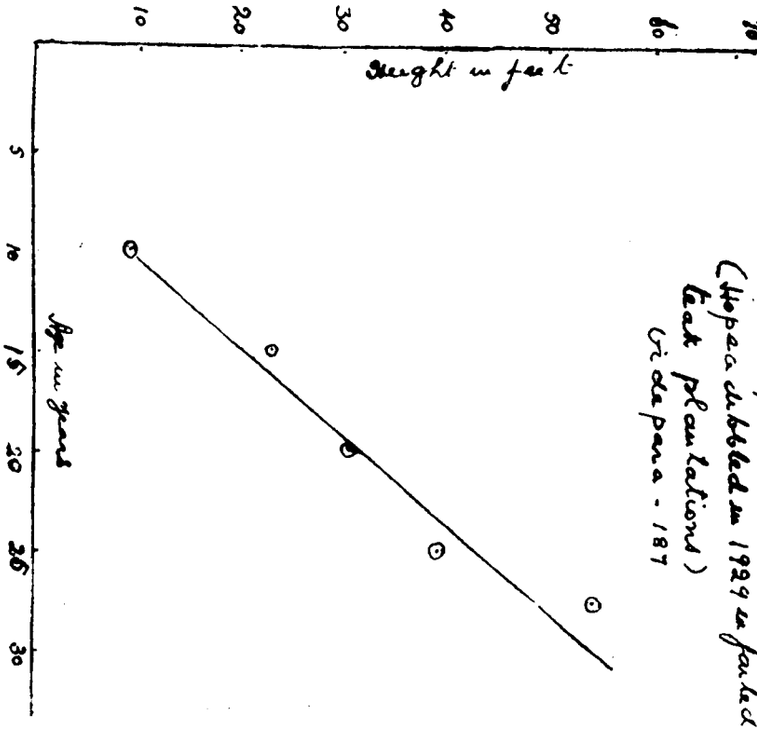


Chart - XIX - B

Hopea Parviflora. diameter & increment

E P 138/36. Nilambur.

