Abridged annual Report on Silviculture Research in Madras State 1957-58

ABRIDGED ANNUAL REPORT ON SILVICULTURAL RESEARCH IN THE MADRAS STATE

FOR THE YEAR 1957-58.

Prepared by

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PART I.

GENERAL.

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

2. *Research Gardens and Stations.*—The statement of Research Centres at the commencement and close of the year is furnished. During the year, a new Research Sub-centre at Masinagudi in the Gudalur Forest Division was opened. The Headquarters of the Research Ranger, Denkanikotta, were shifted to Madurai from Denkanikotta and he was placed in direct charge of the Research Centres at Rameshwaram, Vemburuli and Thanjavur.

3. *Climate and rainfall.*—The climate factors of all research centres are furnished in the form of charts and tables.

4. *Records.*—Statements showing the number of open experimental gardens, and experimental plot files at the commencement and at the close of the year are furnished. There were 650 open experimental plots and experimental garden files at the close of the year, against 503 such files at the commencement of the year.

5. *Sample plots, Tree Incremental plots, Permanent Preservation plots.*—There were 31 sample plots at the close of the year against 32 sample plots at the beginning of the year. The difference is due to conversion of one teak sample plot into a permanent preservation plot. Ten tree incremental plots were also maintained.

6. *Library.*—Twenty-six books were added, bringing the total number of volumes to 1,357.

7. *Documentation.*—Reference is made to additions made to the specific and general ledger files. There were at the end of the year 897 specific ledger files and 573 general ledger files.

8. *Photographic collection.*—Eighteen specific photographs and four general photographs were added bringing the total to 1,013 specific photographs and 863 general photographs.

9. *Staff and Administration.*—Shri P. Venkataramany, M.A., I.F.S., continued as State Silviculturist throughout the year. At the end of the year there were one Research Range Officer and nine Research Foresters in the Silviculturists' Division.

10. *Technical advice, contributions and publications.*—Details of technical publications prepared during the year are given.

11. *Acknowledgments.*—Valuable advice, help and suggestions received, are duly acknowledged.

PART II.

EXPERIMENTAL SILVICULTURE.

(i) GENREAL.

12. Consequent on re-organization of States from November 1956, more emphasis was placed on problems of afforestation of fuel species and artificial regeneration of Cashew (*Anacardium Occidentale*). Several notable experiments started in recent years are referred to.

(ii) NATURAL REGENERATION INCLUDING COPPICE ROOT SUCKERS, ETC;

(a) *Natural regeneration by seed.*

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

14. *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.

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

16. *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.

17. *Hopea parviflora—Canopy manipulation to regulate development of established seedlings.*—Clearfelling over established natural regeneration of 3′ to 8′ in height benefits it appreciably.

(b) *Natural Regeneration by Coppice.*

18. The need for research on teak coppice crops for the production of electric transmission poles on a short coppice rotation is referred to.

19. *Teak coppice.*—Experimental plot 100/57 land in Coimbatore South Division is described. The 1928 teak plantation was coppiced at the age of 29 years to observe the growth and development of the teak coppice crop.

20. *Teak coppice shoots in irrigated plantations.*—There is no significant difference between thinning and no thinning of coppice shoots in an irrigated teak plantation.

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

21. *Suppliers of seeds, seedlings and stumps.*—During the year, 179 indents comprising 66 species, aggregating to 34,122 lb. 10¾ oz., 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 furnished in Appendix 'C'. 29,200 pounds of teak seeds and 53,335 teak stumps were supplied during the year. List of exotic seeds received for trials is furnished in Appendix 'D'.

22. *Germination tests and seed weighments.*—A tabular statement showing seed weight, germinative capacity, plant per cent, plants per pound and best method of raising all species 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'.

23. *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 standard 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) control—no treatment;

is furnished. Appendix 'F' gives this information.

24. *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.

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

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

(iv) Nursery Work.

27. *Nurseries.*—These were maintained in all Reserach Centres. A large number of exotic seeds, particularly of the genus Eucalyptus, were tried in Ootacamund Nursery. The Research Garden at Aramby, where a large number of exotic trees exist, is being developed as a seed multiplication plot for supply of seeds of exotic species.

(v) Artificial Regeneration.

28. Artificial regeneration will be described in the following paragraphs separate ly for (i) teak ; (ii) indigenous hard wood species ; (iii) soft woods ; (iv) exotics ; (v) bamboos and canes ; (vi) plants yielding minor forest produce including medicinal plants ; and (vii) fodder grasses.

(a) *Experiments on teak.*

29. *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.

30. *Teak plantations.—Imperata cylindrica grass—Eradication or control.*—Experiments on the introduction of *Glyricidia maculata* in teak plantations in Gudalur Division to control the thick growth of *Imperata cylindrica* grass are described. Further observations are being made.

31. *Teak planting in Rameshwaram.*—Experiments during 1955, 56 and 1957 are described. The indication that teak can be raised successfully in Rameshwaram with watering provided wind protection is also given.

32. *Teak—Introduction in Markanam Centre.*—Experiments started in 1955 and 1956 are furnished. The indications are that teak can be successfully established in a locality like Markanam provided watering is done to compensate for the inadequate rainfall. The rate of growth, however, is poor.

33. *Teak—Introduction in Thanjavur district.*—Experiments on the introduction of Teak in the Thanjavur district are described. Making allowance for damage caused by village cattle, it can be inferred that teak can be successfully established provided watering is done in the early stages till the plants send their tap roots to the sub-soil water-level.

34. *Artificial Regeneration of teak.*—As a large number of experiments have been transferred to Kerala State and as the results of these experiments are of great interest, a brief abstract of the results of these experiments is furnished as Appendix 'J'.

35. *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 A.I.Q. II, A.I.Q. III, while there may be a slight but not appreciable decrease in site quality in poor site qualities such as A.I.Q. IV. Taken on the whole, there is no need for any fear that the quality of pure teak plantations in the Second Rotation will fall off.

(b) *Indigenous Hardwood Species.*

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

(c) *Indigenous Softwood Species.*

37. *Ailanthus excelsa.*—The species can attain a mean height of 18' and mean diameter of 5" in three years. A lepidopterous defoliator *Eligna narcissus* is found in plantations and nurseries. An experiment on the spraying of Hexidol solution on the crown and trunk of the plants, did not give any definite results.

38. *Ailanthus Malabarica.*—The species can attain a mean height of 31½' in five years. As in the case of *Ailanthus excelsa* this is also subject to the attacks of *Eligna narcissus.*

39. *Bombax malabaricum.*—Experiments on the artificial re-generation in Markanam and Topslip centres are described. The Bombax shoot borer *Tonica neriferana* is referred to.

40. *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.

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

42. *Sterculia Companulata.*—Nine months to one year old transplants give the best results. The species is very liable to damage by deer.

(d) *Exotics.*

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

44. *Acacia mollissima and Acacia decurrens—Experimental introduction in lower altitude of* 1,500′.—Experimental introduction of the plants in Topslip is described. Renewing the result of the last three years, the tentative conclusion is the climate of Topslip, particularly its elevation, is unsuitable for the two species.

45. *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 during the years 1942–43 to 1952–53 are furnished. No conclusions can be drawn from these data as they relate to barks from plants of different ages and the barks were stripped at different times in different years.

46. *Acacia mollissima – Manurial experiments.*—Addition to 2 ounce of N.P.K. fertilizer mixture with 3′ diameter scraping round the plants give the best results. Addition of one ounce of fertilizer mixture gave slightly less height growth.

47. *Acacia mollissima.*—Early planting is superior to late planting.

48. *Acacia mollissima—Experiment with different rotations.*—Data are furnished for yield of green and dry bark per acre at rotations of 7, 10, 13 and 16 years. The indication is that the mean annual increment for dry bark culminates at the age of 13 years. Considering the yield of both bark and wood, a rotation of 13 years seems most advantageous in the Nilgiris.

49. *Sample plots for Acacia mollissima.*—These do not exist now. They will be laid now.

50. *Albizzia falcata.*—The wood of the species is reported to be useful in the manufacture of paper pulp. It has rapid growth, reaching exploitable size in ten years. Experiments are being started.

51. *Albizzia stipulata.*—Experiments on the species at Markanam and Rameshwaram Research Centres are described. In Markanam, it reaches a height of 8′ in three years.

52. *Aleurites fordii and Amontana.*—These plants have been under trial since 1948. The species can attain a mean height of 16′ in ten years. Produced flowers and fruits at the age of 7 to 8 years.

53. *Bursera delpechiana.*—The plants in Denkanikotta Research Garden are referred to. Attempts to raise plants by vegetative propagation were unsucessful.

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

55. *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 In Rameshwaram it reaches a height of 22″ in two years.

56. *Casuarina cunninghamiana.*—Experiments in Topslip Centre are described. This plant is susceptible to heavy damage by browsing by animals.

57. *Casuarina junghuhniana.*—This species has more rapid growth than *Casuarina equisetifolia.* Fifty air layered cuttings planted in July 1951 gave 21/50 survival with a mean height of 52 feet and a mean girth of 17·8″.

58. *Cedrela odorata.*—The usefulness and economic importance of the species are described. Experiments in Topslip show that the species thrives better under the shade of evergreen top canopy than in the open. Under shade, it reaches a mean height of 8 feet in three seasons.

59. *Ceratonia silieua.*—Germination tests show that seed sown without treatment and seeds sown with soaking in cold water for 24 hours give equally good results. Naked entire transplants are not successful. Tubed plants are more successful.

60. *Chlorophora excelsa.*—Growth statistics are furnished. The plant can grow to a height of 40′ in 15 years. In one locality it has grown faster in both diameter and in height than teak.

61. *Cinnamomum campnora (Japan or Formosa camphor).*—The species can attain a height of 24′ and a girth of 2′ 3″ in 15 years.

62. *Cinnamomum zeylanicum.*—Growth statistics of both the sandy and laterite varieties are furnished. Experiments in Topslip Centre show that these localities with a rainfall of 75″ is not suited to it. It thrives well and yields fertile seeds in Kannoth with a rainfall of 150″.

63. *Copernicia cerifera (Carnuba wax palm).*—The species has reached a height of 2½′ including leaf blades in six years. The overground stem is only 6″ with a cluster of 8 to 12 leaves. The growth is therefore very slow.