Hopea dibbled in failed Teak Plantations

Vide para 184

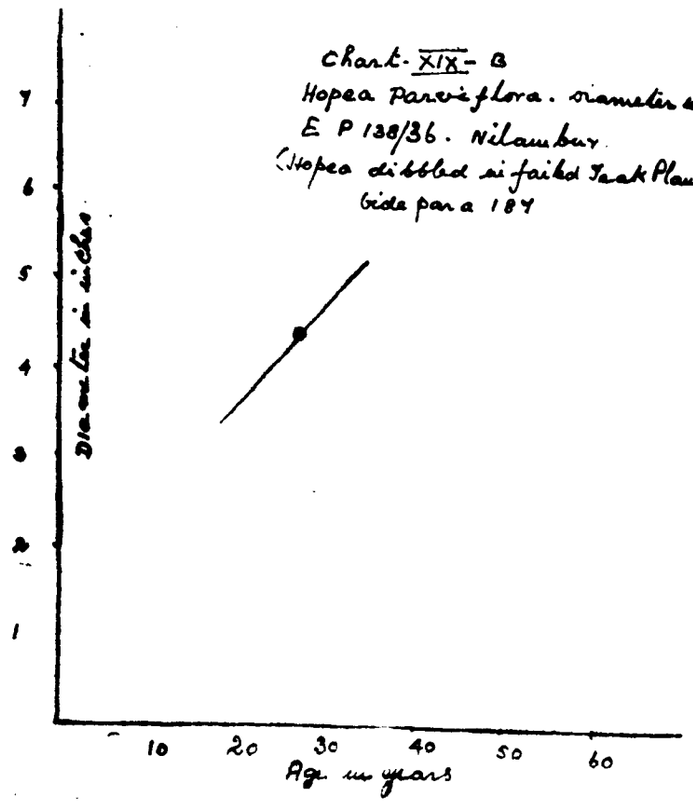


Chart - XX

Eucalyptus Camaldulensis

Syn: — Rostrata

Vide Para 146 B

⊙ DHONI - EG 495/54

⊡ Topslip - EG 507/55

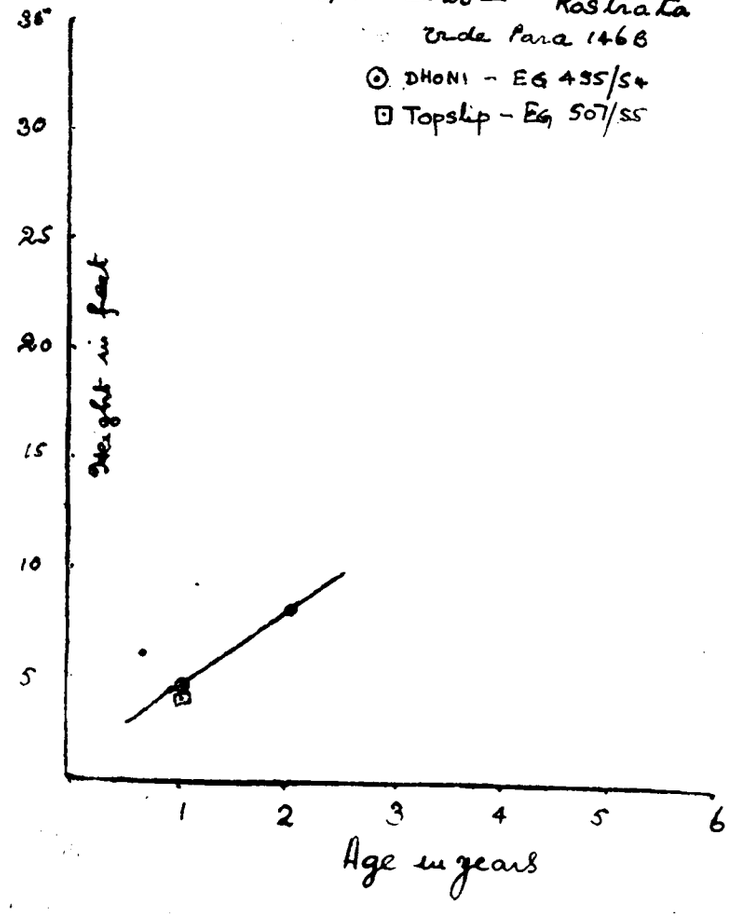


Chart - XIX - B
Hopea Parviflora. Diameter & weight
E P 138/36. Nilambur
Hopea dibbled in failed Teak Plantations
Vide para 184

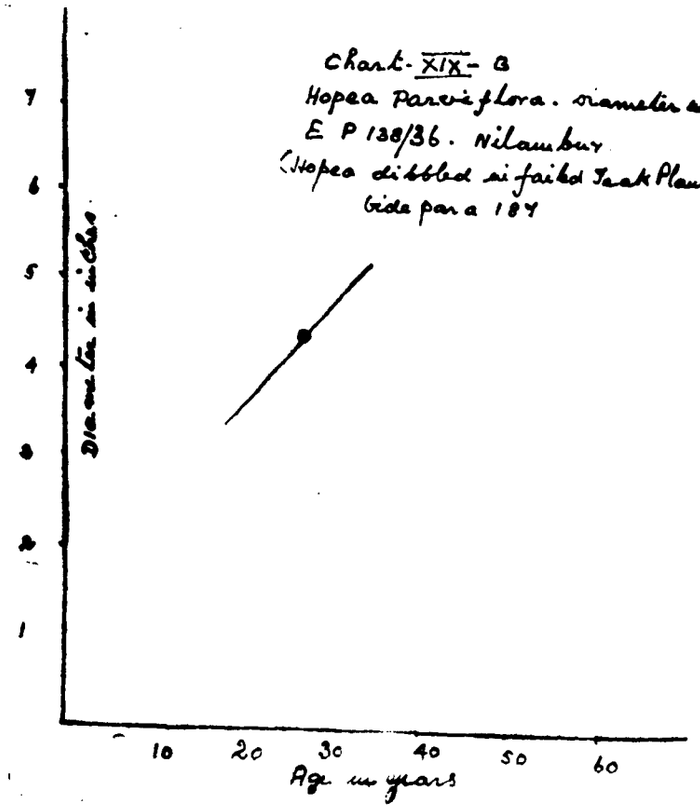


Chart - XX
Eucalyptus Camaldulensis
Syn: — Rostrata
Vide Para 146B
⊙ DHONI - EG 455/54
⊡ Topslip - EG 507/55

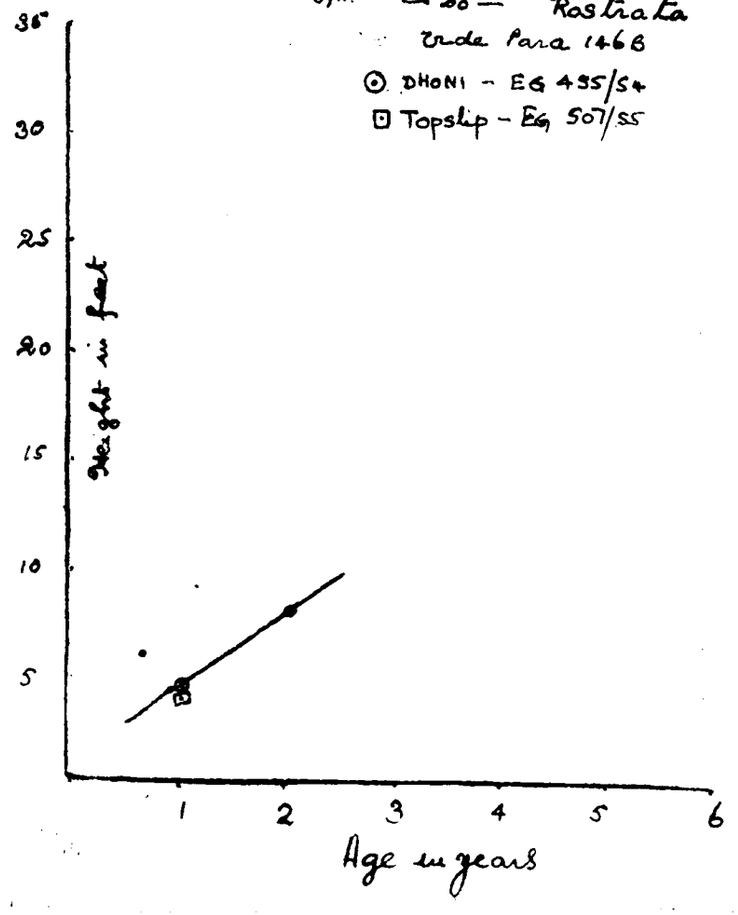


Chart XXI

Delanthus Malabaricus
Vide Para 82, 241 & 87.
⊙ EG Ohoni
⊡ · Bagu
X · Topslip

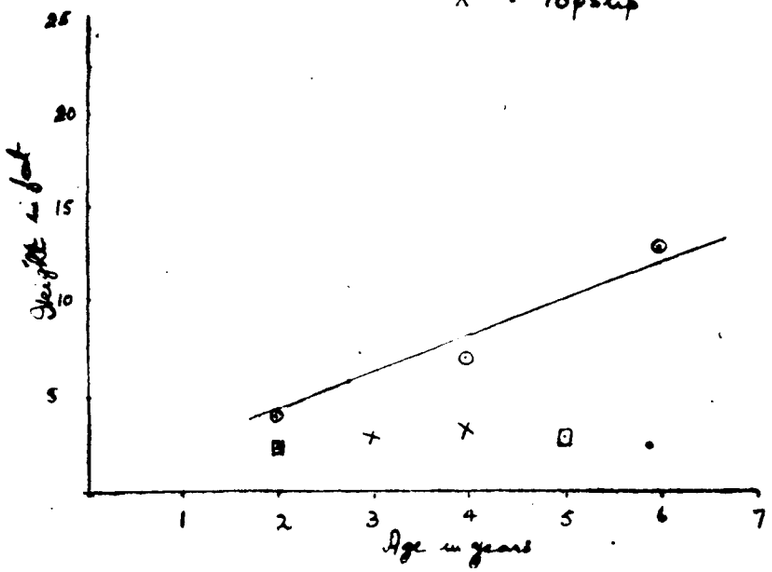


Chart XXII

Gymnura arbuscula (Weight increment)
Vide Para 97
● EG 40/52 · Ohoni
■ EG 90/52 · Periyamkotta