64. *Crocus kashmiriana (Saffron).*—The indications are that in low elevations such as Topslip, the plant does not flourish. Growth at Ootacamund is being watched.

65. *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 of two years old and stump planting of one and two years old plants, are also successful. Growth data is given. It comes up well in burnt Lantana infested areas in Denkanikotta. Results of trials in Markanam and Rameshwaram Research Centres are also given. In Rameshwaram watering and wind protection are necessary.

66. *Eucalyptus species.*—List of new species tried during the year is given. *Eucalyptus globulus* comes up well and is planted extensively in the Nilgiris. *Eucalyptus citriodora* comes up well in medium elevations (5000′) and also at sea level. *Eucalyptus camaldulensis* (*Syn. E. Rostrata*) comes up well in all plains districts as also in sandy soils in coastal district. *Eucalyptus hybrid* of Mysore origin comes up remarkably well in almost all divisions from sea level up to low elevations. The various species are discribed in the alphabetical order of their specific names.

67. *Eucalyptus species—Introduction in Markanam.*—In Markanam, *Eucalyptus hybrid* of Mysore origin grows fastest while *Eucalyptus rudis* and *Eucalyptus camaldulensis* are next best. *Eucalyptus hybrid* in four years reaches a height of 15′ to 40′. *Eucalyptus rudis* in three years reaches a height of 16′. *Eucalyptus camaldulensis* reaches a height of 16′ in three years.

68. *Eucalyptus grandis.*—The species, at Markanam reaches a height of 6′ in three years. The rate of growth is therefore not encouraging.

69. *Eucalyptus hybrid.*—The plants raised from seed of Mysore State origin yield trees with a height of 15′ to 40′ in four years.

70. *Eucalyptus species—Introduction in Rameshwaram.*—Out of nine species tried at Rameshwaram Centre, *Eucalyptus hybrid of* Mysore origin and *Eucalyptus camaldulensis* of Australian origin have given encouraging results. Details of several experiments are furnished.

71. *Eucalyptus species—Introduction in Topslip.*—Out of six species tried in this centre, *Eucalyptus grandis* and *Eucalyptus saligna* are found to be definitely unsuitable. While *Eucalyptus citriodora* has given the most encouraging results reaching a mean height of 30′ and a BHG of 15″ in three years. Details of experiments are furnished.

72. *Eucalyptus camaldulensis* (*Syn. E. Rostrata*).—Growth statistics in different centres are furnished and compared.

73. *Eucalyptus citriodora.*—The analytical data for chemical analysis of leaves, wood and bark are given. Data on growth of the species at Topslip is furnished. Here it has reached a height of 30′ and a girth of 14″ in three years. It comes up better in the open than under shade.

74. *Eucalyptus species—Introduction in Vemburuli Centre.*—Of the three species tried in this centre, *Eucalyptus grandis* is not encouraging. *Eucalyptus rudis* reaches a mean height of 13½′ in three years. *Eucalyptus hybrid* reaches a mean height of 13′ 4″ in two years.

75. *Eucalyptus astringens.*—No germination was obtained.

76. *Eucalyptus brockwayi—Dundas mahogany.*—No germination was obtained.

77. *Eucalyptus dundasi* (*Dendas black butt*).—Seeds received from Australia were tried; but no germination was obtained, except two seedlings at Markanam which reached a height of 40″ in one year.

78. *Eucalyptus globulus—Tree increment Plot.*—The tree increment plot of 1863 was maintained. The tallest tree here is 242′ high.

79. *Eucalyptus globulus—Manurial Experiments.*—Addition of 1 oz., of N.P.K. mixture in the first year is beneficial.

80. *Eucalyptus globulus—Lopping of leaves more than once during rotation.*—The experiment is described. Lopping yields a revenue of Rs. 55 to 75 per acre after paying expenses. The experiments is in progress. Another experiment was started as a repetition. In this the leaves and faggot wood in 1.2 acres yielded a revenue of Rs. 143.75.

81. *Eucalyptus globulus—Reduction of Coppice shoots.*—Blue gum coppice 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 experiment will be available only after a few years. Another experiment on the same subject with an improved design is being started.

82. *Sample plots for Eucalyptus globulus.*—These do not exist now. Attempts are being made to lay sample plots.

83. *Distillation of Bluegum oil in the Nilgiris.*—On a complaint that manufacturers of bluegum oil in the Nilgiris are adulterating Bluegum oil with the oil of redgum (*Eucalyptus Eugenioides*), the physical properties of both oils were examined. Analytical data for both oils are furnished. Though Redgum oil closely resembles bluegum oil in several respects, it is different from bluegum oil as regards certain important characters and hence it is unsuitable for being mixed with the oil of bluegum.

84. *Eucalyptus grandis* (*Flooded gum or Rose gum*).—Results of trials at Markanam and Vemburuli are given.

85. *Eucalyptus longicornis* (*Red Morrel*).—Seeds received from Australia and tried in several centres, did not germinate at all.

86. *Eucalyptus leucoxylon.* (*Yellow gum—White Iron bark*).—Seeds received from Australia did not germinate in any of the Research Centres.

87. *Eucalyptus salubris* (*Cumlet*).—Seeds received from Australia did not germinate in any centre except in Markanam where two seedlings reached a height of 4′ in one year.

88. *Eucalyptus rudis* (*Flooded gum*).—Experiments in Vemburuli and Markanam show that the species reaches a mean height of 12′ to 14′ in three years.

89. *Eucalyptus saligna*—In Topslip Research Centre it reaches a height of 10½′ in two years.

90. *Grevellia robusta.—Acunn-Silver Oak.*—In Salem North, Division it reaches a height of 50′ and a girth of 22″ in ten years.

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

92. *Morus alba—Linn* (*Mulberry*).—Experiments with the species at Topslip, Denkanikotta, Tanjore and Markanam are described.

93. *Ochroma logopus.*—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″ to 9″. In nine years it reaches a height of 35′ and a girth of 20″.

94. *Ocimum camphora* (*Syn. Ocimum kilimandscharicum*).—This can be successfullly raised by broadcast sowing along with planting teak stumps. The yield of leaves obtained from one acre with results of anlysis 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.

95. *Pinus caribae* (*Slash Pine*).—Seeds from British Honduras were tried in Ootacamund. The rate of growth of the species is very pooor.

96. *Pinus taeda* (*Lablolly Pine*).—Growth is poor. It reaches a height of 8′ to 11′ in seven years.

97. *Prosopis juliflora.*—The importance of this species in the artificial regeneration of dry fuel forests is described. Experiments in Markanam and Rameshwaram Centres are described.

98. *Pterocarpus dalbergioides.*—In Kannoth, it reaches a girth of 24″ in 15 years. The species is susceptible to damage by Wild Game. In Topslip it cannot be successfully established due to damage by browsing.

99. *Salix babylonica.*—In the Nilgiris, it reaches a mean height of 43 feet and a girth of 14.1″ in 21 years.

It is reported in Kashmir that cuttings from mature branches with thick bark do not strike root quickly; while if the trees are lopped, they will throw out succulent shoots which will yield cuttings which will strike root easily. This is being tested.

100. *Swietenia mecrophylla—Trial in Tanjore.*-Trial of the species in Tanjore is described. The indication is that it is not suitable.

(*e*) *Bamboos and Canes.*

101. *Dendrocalamus strictus—Bambusa arundinacea.*—Experiments with the species are described. There are no results of significance or importance.

(*f*) *Plants yielding Minor Forest Produce including medicinal plants.*

102. *Anacardium occidentale* (*Cashew*).—The economic importance of this tree which yields a valuable Dollar earning export crop is described.

103. *Anacardium occidentale.*—Silvicultural characters and method of artificial regeneration are described.

104. *Cashew-Artificial Regeneration Technique.*—This is described as practiced in the Madras State.

105. *Anacardium occidentale.*—Experiments in Rameshwaram, Ulundurpet and Marakanam centres are described. The preliminary indications are as follows:—

(*i*) The species can be raised successfully both by direct sowings and by planting basket seedlings, but stump planting is not successful;

(*ii*) Early sowcings are superior to late sowings in Ulundurpet,

(*iii*) Basket seedlings are best raised by dibbling seeds in baskets;

(*iv*) Optimum time for planting basket plants in Ulundurpet in August-September.

106. *Rauwolfia serpentina.*—The occurrence of the plant in Madras State is given and its use in medicine is referred to. Experiments in Topslip are described.

107. *Rauwolfia canascans-Topslip centre.*—The species can be established both by direct sowing and entire transplanting.

(*g*) *Experiments on Fodder Grasses, Fodder Resources in Madras State.*

108. Fodder resources of the State are inadequate to meet the demand of the existing cattle population. Propaganda is necessary to educate the ryots to grow fodder crops in a part of their lands.

109. *Need for Reasearch on Fodder Grasses* is emphasised.

110. *Notes on Fodder Grasses.*—Notes on Fodder grasses tried in the Markanam and Rameshwaram centres are given.

(vi) RECLAMATION AND AFFORESTATION INCLUDING IRRIGATED PLANTATIONS.

111. *Irrigated Teak plantations—Hulicaldrug.*—The technique of raising irrigated teak plantations in Hulicaldrug on a rotation of 20 years, for poducing Electricity transmission poles is described in detail, with special reference to irrigation regime and thinning.

112. *Experiments on Irrigation in Teak Plantations.*—The results of experiments carried out in the past, are given. There is no difference in height or diameter increment between irrigation for first four years and irrigation for first six years. Weekly and fortnightly irrigations are equally beneficial. In plantations raised from coppice, with irrigation, there is no difference in height growth between thinned and unthinned coppice shoots.

113. *Afforestation of Sandy waste lands in Rameshwaram Island.*—Details of an experiment started in 1955, for controlling deposition of sand on the railway track, by erecting baffle walls with condemned sleepers are given. The experiment was partially successful. Another experiment started in 1955-56 on similar lines, was a grand success, during the year 1958. Whereas 30 to 40 mazdoors used to work in previous years, cleaning the sand off the track, during 1958, there was no need at all for employment of such labour gangs.

114. *Sand fixation through baffle walls and planting on mounds formed.*—Conclusions are drawn. It is possible to prevent wind erosion in sandy tracts by this method.