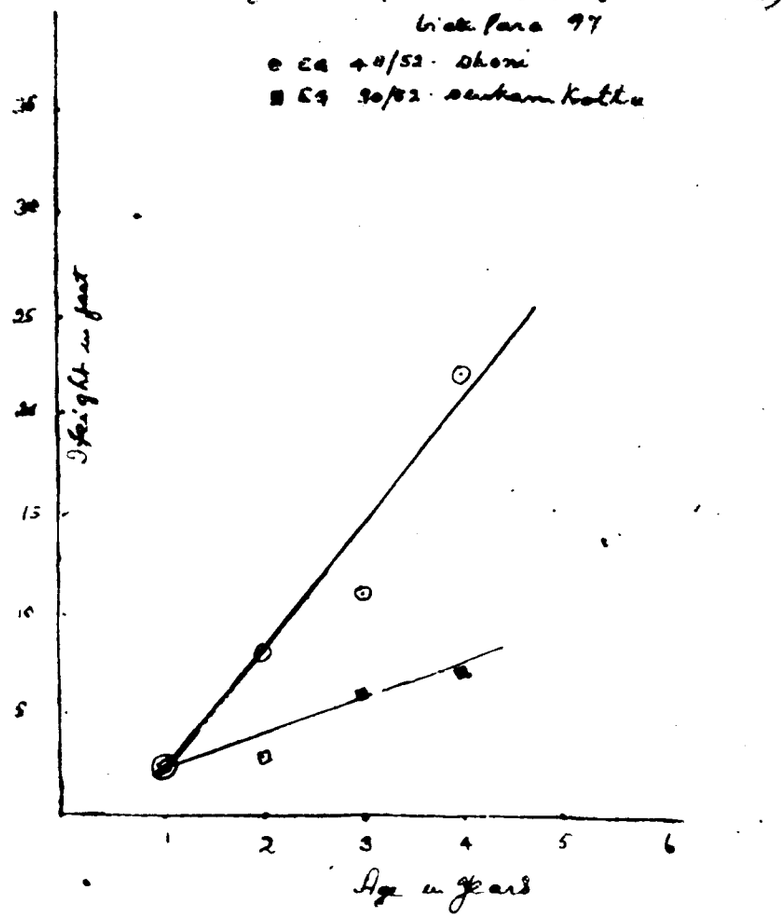


Chart... XXIII

Eucalyptus citriodora

vide Para - 140

⊙ EG 456/54 - Ooni

⊡ EG 491/54 - Topslip

⊙A, ⊡B } EG 113/53 - Devikanikotà

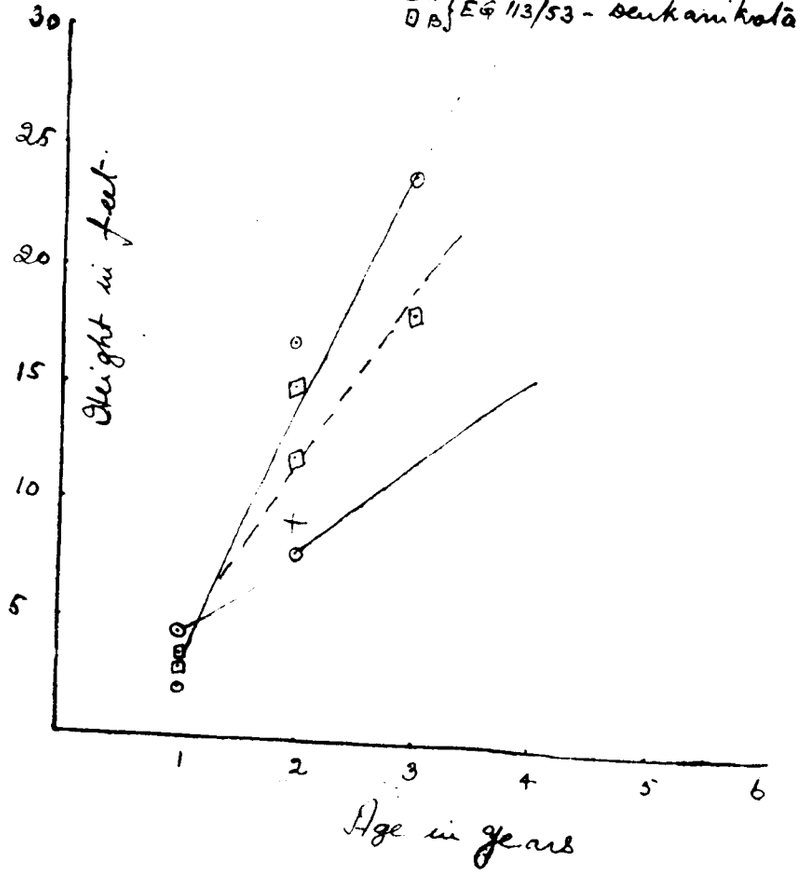


Chart XXIV

Cinnamomum ZEYLANICUM

⊙ EP 75/40 —— Kannoth - Sandy Variety.