115. *Sand Fixation through afforestation in Rameshwaram.*—Experiments carried out in Rameshwaram are discribed and results of numerous experiments are tabulated.

116. *General inference regarding suitability of different species for Rameshwaram.*—The following species have done very well in Rameshwaram Island.

(i) *Casuarina equisetifolia.*
(ii) *Calophillum inophyllum.*
(iii) *Eucalyptus hybrid.*
(iv) *Terminalia catappa.*
(v) *Dalbergia sissoo.*
(vi) *Acacia palnifrons.*
(vii) *Acacia arabica.*

117. *Direct sowing of seeds for sand-fixation.*—Dibbling of Palmyra (Borassus flabellifer) seed in line, has given satisfactory results.

118. *Vegitative propagation through stem cutting-Rameshwaram.*—Vegetative propagation has not been successful with any of the species tried.

(vii) TENDING, THINING, CLIMBER CUTTING, WEEDS.

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

120. *Thinning in teak plantations.*—All the teak sample plots dealing with Research on thinning of teak plantations crops have been transferred to Kerala State. An article compiled on "Thinning Research in Teak Plantations" is attached as Appendix 'K'.

121. *Eradication of Lantana through bamboos.—Bambusa arundinacea* cannot be successfully established under the cover of *Lantana.*

122. *Eradication of Lantana through clear-felling, burning and planting forest crop with kumri.*—Details of experiment in Salem North Division are frunished. Cutting and burning Lantana and planting in lines 22' apart with a kumri crop of Ragi, is successful. *Eucalyptus rostrata, Eucalyptus citriodora* and *Eculalyptus hybrid* reach 14' 9", 15' and 14' 2" respectively in three years.

123. *Eradication of Lantana through weedicides.*—Experiment with 2-4-D, 2-4-5-T, Pentachlorphenol, Extra-A (Sandoz product) and shell weed-Killer are described. Spraying with the above chemicals killed the plant above the ground. During the north east monsoon rains, in September 1957, fresh shoots appeared from below ground-level. No seedlings also appeared from dormant seeds. Application of medicine can, at best, control the growth of Lantana. Further experiments are necessary to devise methods of eradicating Lantana.

124. *Eradication of Lantana through biological method.*—Effect of attack by the Lantana scale insect Orthezia insignis-Browns is described.

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

(viii) MIXTURES.

126. *Nil.*

(ix) UNDER PLANTING.

127. *Teak plantations in Wynaad and Nilambur—Is underplanting necessary ?*—The problem is discussed and case made out for "No Underplanting".

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

129. *Piper nigrum—(Pepper)—Introduction in teak plantations after final thinning.*—An experiment on growing pepper in a teak plantation after final thinning using the teak trees as standards is described. At the end of one year, there were 295/400 survivals with new shoots 9"—18" long. For this experiment rooted pepper cuttings obtained from the Pepper Development Officer, Tallipramba were used. The preliminary indication is that the rainfall of the locality is too meagre for successful cultivation of Pepper Vine.

130. *Lac cultivation in Denkanikotta.*—Lac cultivation was carried on a small scale.

131. *Manufacture of lac products at Cumbum.*—The Lac Factory previously at Denkanikotta is now functioning at Cumbum under the control of the Forest Utilisation Officer, Madras.

(x) SILVICULTURAL SYSTEMS.

132. *Nil.*

(xi) MISCELLANEOUS.

133. *Nil.*

PART III.

WORKING PLANS AND STATISTICS.

(i) WORKING PLANS.

134. *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.

135. *Sample plots—Permanent preservation plots and tree Increment plots.*—Two new sample plots for *Ailanthus excelsa* were opened during the year. Details of plots in existence are given. Appendix 'B' gives complete lists.

(iii) BARK MEASUREMENTS.

136. *Nil.*

(iv) MISCELLANEOUS FORMULAE, ETC.

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

PART IV.

MISCELLANEOUS.

A. FOREST BOTONY.

138. *Fungus disease of casuarina equisetifolia.*—The Fungus disease is briefly described.

B. FOREST ENTOMOLOGY.

(*a*) *Systematic Entomology.*

139. *Nil.*

(*b*) *Economic Entomology.*

(*i*) Specific Investigations.

140. *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.

141. *Ailanthus excelsa and A. Malabarica—Defoliator attack.*—Attacks of the defoliator *Eligna narcissus* (Notuidae) is described. Experiments on spraying of Hexidol (2 gallons of water *plus* 1lb. hexidol) on the crown and trunk of *Ailanthus excelsa* show no difference in the intensity of defoliation between sprayed and unsprayed trees.

142. *Bombax malabaricum—Shoot borer.*—Attack of the shoot borer *Tonica nevifrana* is described. Experiments on the spraying and dusting on insecticides are proposed for trials.

(*iii*) Unclassified and unidentified damage.

143. *Nil.*

C. FOREST ZOOLOGY.

144. *Nil.*

D. UTILIZATION.

145. *Forest Utilization.*—There is a wholetime Forest Utilization Officer with headquarters at Madras working directly under the control of the Chief Conservator of Forests. His report for the year is furnished as Appendix 'I'.

P. VENKATARAMANY,
State Silviculturist, Madras State.

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ANNUAL REPORT ON SILVICULTURAL RESEARCH IN MADRAS STATE FOR THE YEAR 1957–58.

PART I.

GENERAL.

1. *Silvicultural Research Programme.*—The silvicultural research programme for the year 1957–58 was prepared by the State Silviculturist in consultation with District Forest Officers and was approved by the Chief Conservator of Forests, Madras.

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 sub-centre was opened at Masinagudi in the Gudalur Forest Division. There is no separate staff for this centre. The research staff at Ootacamund centre will be in charge of works in this sub-centre also. The Headquarters of the Research Ranger, Denkanikotta, were shifted to Madurai with effect from 17th February 1958. This Research Ranger is in direct charge of the Research Centres at Rameshwaram, Vemburuli and Thanjavur.

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

TABLE I.—*Statement of research centres and gardens.*

Research centres with staff at the beginning of the year 1st April 1957.	*Research centres and staff at the end of the year on 31st March 1958.*	*Reasons for change.*
(1)	(2)	(3)
I. Research Station. Denkanikotta—*Staff*— Research Ranger. 1 Range poon. .. 1 Forest Guards .. 2 Reserve Watcher . 1	Research Station, Denkanikotta—*Staff*— Reserve Watcher 1	The change is due to the transfer of headquarters of the Research Ranger, Denkanikotta, to Madurai with effect from 17th February 1958. Forest Guards posts are kept vacant.
II. Research Station, Madurai—*Staff*— *Nil.*	Research Station, Madurai—*Staff*— Research Ranger 1 Range poon .. 1	The hedquarters of the Research Ranger, Denkanikotta was transferred to Madurai with effect from 17th February 1958.
III. Research Station, Ootacamund—*Staff*— Research Forester 1 Forest Guard .. 1	Research Station, Ootacamund—*Staff*— Research Forester.. 1 Forest Guard .. 1	No change. A sub-centre was opened in 1957–58 for undertaking experiments on *Eucalyptus hybrid* and other species suitable for that centre.

TABLE I.—*Statement of research centres and gardens*—cont.

Research centres with staff at the beginning of the year 1st April 1957.	*Research centres and staff at the end of the year on 31st March 1960.*	*Reasons for change.*
(1)	(2)	(3)
IV. Research Station, Rameshwaram—*Staff*— Forester .. .. 1 Reserve watcher .. 1	Research Station, Rameshwaram—*Staff*— Forester .. .. 1 Reserve watcher .. 1	With effect from 1st March 1958 this centre was placed under the supervision of Research Ranger, Madurai.
V. Research Station, Markanam—*Staff*— Research Forester.. 1 Mali I	Research Station, Markanam—*Staff*— Research Forester .. 1 Mali 1	No change.
VI. Research Station, Vembruli—*Staff*— Research Forester.. 1 Mali.. 1	Research Station, Vembruli—*Staff*— Research Forester .. 1 Mali 1	With effect from 1st March 1958 this centre was placed under the supervision of Research Ranger, Madurai.
VII. Research Station, Thanjavur—*Staff*— Reserach Forester .. 1	Research Station, Thanjavur—*Staff*— Research Forester .. 1 Reserve watcher .. 1	A reserve watcher was appointed in the centre on 25th November 1957. This centre was placed under the supervision of Research Ranger, Madurai, with effect from 1st March 1958.
VIII. Research Station, Topslip—*Staff*— Research Forester .. 1 Mali 1	Research Station, Topslip—*Staff*— Research Forester .. 1 Mali 1	No change.
IX. Research Station, Ulundurpet—*Staff*— Research Forester .. 1	Research Station, Ulundurpet—*Staff*— Research Forester .. 1	No. change.

3. *Climate and rainfall.*—The climatic factors of each of the research centres are given in the form or charts which give the monthly averages of rainfall with 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 to enable any one reading the report to understand the climatic factors of the locality under which the experiment was conducted.

4. *Records.*—The records for experimental plot files were maintained both by the State Silviculturist and Research Ranger or Research Foresters concerned. Those for experimental gardens were maintained by the Research Ranger and Research Forester and subsequently sent to the State Silviculturist for analysis of measurements.

The following statement summarises 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)
Madurai	1. Denkanikotta ..	7	..	1	6
	2. Bennari	84	..	..	84
	3. Ootacamund ..	9	3	1	11
	4. Topslip	15	1	5	11
	Total ..	115	4	7	112

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)
Madurai	1. Denkanikotta ..	50	..	..	50
	2. Vemburuli ..	10	25	6	29
	3. Rameshwaram ..	76	44	36	84
	4. Thanjavur ..	9	38	..	47
	5. Ootacamund ..	45	19	..	64
	6. Topslip	104	15	83	36
	7. Markanam ..	89	56	40	105
	8. Ulundurpet ..	..	23	..	23
	Total ..	383	220	165	438

TABLE IV.—*Abstract of experimental plot files and experimental garden 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.*
(1)	(2)	(3)	(4)	(5)
Experimental plot files	115	4	7	112
Experimental garden files	383	220	165	438
Total ..	498	224	172	550

5. *Comptation and analysis of annual mesurements.*—Attention is invited to paragraph 5 of the Annual Report on Silvicultural Research for the year 1955–56 and paragraph 5 of the Annual Report on Silvicultural Research for the year 1956–57.