⊡ EP 76/40 —— Kannoth - Laterite Variety

X EP 237/50 — Kannoth Sandy Variety

● EP 238/50 Kannoth Laterite Variety

Para 128

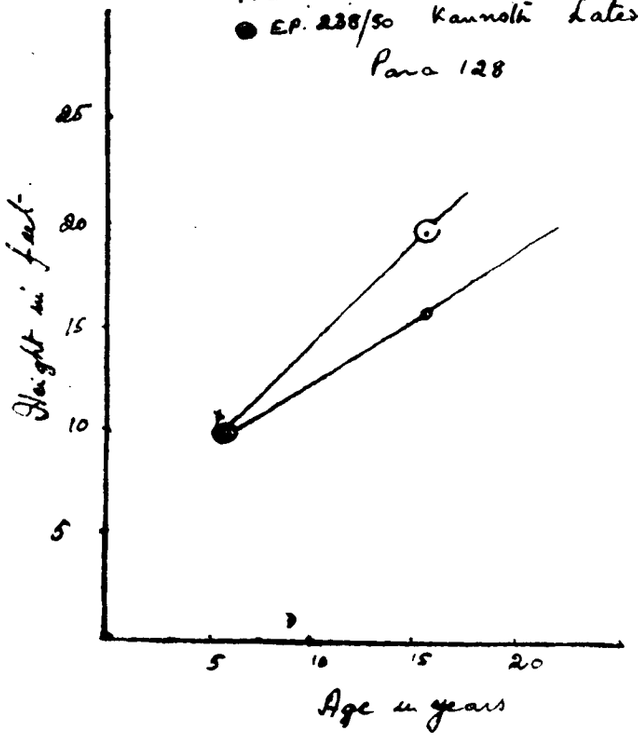


CHART XXV
Eucalyptus Rudis