There were 498 experimental plot and experimetal garden files at the commencement of the year ; there were 550 files at the close of the year.

The work of computation of Annual Measurements of all these Experiments is now complete.

The special duty forester who was 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.

6. *Sample plots.*—During the year no new sample plots were opened. But one sample plot No. 1 of South Coimbatore Division was converted into a permanent preservation plot. (Please *see* paragraph below.) Hence at the close of the year, there were 31 sample plots in all, as against 32 sample plots noted in paragraph 6 of the Annual Report on Silvicultural Research for 1956–57. Please see Appendix 'B' for detailed list of sample plots.

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

Serial number and division. (1)	*Species.* (2)	*Number of sample plots.* (3)
1 Nilgiris	*Acacia decurrens*	1
2 Do.	*Acacia mollissima*	2
3 Do.	*Eucalyptus acmenoides*	1
4 Do.	*Eucalyptus euginoides*	1
5 Do.	*Eucalyptus paniculata*	1
6 Do.	*Eucalyptus palularis*	1
7 Do.	*Eucalyptus propinqua*	1
8 Coimbatore, South	*Tectona grandis*	1
9 Do.	*Ailanthus excelsa*	19
10 Coimbatore, North	*Tectona grandis*	2
		2
		31

7. *Tree increment plots and permanent preservation plots.*—The following tree increment plots were maintained during the year:—

Nilgiris	1	Tree increment plot	Eucalyptus.
Do.	2	Do.	Shola species.
Salem, North	1	Do.	Sandalwood.
Salem, South	2	Do.	Do.
Vellore, East	1	Do.	Do.
Coimbatore, South	1	Do.	Mesuaferrea.
Do.	1	Do.	Ropea parviflora.
Do.	1	Do.	Galophyllum elatum.
Total	10		

The sample plot No. 1 located on the teak plantation of 1872 in Mount Stuart is the oldest teak plantation in the Madras being 85 years old by 1957–58. As it was considered desirable to maintain this as a permanent preservation plot, this was converted into a permanent preservation plot I of Coimbatore South under orders of the Chief Conservator of Forests (vide Dis. No. 300/56, dated 15th November 1956 communicated in State Silviculturist's No. 10508/55-F, dated 20th November 1956.) This permanent preservation plot consists of 3·3 acres (1 acre of plot proper and 2·3 acres of surround). Besides teak which is the principal crop, this plot contains also trees of *Dalbergia latifolia*, *Pterocarpus, marsupium*, *Albissia odorotissima*, etc. Now there are 63 trees in all in the main plot of 1 acre and 155 trees in all in the surround of 2·3 acres,

Appendix B to this report furnishes a detailed list of tree increment plots and permanent preservation plots in the Madras State, as on 31st March 1958.

8. *Library.*—The library in the office of the State Silviculturist was maintained. This library serves the needs of the Madras State Forest Department as well as other departments.

During the year 2 volumes were added to the library at a total cost of Rs. 25·50. These are in addition to 64 volumes which are publications of the Forest Research Institute, Dehra Dun and the Madras Government dealing with—

Administration Reports ;

Silvicultural and other notes of the Forest Research Institute ;

Working Plans of Divisions ;

Departmental Manuals, Codes, etc.

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 :—

Number of volumes at the beginning of the year	1,511
Additions during the year	26
Number of volumes at the end of the year	1,537

9. *Documentation.*—The ledger files of the office of the State Silviculturist, Madras, 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 eighty-six additions to the general ledger files and ninety-two additions to the specific ledger files were made.

At the VIII silvicultural conference held at Debra Dun in December 1951, it was recommended that "The Oxford System of decimal classification for forestry" should be adopted. In accordance with this recommendation, the Oxford system was adopted as regards fresh additions to both specific ledger files and general files.

At the end of the year there was 989 specific ledger files and 659 general ledger files as shown below:—

TABLE VI.—*Abstract of ledger files under "Howard's system of filing information on forestry".*

Name of file.	*At the beginning of the year.*	*Added during the year.*	*At the end of the year.*
(1)	(2)	(3)	(4)
Specific ledger files	897	..	897
General ledger files	573	..	573

Abstract of ledger files uuder the "Oxford System of decimal classification".

Name of file.	*At the beginning of the .. year.*	*Added during the year.*	*At the end of the year.*
(1)	(2)	(3)	(4)
Specific ledger files	..	92	92
General ledger files	..	86	86

In addition 54 entries were made in the existing general ledger files and 175 entries were made in the specific ledger files, making a total of 229 entries during the year.

10. *Photographic collections.*—During the year 18 additions were made to the specific photographs and 4 were made to the general photographs as shown below:—

TABLE VII.—*Abstract of photograpyic collections.*

Particulars.	*Number at the beginning of the year.*	*Added during the year.*	*Number at the end of the year.*
(1)	(2)	(3)	(4)
Specific photographs	995	18	1,013
General photographs	865	4	867

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

12. *Staff under the State Silviculturist.*—The office of the State Silviculturist which was at Ootacamund since a very long time was shifted to Madras with effect from 22—4—1957 as per orders of the Government issued in G.O. No. 306, dated 2nd February 1957.

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 showing the staff under the State Siviculturist.*

Serial number and staff at the beginning of the year.	*Staff at the end of the year.*	*Reasons for change.*
(1)	(2)	(3)
I Research Ranger 1	Research Ranger ..	No change.
II Research Foresters 9	Research Foresters .. 9	Do.
III Forest guard .. 1	Forest guard .. 1	Do.
IV Reserve watchers 2	Reserve watchers .. 3	One reserve watcher was appointed for Thanjavur centre with effect from 25th November 1957.
V Malis .. 3	Malis .. 4	One mali was appointed at office to look after the gardens with effect from 12th February 1958.
VI Upper division clerks 2.	Upper division clerks 2.	No change.
VII Lower division clerks 3	Lower division clerks 3	Do.
VIII Typist 1	Typist 1	Do.
IX Steno.typist .. 1	Steno.typist 1	Do.
X Peons 4	Peons 5	One peon was appointed on 3rd February 1958 in an existing vacancy.

13. *Tours.*—The State Silviculturist toured for a total of 188 days during the year under report.

14. *Office inspections.*—The following research range office and Research Foresters accounts were inspected by the State Silviculturist during the year on the dates as noted below:—

(1) Denkanikotta Research Range, Madurai ..	5th March 1958.
(2) Research Forester's accounts, Ootacamund.	12th and 13th July 1957.
(3) Research Forester's accounts, Thanjavur ..	27th February 1958.
(4) Research Forester's accounts, Ulundurpet	22nd February 1958.
(5) Research Forester's accounts, Rameshwaram	3rd March 1958.
(6) Research Forester's accounts, Vemburuli ..	4th March 1958.
(7) Research Forester's accounts, Topslip ..	31st March 1958.
(8) Research Forester's accounts, Markanam ..	29th and 30th April 1957

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

The office of the State Silviculturist was inspected by the Chief Conservator of Forests, Madras, on 14th and 15th March 1958 and the general condition of the office was found to be satisfactory.

15. *Discipline.*—Sri G. Ramakrishnan, Research Forester, Vemburuli, was charge-sheeted for neglect of duty and this is pending final disposal. The discipline of the rest of the staff, both ministerial and executive was quite satisfactory.

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, contributions and publications.* During the year, the State Silviculturist gave technical advice on all matters referred to him by several officers in the State, with reference to ledger files in his office.

The following technical papers were prepared during the year:—

(1) Progress of research on the artificial regeneration of teak submitted to the All-India Teak Symposium 1957-58.

(2) The work and achievements of the Nilgiris District Soil Conservation Board submitted to the Soil Conservation Seminar organised by the Central Soil Conservation Board.

(3) Chapter on "Hulicaldrug Irrigated Teak Plantations" in the Coimbatore South Division working plan.

(4) Thinning cycle and Intensity of thinning for teak plantations in the Tirunelveli North Forest Division

(5) Article on Bidi leaves (*Diospyros tomentosa*) for inclusion in the Tamil Encyclopaedia, being published by the Chief Editor Tamil Encyclopaedia, Madras.

18. *Acknowledgment.*—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 sample plots, tree increment plots, permanent preservation plots, open experimental plots and open experimental gardens of previous years. Consequent on the re-organization of States with effect from 1st November 1956, a large proportion of experiments on teak which were located within the Kerala State were transferred to Kerala State. With this transfer, the emphasis on Silvicultural Research in the present reduced Madras State was shifted to problems of afforestation of fuel species, the possibility of control of shifting sand and fixation of sand dunes and the artificial regeneration of cashew, (*Anacardium occidentale*). Among notable new experiments started during recent years, were those on the lopping of leaves of *Eucalyptus globulus* for distillation of oil, reduction of coppica shoots in young Bluegum coppica crops, trials of various exotic species of Eucalyptus both at high elevations (in the Nilgiris) and at sea level (Markanam, Rameshwaram Research Centres) artificial introduction of teak in the east coast districts with watering in the first year, and artificial regeneration of Cashew (*Anacardium occidentale*).

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

(a) *Natural regeneration by seed.*

20. *Acacia mollissima.*—When a nature wattle plantation is clear-felled, 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′ wide strips untouched at intervals of 11′ while the intervening space is forked ;

C : Passing a light uniform fire over the area.

The control plot has a closed canopy with about 500 stumps per acre with an average breast height girth of $10\frac{1}{2}$″ at the age of 4 years (clear felling done on 1st September 1954).

In the sub plots, where there was a light ground fire, there are innumerable seedlings from seeds lying dormant on the ground prior to clear-felling. A light ground fire is helpful in inducing a large quantity of natural regeneration.

In the forked plot, conditions are similar to the control plot. Forking is therefore not beneficial.

The general conclusion can therefore be drawn that forking is not beneficial, that a light ground fire increases the quantity of natural regeneration coming up from seeds laying on the ground, and that a good crop can be obtained with clear-felling even without any treatment at all, resulting in a close canopy at the age of 4 years.

21. *Natural regeneration by seeds.*—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 under growths cut and removed and soil working done by forms B.

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

E.P. No. 54/1933—*Hopea parviflora.*—Treatment 'A' (weeding) gives significantly the largest number of seedlings above 9" in height.

As definite conclusion has been reached, the plot has been closed, as per Chief Conservator's Reference No. Rt. 725/58, dated 23rd April 1958.

E.P. No. 55/1933—*Mesua ferrea.*—It is found that there is no significant difference between treatment and control in respect of seedlings both above 9" and below 9" though in earlier years treated plots and better stocking than control plots. From 1951 onwards, there was no new recruitment of seedlings below 9" 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, the plot has been closed as per Chief Conservator's Reference No. 727/58, dated 23rd April 1958.

E.P. No. 56/1933—*Calophyllum elatum.*—There are only two seedlings below 9" in height in the forked area. There are no plants in the control or weeded sectors. All the trees are over-mature and no seed-fall 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 indication. This plot has been closed as per Chief Conservator's Reference No. Rt. 724/58, dated 23rd April 1958.

22. *Hopea parviflora—Canopy manipulation over established natural regeneration.—E.Ps.* 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: Clear-felling 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 clear-felling 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 clear-felled plot is 27' while in the control plot it is only 11' 3".

In treatment 'A', the number of unestablished regeneration is nearly 8 times that of established regeneration. In treatment 'B' the proportion was 4½ times and in treatment 'C', there were only six established and 23 unestablished plants.

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

23. *Hopea parviflora—Canopy manipulation to regulate development of established seedlings.*—E.Ps. Nos. 75 and 76 of South Coimbatore were started in 1937 to observe development of established natural regeneration of *Hopea parviflora* 3' to 8' in height as follows:—

E.P. No. 75—under evergreen top canopy shade;

E.P. No. 76—after clear-felling the overwood.

Latest measurements indicate that the number of survivals and mean height are distinctly greater in the clear-felled plot. The indications are, that at the stage when the regeneration is established, clear-felling the overwood benefits the natural regeneration appreciably.

(b) Natural regeneration by Coppice.

24. *Need for research on teak coppice crops*—Teak, in the past, has always been worked either with natural regeneration in selection forest, or with artificial regeneration after clear-felling mixed deciduous forest and burning slash. Plantations of teak, raised in the past were clear-felled and planted with rotations ranging from 70 years to 90 or 100 years depending on the site quality, class, the local factors regulating the size of material required in the region and other relevant considerations. Coppice system was not adopted anywhere.

In the recent years, with the rapid development of rural electrification, there is an ever increasing demand for Electricity Transmission poles. Thinnings from teak plantations worked on a long rotation are insufficient to meet this demand. It may be necessary in the not distant future to work teak plantations on the coppice system on a rotation of about 30 years, with the object of producing a much large quantity of teak transmission poles for meeting local requirements.

24-A. *E.P. No.* 100/57—*Tectona grandis—Coppice crop—Topslip centre.*—With the object of collecting data on the growth and silvicultural requirements of teak raised as a coppice crop, E.P. No. 100/57 was started on 1957-58.

An area of 4·2 acres, consisting of as uniform selected a growth of teak as possible, was in the 1928 teak plantation at Topslip about 3 furlongs away from Topslip on the Topslip-Sethumadai Ghat road.

All trees were enumerated and height and diameter measurements were recorded. Diameter measurements at right angles were recorded separately for 50 dominent trees, with height, so as to work out the site quality class. The site quality class was determined to be ·7 IV.

Clear-felling of all trees was commenced on 31st August 1957 and completed by 26th September 1957. The yield of timber and saleable poles was as follows :—

1 Teak round	A L III	8 logs	95 cft.
2 Do.	A 8 III	6 logs	51 cft.
3 Do.	C VIII	369 logs	1,071 cft.
	Total	383 logs	1,217 cft.
4 Teak poles	12″—18″ mid girth	60	72 cft.
5 Do.	19″—24″ Do.	36	86·3 cft.
6 Do.	25″—30″ Do.	37	148 0 cft.
7 Do.	31″—36″ Do.	42	247·8 cft.
	Total poles	..	554·2 cft.
	Total yield of timber and poles	..	1771·2 cft.

The age of the teak plantation at the time of clear-felling was 29 years. The yield per acre was 422 cft. This corresponds to quality class.

It is proposed to carry out measurements, as for sample plots once in 6 years and observe the growth and development of the teak coppice crop obtained by clear-felling.

24-B. *E.P. No.* 5/1938 *Effect of thinning the coppice shoots in an irrigated teak plantation—Hulicaldrug.*—Attention is invited to paragraph 203 under irrigated teak plantations, wherein the measurements of this experiment are given in detail and the results discussed at length. There were two treatments, namely :—

A ; Thinning of coppice shoots to 2 stems per stool.

B : Coppice shoots left unthinned,

The experiment was started in 1938. The measurements recorded in subsequent years are furnished below :—

TABLE VIII.—*Mean height of trees with thinning of coppice shoots and without thinning.*

Treatment.	1941	1944	1956	1949
A: Coppice shoots thinned	23·0′	34·8′	43·5′	45·6′
B: Coppice shoots left unthinned	23·7′	33·7′	46·9′	47·1′

The indication is that there is no significant difference between thinning and no thinning in an irrigated teak plantation in Hulicaldrug as regards height growth. As diameter measurements were not recorded at any time, it is not possible to venture any opinion on the volume production of the irrigated teak coppice crop under the two treatments.

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

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

During the year, arrangements were made for the supply of 179 indents comprising 66 species and an aggregate quantity of 34,122 lb. 10¾ lb. of seeds. The corresponding figures for the previous year were 182 indents comprising 65 species with an aggregate quantity of 24,600 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, Acacia mollissima, Acacia decurrens, Anacardium occidentale.*

The gross revenue realized by seeds supplied during the year was 9,683·87 against Rs. 7,945–8–3 during the previous year. This revenue of Rs. 9,683·87 refers only to the cost of seeds supplied from the State Silviculturists Division and realized in the State Silviculturist Division. For the seeds supplied by the District Forest Officers direct to the consignees cost of the seeds was realized by the concerned District Forest Officers and that amount is not included in this. The enormous volume and variety of seeds, collected and supplied either directly by the State Silviculturist or under his auspices can be gauged from the tabular statement in Appendix C.

During the year, 29,200 lb. of teak seeds and 53,335 teak stumps were supplied to indentors in and outside Madras State. The corresponding figures for the previous year were 20,698 lb. 8 oz. of teak seeds and 64,350 teak stumps. This is particularly brought to notice as teak seeds of Madras (including Kerala) origin are deservedly held in high regard by every one in India and abroad.

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

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

TABLE No. IX.

27. Results of germination tests in 1957–58.

Species. (1)	Number of seeds. per oz. (2)	Number of seeds. per lb. (3)	Germination capacity. (4)	Plant per cent. (5)	Plant per pound. (6)	Remarks. (7)
Cenchrus ciliaris	15,232	2,43,712	29	29	550	No treatment.
Albizia falcata	389	6,224	39	38·75	2,000	Do.
Casuarina cunninghamiana	1,220	19,520	70	70	17,152	Do.
Cassia siamea	860	13,760	36	36	4,864	Control is good.
Casuarina decaisneana	2,240	35,840	50	41	15,360	No treatment.
Manihot glaziovii	928	14,848	28	28	4,224	Do.
Eucalyptus leucoxylon	1,474	23,584	14	4	64	Poor survival.
Itachi bushclover	100	1,600	44	20	320	No treatment.
Diospyrus lotus	250	4,000	55	2	32	....

28. *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 result are progressively combined with the previous year's results and results up to date, are indicated in the following paragraphs :

29. The germinative capacity of the seed of the following species was not apparently improved by any of the treatments used :—

Acacia auriculformis
Acacia cyclopis
A. ferruginea
A. Leucophloea
A. melanoxylon
A. planifrons
A. saligna
A. sundra
Acrocarpus fraxinifolius
Albizzia amara
A. lebbeck
Bauhinia racemosa
Bischolfia javanica
Eugenia arnottiana
Grewia tiliofolia
Holontelia integrifolia
Leucana glauca
Markhamia platycalyx
Poinciana elata.
Promna tomentosa
Prosopis juliflora
P. specigera
Zizyphus glabrate
Z. incurva
Z. jujuba
Z. xylopyrus
Commiphora caudata
Civotia rottleriformis

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

Anacardium occidentale
Azadirachta indica
Berberis tinctoria
Cassia siamea
Chorisia speciosa
Cupressus torulosa
Dendrocalemus strictus
Eloeocarpus oblongus
Glochidion neilgherrense
Hakea saligna
Ligustrum neilgherrense
Litsea zeylanica
Mahonea leschenaultil
Moliosma wightil
Michelia nilgirica
Quercus inicana
Sapindus emarginatus
Tamarindus indica

31. The germinative capacity of seed of the following species has apparently beenbest when they were soaked in cold water for 24 hours prior to sowing, and when sown without removing the seed coat.—

Alangium lamarckii
Ailanthus excelsa
Bombax malabaricum
Ochroma lagopus
Pinus longifolia
P. insignis

Cassia marginata
Chuckrassia tabularis
Harrisonia benetti
Mangifera indica
Pongamia glabra
Soymida febrifuga
Thyrostachys oliveri
Pteroarpus santalinus

32. 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
A. Cyanophylla
A. dealbata
Acacia decurrens
A. mollissima
Myrsine weightiana

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

Adenanthera pavoniana
Alangium lamarckii
Azadirachta indica
Balanocarpus utilis
Dauhinia purpurea
Bombax malabaricum
Calophyllum elatum
Canthium didymum
Cassia auriculata
C. fistula
C. marginata.
C. siamea
Chuckrassia tabularis
Chlorophora excelsa
Chlorxylon swietenia
Dalbergia latifolia
D. sissoides
Dendrocalemus strictus
Dolichandrone crispa
D. falcata
Erythroxylon monogynum
Evodia roxburghiana
Feronia elephantum
Gluta travancorica
Gmeliana arborea
Juniperus procera.
Legerstroemia flos reginae
L. laneolata
Ligustrum neilgherrense
Litsea zeylanica
Mahonia leschenualitu
Mangifera indica
Neolitsea zeylanica
Paloquium ellipticum
Pinus insignis
Pithecolobium dulce
Pterocarpus dalbergioides
P. marsupium
Schleichera trijuga
Sterculia urens
Strychnos nux vomica.
S. potatorum
Tectona grandis
Terminalia chebula
T. erenulata
T. paniculata
Thyrostachys oliveri
Veteria indica
Vitex altissima
V. littoralis
V. pedunculario

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

35. *Seed pre-treatment—Obdurate species.*—The following species which usually give a very low or variable germination per cent were experimented on with special tests to try and increase their germination. The treatments were :—

(*a*) Control ;

(*b*) Soaking in lime water for 24 hours ;

(*c*) Soaking in cold water for 48 hours and then keeping moist in straw out of free circulation of air (Fermenting) ;

(*d*) Scorching over a fire ;

(*e*) Soaking in concentrated sulphuric acid ;

(*f*) Exposing to sun and watering on alternate dates.