Vide Para 146B
Ref. EG 507/56 Topslip

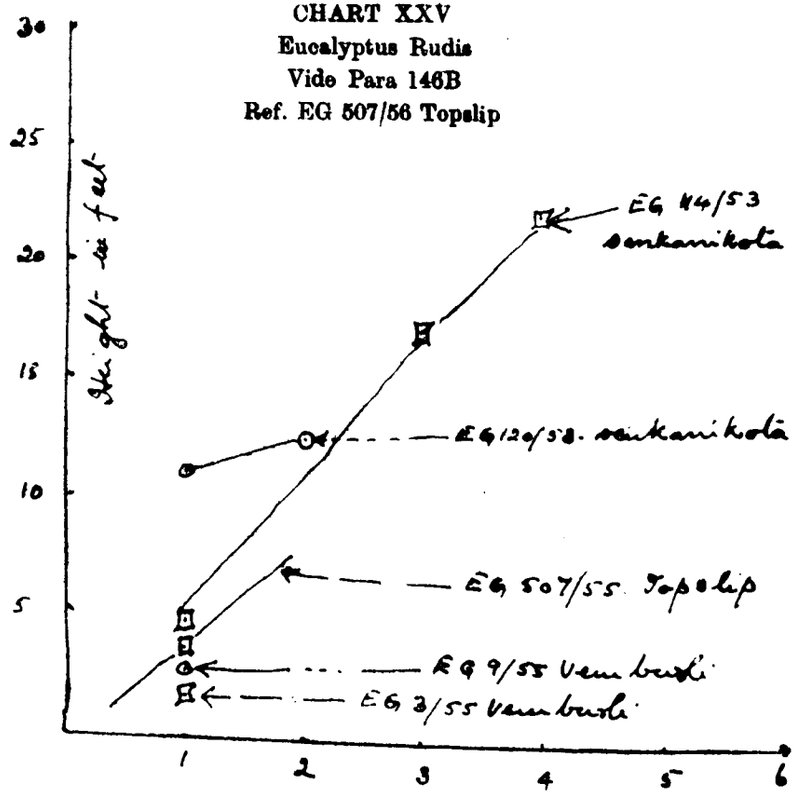
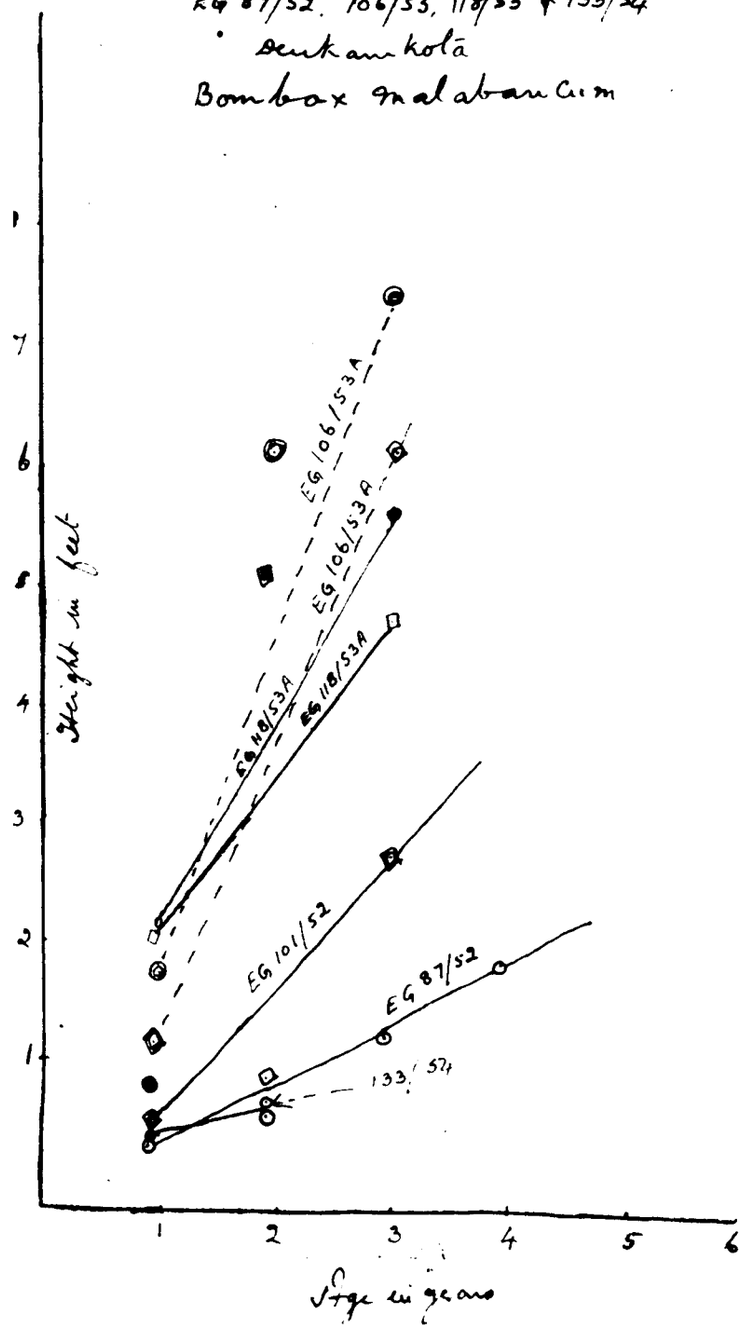
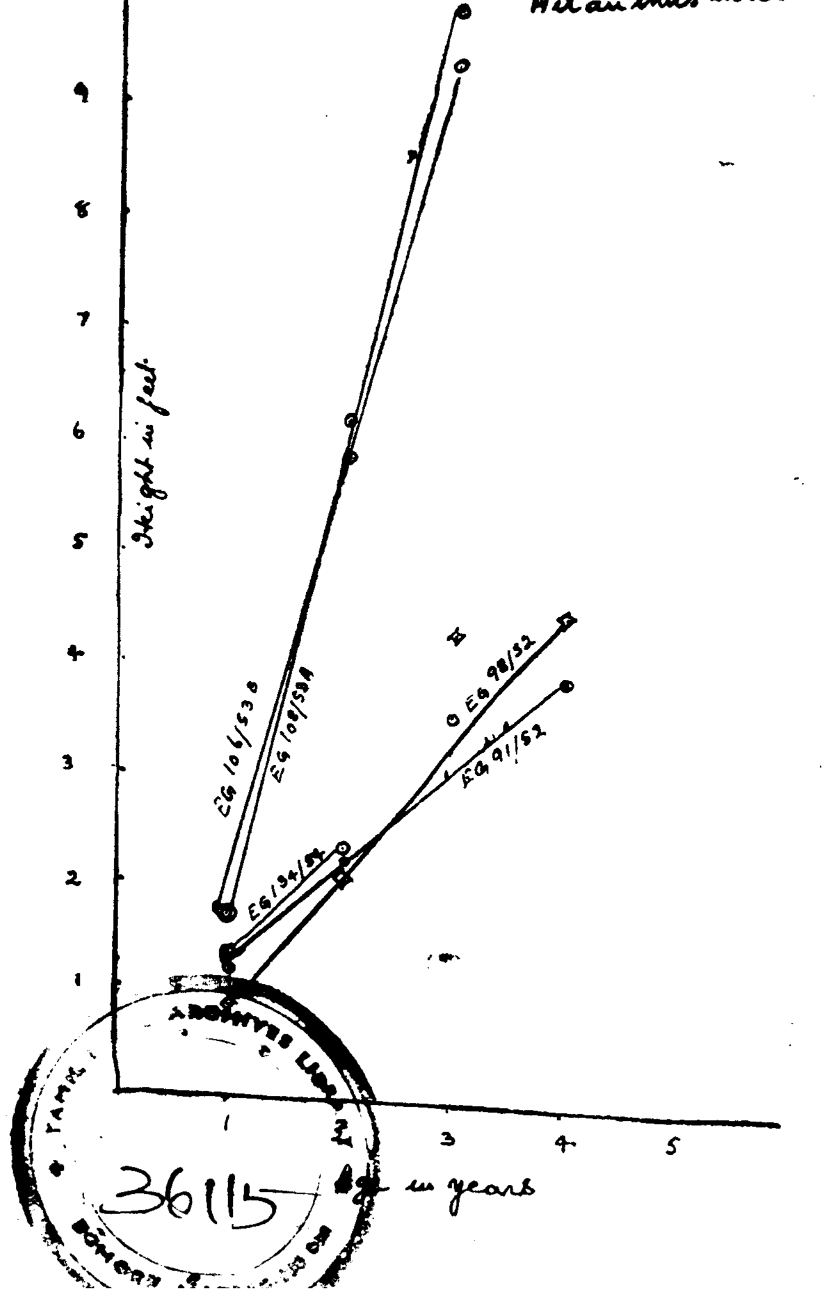


Chart XXVI
EG 87/52. 106/53, 118/53 & 133/54
Senkanikola
Bombax malabaricum



Rj
JB. 211, f3 r N58
r1/50;1

Chart XXVII
EG 91/52, 98/52, 108/53 134/54
Denkam kota
Ailanthus excelsa.



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