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

TABLE X.—*Percentage of germination of seeds of obdurate species.*

Species.	Number of tests.	Percentage of germination of seeds treated with						Other remarks.
		Control.	Lime water.	Fermenting.	Scorching.	Sulphuric acid.	Weathering.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Acacia arabica	1	12·6	X	13·4	X	21·5	X	Seed passed through goats gave 21·9 per cent.
Acacia auriculiformis ..	21	9	X	9	X	6	9	
A. leucophloea	43	13	X	13	X	14	8	
Alangium lamarckii ..	1	2	X	3	X	3	6	
Acrocarpus fraxinifolius ..	30	9	6	13	4	X	6¼	
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. marginata	12	20	13	9	0	35	1	
Erythroxylon monogynum ..	13	6	X	2	X	7	6	
Givotia rottleriformis ..	9	3	X	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	

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

38. *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 orders :—

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

(ii) *Acacia mollissima.*—The testa is very hard and without pre-treatment the seeds give a low germination per cent (5%). The usual method of pre-treatment is to boil water (about 5 times the volume of seed to be treated) in a drum ; just when the water has started to boil, the fire is removed from underneath, and the seeds are put into the water and well stirred. The water with the seeds is then allowed to cool for 12 hours. Finally the seeds are washed 4 or 5 times in clean cold water to remove the gummy muscilage and dried in the shade. Seed, pre-treated in the above manner give a germination per cent of 53 to 60 and a plant per cent of 14 to 20.

(iii) *Acrocarpus fraxinifolious.*—Pre-treatment is not an important factor in the case of the 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) *Ailanthus 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 a plant per cent of 28 to 39.

(v) *Azadireehta 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 both processes occur in nature. Germination tests show that such seed is superior to seeds collected direct from the mother trees. In the alternative the seeds collected from the trees should be depulped so that the seed is white when dry.

(vi) *Cassia fistula.*—Soaking in concentrated sulphuric acid increases germinative capacity.

(vii) *Chrysanthemum cinerariasfolium* (*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) *Melie 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″ layer of leaf litter and burnt. Immediately after the burn, the seeds should be covered with a 3″ 4″ layer of earth and watered liberally.

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

(iv) Nursery Work.

39. *Nursery work.*—Nurseries were maintained in all the eight Research Centres, namely, Merkanam, Vemburuli, Rameshwaram, Ootacamund, Topslip, Tanjore, Denkanikotta and Ulundurpet. Seedlings were raised for use in Research Experiments and also for supply to other departmental officers and for distribution to the public during Vanamahotsava.

40. *Black Bridge Research Nursery.*—In the Black Bridge Research Nursery in the Ootacamund Research Station, a very large number of exotic foreign seeds, received for trials, was tried. Details of these trials are furnished in the following table. It will be seen that germination was absent in a very large number of cases. These species will be tried again as opportunities arise.

Table XI.—*Trial of exotics at Black Bridge Research Nursery.*

Serial number and species.	*Origin of seed and date of sowing.*	*Quantity sown.*	*Number germinated.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)
1 *Eucalyptus astringens.*	19th July 1957.	½ oz. ..	Nil.	..
2 *E .camaldulensis* ..	Do.	Do. ..	23	..
3 *E. cladocalyx* ..	Do.	Do. ..	Nil.	..
4 *E. flocktoniae* ..	Do.	Do. ..	Nil.	..
5 *E. fruticetorum* ..	Do.	Do. ..	Nil.	..

TABLE XI.—*Trial of exotics at Black Bridge Research Nursery* – cont.

Serial numbers and species.	*Origin of seed and date of sowing.*	*Quantity sown.*	*Number germinated.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)
6 *E. leucoxylon* ..	19th July 1957.	½ oz. ..	Nil.	..
7 *E. macarthenai* ..	Do.	Do. ..	Nil.	..
8 *E. macrophylla* ..	Do.	Do. ..	Nil.	..
9 *E. melliodora* ..	Do.	Do. ..	Nil.	..
10 *E. mecrocarpa* ..	Do.	Do. ..	Nil.	..
11 *E. polyanthesis* ..	Do.	Do. ..	Nil	..
12 *E. salmonophloea* ..	Do.	Do. ..	Nil.	..
13 *E. salubris*	Do.	Do. ..	1	..
14 *E. Sideroxylon* ..	Do.	Do. ..	1	..
15 *E. microtheca* ..	Do.	Do. ..	Nil.	..
16 *E. maidenii* ..	Tanganyika 17th July 1957.	8 oz. ..	105	..
17 *E. maculata* ..	Do.	Do. ..	205	..
18 *E. citriodora* ..	Do.	Do. ..	85	..
19 *E. camaldulensis* ..	Do.	Do. ..	120	..
20 *Cinnamomum camphora.*	Do.	Do. ..	Nil.	Germination.
21 *Tristanea conferata.*	Belgian Congo, 9th September 1957.	½ oz. ..	Nil.	..
22 *Callitris glauca* ..	Do.	Do. ..	Nil	..
23 *Callitris robusta* ..	Do.	Do.	Nil.	..
24 *Callitris calcarata* ..	Do.	Do. ..	Nil.	..

41. *Aramby seed multiplication plot.*—Since 1950 (two species date back to 1940 and 1943), a large number of exotic species, notably of the genus Eucalyptus, were being raised in the Aramby Research Garden in the Nilgiris. A large number of these plants have been established and we are in the happy position to collect seeds of these viable exotic species in future. These seeds are especially valuable since it is difficult to secure viable seeds of exotic valuble species from sources outside India. The following statement shows the particulars relating to these exotic species with the mean height and girth of the trees.

TABLE XII.—*Statement showing the particulars relating to exotic species with the mean height and girth of the trees.*

Serial number and species.	*Year of raising.*	*Method of propagation.*	*Mean*	
			Height.	*Girth.*
(1)	(2)	(3)	(4)	(5)
1 *Eucalyptus maculata* ..	1950	Sowing ..	55′	24″
2 *E. marginata*	1950	Do. ..	56′	28″
3 *E. tereticornis*	1953	Do. ..	18′	4″

TABLE XII.—*Statement showing the particulars relating to exotic species with the mean height and girth of the trees*—cont.

Serial number and species.	*Year of raising.*	*Method of propagation.*	*Mean*	
			Height.	*Girth.*
(1)	(2)	(3)	(4)	(5)
4 *E. dalugoides*	1950	Sowing. ..	58′	19″
5 *E. hybrid*	1952	Do. ..	30′	18″
6 *E. drapanophylla*	1952	Do. ..	16′	3″
7 *E. diversicolor*	1953	Do. ..	25′	10″
8 *E. rudis*	1953	Do. ..	30′	13″
9 *E. rostrata*	1952	Do. ..	40′	22″
10 *E. denes*	1953	Do. ..	20′	7″
11 *E. ficifolia*	1953	Do. ..	12′	3″
12 *Pinus taeda*	1950	Do. ..	12′	..
13 *Aleurites fordii*	1952	Do. ..	4′8″	..
14 *Aleurites montana*	1952	Do. ..	4′2″	..
15 *Acacia pycnatha*	1953	Do. ..	15′	..
16 *Cinnamomum camphora* ..	1943	Do. ..	25′	..
17 *Alnus napelensis*	1940	Do. ..	80′	4′0″
18 *Eucalyptus citridora* ..	1954	Do. ..	15′	..

Since it is difficult to secure import of seeds of foreign exotic Eucalyptus species, the old Aramby Research nursery has been converted into a seed multiplication plot for exotic Eucalyptus species and the seeds obtained from the existing trees will be utilised for propagation purposes.

(v) ARTIFICIAL REGENERATION.

42. In conformity with the parctice adopted for the annual report of the previous year, experiments on teak will be described in the first place. Thereafter, the results of experiments on indigenuous hardwood species will follow in alphabetical order.

Softwood.—Softwood species, particularly those suitable for the match and plywood industries have been given special attention and data have been collected on *Melia dubia, Ailanthus excelsa, Ailanthus malabarica, 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.*

43. *Teak—All India teak seed origin experiments.*—(1) *S.Ps. Nos. 96 to 119 of Nilambur and S.Ps. 2 to 17 of South Coimbatore*—(*Note.*—The S.Ps. Nos. 2 to 17 of South Coimbatore were opened in 1939, along with S.Ps. Nos. 96 to 119 in Nilambur Division. The

two sets of sample plots go together for purpose of drawing conclusions. Hence even though the S.Ps. Nos. 96 to 119 of Nilambur Division are now in Kerala State, they are referred to in this report).

S.Ps. Nos. 96 to 119 of Nilambur and S.Ps. Nos. 2 to 17 of South Coimbatore.—Experiments started in Nilambur (S.Ps. 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) Anamalais,
(5) South Bombay.
(6) Nilambur.

and there are four Sample Plots for each seed origin. In Coimbatore South, four seed origins were tried, viz., (1) South Burma, (2) Anamalais, (3) Mysore and (4) Nilambur. There are four 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 Februray 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 equally 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—

South Burma—1,110 c.ft.
South Bombay—1,088 c.ft.
Nilambur—845 c.ft.
Travancore—812 c ft.
Anamalais—775 c.ft.
North Burma—745 c.ft.

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

Mount Stuart—2,400 c.ft.
Nilambur—2,150 c.ft.
Mysore—1,830 c.ft.
South Burma—1,132 c.ft.

(2) 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 therefore contradictory for the present and hence further observations are necessary before we can draw any definite conclusion.

The S.Ps. Nos. 96 to 119 at Nilambur were handed over to Kerala State on 1st November 1956. The S.Ps. Nos. 2 to 17 in South Coimbatore were maintained and new enamel number plates were affixed to the trees.

44. *Teak—Imperata grass in plantations.*—(i) 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 per cent rate of growth.

(ii) An experiment was tried in Kargudi, Gudalur 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.

(iii) *Seeds of Glyricidia maculata* were supplied to the District Forest Officer, Gudalore Division for trial as an under crop in teak plantations, of ages 1 to 3 with a view to see whether the *Glyricidia maculata* can control and if possible eradicate the thick growth of the grass *Imperata cylindrica*.

Seeds were sown on 28th May 1956 over half acre in the 1955 teak plantation of age one year, in Theppakadu block, Mudumalai Range in between teak plants. Within a week, germination was observed. But 30 per cent of plants died during the hot weather of 1957. The survivals at the end of the year were only about 100 seedlings with an average height of 1 foot. Further observations are being made.

45. *Introduction of teak in Rameshwaram Island.*—Experiments were started in June 1955 to determine whether teak can be successfully introduced in Rameshwaram Island. As the rainfall in the locality namely 30" is less than the optimum required for the growth of teak, it was thought that watering of the plants with $\frac{1}{4}$ pot of water equivalent to $\frac{3}{4}$ gallon of water, on non-rainy days, will boost up growth of the plants and that when the tap root reaches subsoil moisture the plants can thrive without further watering.

E. G. No. 1/55—Tectona grandis—Rameshwaram Centre.—125 Teak stumps were planted at an espacement of $8\frac{1}{2}' \times 8\frac{1}{2}'$ in crow-bar holes on 3rd June 1955 and watering was done as per schedule below :—

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.

In March 1956 there were 32/126 survivals with an average hight of 6". The poor survivals were due to hot scorching winds carring sand particles which have an abrasive action on the tender stems and have the effect of damaging the plants. In June 1956 casualties were replaced and wind protection was given by planting palmyra leaves with the stalks planted in crowbar holes and the leaf blade projecting above ground as a dwarf wall, in the wind ward side of the plant, so that the plant is protected from searching winds and the sand blast. By March 1957 there were 87/196 survivals with a mean height of 5". Again watering was continued on alternate days from April to October 1957. By March 1958 there were 80/125 survivals with a mean height of 10". Further observations are being continued.

E. G. No. 49/56—*Tectona Grandis—Rameshwaram Centre.*—128 Teak stumps got from Wynaad (Malabar district) were planted on 25th September 1956 in crow-bar holes at an espacement of 8½' x 8½'. Watering was done as per watering regime referred to earlier under E. G. 1/1955 of Rameshwaram Centre. By March 1957 there were 97 survivals with a mean height of 4". By March 1958 there were 97 survivals with a mean height of 10". Wind protection by means of palmyra leaves planted in the windward side of the plant is given individually to all the plants to prevent damage by the desiccating action of strong hot winds carring abrasive sand particles. The indications are that with watering and protection from hot winds, teak can be established ; but the growth is very slow. Further observations are in progress.

E. G. No. 83/57—*Tectona grandis—Rameshwaram Centre.*—100 stumps received from Markanam Centre were planted on 16th October 1957 in crow-bar holes and watering was done on alternate days. At the end of March 1958 there were 88/100 survivals with a mean height of 4". Further observations will be made. The results of the three experiments described above are summarised in the following table :—

TABLE XIII.—*Statement showing results of experiments on introduction of Teak in Rameshwaram Centre.*

Serial number.	*Species.*	*E.G. No.*	*Method of planting.*	*Survival in March 1958.*	*Mean height.*	*Remarks.*
1.	Tectona grandis.	1/55	Stumps in crow-bar holes.	80/126	10"	
2.	Do.	48/56	Do.	124/128	10"	
3.	Do.	83/57	Do.	18/100	4"	

Analysing the figures in the above table, we can draw the inference that *Tectona grandis* can be raised in Rameshwaram with watering. Wind protection is also very essential.

46. *Tectona grandis—Introduction in East-Coast districts.*—With a view to increase the production of teak, in the now reduced Madras State, experiments were conducted in the various Research Centres on the introduction of teak. As the rainfall in the locality is only 30" to 40", it was considered that if watering is done during first year, on the same lines as for *Casuarina ecuisetifolia* the teak plants will establish themselves and will develop a long tap root which may reach the sub-soil water level. Thereafter the plants may grow eventhough the rainfall is less than the optimum rainfall for the species. The experiments carried out in Merkanam, Tanjore, Rameshwaram are viewed below :—

E. G. No. 14/55 *and* 15/55—*Tectona grandis—Markanam.*—

Teak stumps, obtained from Topslip nursery of Coimbatore South division were planted on 3rd June 1955 and 19th July 1955 in crow-bar holes at an espacement of 6' x 6'. Watering was done as per schedule below during the first year:—

1/3 pot—1 gallon of water per plant on the day of planting.

1/3 pot—1 gallon of water per plant once daily for 15 days.

1/3 pot—1 gallon of water per plant on alternate days up to September 1955.

1/3 pot—1 gallon of water per plant once in three days up to 31st March 1956.

By March 1956, the mean height of the plants was only 8" in E.G 14/55, 10" in E.G. 15/55. As it was clear that the plants had not developed deep root system capable of topping sub-soil moisture, watering was continued during the second year at the rate of 1/2 pot of water per plant daily from April 1956 onwards to 31st March 1957.

By March 1957, the plants were 1/2' to 2½" in E.G. No. 14/55 and ⅓' to 3' in E.G. 15/66 with a survivals per cent of 96. By March 1958, the mean height was 3' with survival of 580/600 in E.G 14/55. The mean height was 3½' with a survival of 535/588 in E.G.15/55.

E. G. No. 63/56—*Tectona grandis—Markanam.*—Here teak stumps of Wynaad origin were planted in crow-bar holes on 9th August 1956 at 6' x 5' espacement. Watering was done as per the following schedule :—

Watering the plants with 1/3 pot—one gallon on the day of planting.

Watering the plants 1/3 pot—one gallon twice daily for 8 days.

Watering the plants with 1/3 pot—one gallon on alternate days from the ninth day onwards till end of September 1956.

Watering the plants with 1/3 pot—one gallon once in 3 days from October 1956 to 31st March 1957.

By March 1957, the average height was 6" with a survival per centage of 82. By March 1958, the survival percentage was 50 with a mean height of 12" (height varying from 6" to 5').

The tentative conclusion can therefore be drawn that teak can be successfully established in locality like Markanam, provided watering is done in order to compensate for the rainfall being less than the optimum rainfall for the species. The rate of growth however is poor; the mean height at the end of one year being only 6" and the mean height at the end of year being only 12".

47. *Introduction of teak in the Tanjore district.*—With a view to augment the resources of teak in the residuary Madras State after the re-organisation of States in November 1956, experiments were carried out during the year, on the introduction of teak in the Tanjore district in the Public Works Department, Padugai lands on the banks of irrigation canals as per details furnished in the tabular statement below. In three experiments, the seedlings were watered as per watering schedule below :—

1/3 pot of water— one gallon on the day of planting and for fifteen days thereafter.

1/3 pot of water—one gallon once in two days for the next 2½ months.

1/3 pot of water—one gallon once in three days for the three months.

The idea was that the seedlings will be helped to grow fast till the top root reaches the sub-soil water level, so that afterwards the seedlings can grow from sub-soil moisture in spite of deficient rainfall. In four experiments, watering was not done at all.

In all the experiments, there was great damage to the seedlings from stray cattle which broke the leading shoots.

At the end of second year in March 1958, the survival per cent and height growth were as shown below. Making allowance for the damage by cattle, it can be inferred that teak can be successfully established in the Padugai lands in the Tanjore district.

TABLE XIV.—*Statement showing results of experiments on the introduction of teak in Tanjore district.*

Experimental garden number and locality.	*Number planted.*	*Date of planting.*	*With watering or without watering.*	*Survival percentage in March-April 1958.*	*Mean height in March-April 1958.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
2 Vennar-Vettar Regulator.	1,210	July, 1956.	With watering.	99	1 foot.	..
3 Do.	665	Do.	Do.	93	1' 8"	..
6 Do.	1,219	September 1956.	Without watering.	86	10"	..
7 Thirukattupalli	424	October 1956.	Do.	8	3'	..
9 Vennar-Vettar Regulator.	1,210	Do.	Do.	99	11"	..
12 Do.	302	July 1957	With watering.	100	4'6"	..
13 Do.	328	Do.	Do.	100	5'4"	..
35 Do.	265	September 1957.	Without watering.	42	3"	..

The data furnished in the above table shows that teak can be successfully established in the Tanjore delta provided watering is done in the early stages till the plants send their tap roots to the sub soil water table.

48. A large number of experiments on the artificial regeneration of teak were conducted in the composite Madras State including the Nilambur and Wynaad Research Centres of the Malabar district which is now in the new Kerala State and the results of these experiments were given in detail in paragraphs 48 to 66 of the Annual Report on Silvicultural Research for the year 1955–56. With the re-organisation of States, many of these experiments have gone to the new Kerala State and only some experiments started in the Top slip Research Centre are in this State. However as the results of those experiments are required for ready reference by the District Forest officers dealing with artificial regeneration of teak a brief abstract of the results of these experiments is furnished as Appendix J.

49. *(a) Deterioration of site quality in second rotation pure teak plantation crops.*

(NOTE.—In view of the settled policy of the Madras State to ıtend Teak Plantation crops wherever possible and to raise it ıccessively rotation after rotation in the same area, paragraph 66 f the Annual Report on Silvicultural Research for 1955-56 is ›produced here for information, eventhough the sample plots on 'hich the conclusions are based have been transferred to the Kerala tate).

There has been a widespread apprehension in the past that there s steady deterioration of soil and consequent lowering of site quality nder pure teak plantations and that therefore, a second rotation eak plantation raised after clearfelling an existing teak plantation vill be appreciably poorer in quality than the first rotation crop.

To ascertain how far this is true, sample plots 17 (*a*), 18 (*a*) and .9 (*a*) were laid in Nilambur in the exact sites occupied by the sample ›lots 17, 18 and 19 which were first rotation teak plantations, after :lear-felling and replanting. The site quality of the first rotation :eak plantations in sample plots, 17, 18 and 19 is available from neasurements. The site quality of the second rotation teak plan- :ations has been computed. The following tabular statement shows the results :—

TABLE XV.—*Comparative statement showing site qualities of I rotation and II rotation of Teak Plantations in the same site.*

S. P. numbers.	*All-India site quality in first rotation.*	*All-India site quality in second rotation.*	*Remarks.*
(1)	(2)	(3)	(4)
17 (*a*) ..	0·1 II	1·7 II	Considerable increase in site quality.
18 (*a*) ..	0·4 III	0·8 III	Slight increase.
19 (*a*) ..	1·6 IV	1·0 IV	Slight deterioration.

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

The above indication is corroborated by observations in other sample plots located in second rotation teak plantations. There are several teak plantations in Nilambur in areas for which site quality in the first rotation has been ascertained and noted in the working plans prepared by B. Bourne in 1917-1918 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 tentative conclusion which needs confirmation through repetition of the experiments 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 of 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.

50. *Hopea parviflora—Frequency of weeding—E.P. 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 subsequent years ;

C : Plots weeded once in September in the first year and twice a year in July and September in subsequent years ; and

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. If may be stated that regular weeding three times a year till the seedlings reach the sapling stage encourage 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.

The conclusion can be drawn from this experiment that weeding is beneficial but not significant. Best mean height is obtained by three weedlings.

(c) *Indigenous softwood species.*

51. *Introduction of valuable softwood and hardwood species in evergreen forests (like Kdriaznshola) without clear felling.*—Attempts at introducing valuable hardwood and softwood species in the Jariyan shola evergreen forests, without clear-felling under the top canopy were started in 1953. The experiments were continued up to March 1957 when final conclusions were drawn. These are given in paragraph 50 of the Annual Report on Silvicultural Research for 1956–57.

52. *Ailanthus excelsa.*—This is a valuable softwood suitable for the match industry. This is the 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" in Denkanikotta and in four years 48·9" in Bennari.

During 1956, two sample plots have been opened for *Ailanthus excelsa*, in the Ayerangal Kumri regeneration plots, to study the growth and development of the species and collect statistical data. At the age of three years, the mean diameter of the plants in the sample plots is 5 inches and the mean height is 18 feet.

53. *Defoliater attack—Eligna narcissus* (*Noctiudal*).—A *Lepidopterous defoliator, Eligna narcissus* (*Noctiudal*) in plantations and nurseries of *Ailanthus excelsa*, is noticed in the Madras State, almost everywhere, including the Ayerangal kumri plantations in Coimbatore South Forest Division.

Experiments on the control of the defoliator were started in 1956. In five sub-plots of 1 square chain each, in the Ayerangal softwood plantation of 1955, the plants were sprayed with Hexidol (solution 1 lb. of Hexidol with two gallons of water) during the months of October 1956 to December 1956 (three sprayings); spraying was done on the crown as well as on the trunks of the plants, where the insects pupæ. Observation in January 1957 showed that there was no appreciable difference in the matter of defoliator attack between the sprayed sub-plots and rest of the plantation which was treated as control i.e. without spraying. The experiments were repeated in 1957–58 with similar results.

54. *Ailanthus malberica—Growth and silvicultural requirements.*—The timber of this species is in great demand for the match industry. To assertain the growth and silvicultural requirements of the species, several experiments were laid out at topslip. The height growth and survival per cent are given below. All the three experimental gardens have been closed.

TABLE XVI.—*Statement showing the growth statistics of Ailanthus malberica.*

Experimental plantation or experimental gerden number.	*Deciduous or evergreen locality.*	*Centre.*	*Age.*	*Mean height in feet.*	*Survival percentage.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
E.G. 406/50	Deciduous.	Topslip ..	5	3½′	31/50	..
E.G. 469/53	Evergreen.	Do. ..	3	2½′	8/25	Poor survival.
E.G. 504/54	Do.	Do. ..	2	3½′	..	..

Throughout the Madras State, this plant is liable to attack by a defoliator—*Eligna narcissus* (Lepidoptere Noctiuidai). Reference may be made to the experiments on the control of this insect under "*Ailanthus excelsa*".

55. *Bombax malbericum* (*Samul*).—(1) This is one of the best matchwoods of the State and attempts are being made in all districts to increase the area under Samul. 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.

(2) This was introduced as an underplant in the evergreen forests of Karianshola in Topslip Centre. Regular experimental gardens were also started in Markanam Centre.

E.G. No. 503/54—*Topslip.*—When three years old, the plants were 2½′ high on an average with 27 per cent survivals. The low percentage of survival is due to damage by wild game. This experimental garden was closed during the year.

E.G. No. 122/57—*Markanam.*—Hundred seedlings were planted on 4th October 1957 at an espacement of 6′×6′. By March 1958, the survivals were 57 per cent with a mean hieght of 21" (minimum heigh 6" and maximum height 3′).

E.G. No. 123/57—*Markanam.*—This was a comparison experiment with 90 seedlings allotted to three treatments as below :—

A : Direct sowing of seeds.

B : Planting stumps.

C : Naked transplants.

By March 1958, the survival per cent was 10, 3, 3 respectively and height growth ½′, 1′. 13" respectively.

E.G. No. 106/57—*Markanam.*—In this experimental garden 30 pot plants were planted on 17th August 1957 at an espacement of 6′×6′. In March 1958, the survival was 66 per cent and

mean height was 1'. It may be noted that pot plants have given considerably better height growth and survival than naked transplants (vide E.G. No. 122/57).

56. *Bombax malbaricum—Shoot borer attack.*—The species is subject to a shoot borer attack known as 'Tenica nevifarens' (Accopheridal). The best method of control of this part is by the mechanical method by destruction of pupae. Secondly by planting in vide espacement and mixing with other species, since Samuls in nature non-gregorious.

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.

57. *Malia 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 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"—12" can be transplanted at the beginning of the south-west or north-east monsoon. The rate of growth is extremely rapid even in regions of poor rainfall of 30" —40" per annum. A height growth of 10'—15' is obtained in two years and 40' in six years.

E.G. No. 115/53—*Denkanikotta.*—Transplanting seedlings in crow bar holes and 1' cube pits both gave 100 per cent survivals at the end of 1957 in December the mean height is about 11 feet.

*E.B. No.*29/53—*Denkanikotta.*—Half an acre was planted at an espacement of 22' × 9'. The plants are well established and at the end of December 1957, the mean height is 29' with 90 per cent survivals at the age of five years.

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 officiacious in inducing root formation in cuttings of *Melia dubia.*

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

E.G. No. 464/53—*Topslip—Spondies mangifera.*—Fifty, one year old seedlings were planted. At the end of one year the average height was 13'8" and survivals were 49 out of 50. In 1955 at the age of two years, the survivals were 37 out of 50. All the plants had broken tops due to browsing by wild game. Hence height growth was not recorded. As the species is particularly liable to damage by wild game, particularly deer, it is not worth trying this species in localities subject to such damage. This experimental garden was closed during the year.

59. *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 give 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 gave only 40 per cent to 45 per cent survival against 80 per cent to 90 per cent survival with transplants.

Topslip Centre—E.G. No. 468/53, 493/54, 496/54, 509/55 *and* 519/55.—As there was heavy damage by browing of deer, it was found from the experiments that this species cannot be raised successfully in this centre. Hence the above experimantal gardens were closed during the year.

(*d*) *Exotics.*

60. *Acacia mollissima* (*Black wattle*).—When exactly wattle was introduced in the Nilgiris is not known, probably, it was about 1840. To begin with, wattle was planted only in the tea estates as a nurse crop for tea. But the Forest Department focussed attention and started systematic planting only in 1939 when trade relations with South Africa became strained. In the beginning both the Black and Green wattles were planted. The bark of the Black wattle (*Acassia mollissima*) is preferred to that of other Acacias, both on account of its high tanning 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 tanning contents

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 (*Accacia mollissima*) will be done in future.

61. Its valuable tan bark plays a great role in the national economy and its weed is 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.

62. *Acacia mollissima and Acacia decurrens—Experimental introduction in Lower altitutes of* 1,500 *feet.*—On account of the importance of large sacle 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.

E. Gs. Nos. 478/54 and 479/54—*Topslip.*—In 1954, seeds pretreated by soaking in clod water for 48 hours, were sown immediately after the first pre-monsoon showers in soil worked patches at 10 to 20 seeds per stake. 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 1958 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. The above experiments have been closed during the year.

E. Gs. Nos. 528/55 and 529/55—*Topslip.*—During 1955, the experiment was repeated at Topslip by planting out mossed seedlings *Acacia mollissima* and *Acacia decurrens* 3" to 6 " high, got from Ootacamund. In March 1956, about 5 months after planting, the survivals were 30 per cent for *Acacia mollissima* and 23 per cent for *Acacia decurrens*. Subsequently the experimental gardens were closed.

63. *E. Gs. Nos.* 531/56 and 532/56—*Topslip.*—Seeds of *Acacia decurrens* and *Acacia mollissima*, obtained from Nilgiris were dibbled in the nursery in April 1956. The seedlings were transplanted into Bamboo tubes filled with soil. 100 tubed seedlings in each

species were planted out in July 1956 at an espacement of 6′ × 6′. The seedlings were about 8" high at the time of planting. The survivals on different dates were as follows :—

TABLE XVII—*Survivals of Acacia decurrens and Acacia mollissima in Topslip.*

Species.	*Number planted on 17th July 1956.*	*Survivals on*			*Remarks.*
		10th January 1957.	*24th March 1957.*	*March 1958.*	
(1)	(2)	(3)	(4)	(5)	(6)
Acacia decurrens.	100	32	27	Nil.	Closed.
Acacia mollissima	100	9	9	Nil.	Do.

64. *E. G. No.* 536/56—*Acacia mollissima—Topslip.*—Hundred mossed seedlings obtained from Ootacamund were planted on 18th October 1956. The seedlings were 1 inch to 5 inches high at the time of planting. On 24th March 1957 there were 16/100 survivals with a mean height of 6". During the month of March 1958 all the seedlings were dead. The Experimental Garden has been closed subsequently.

65. Reviewing the results of the experiments conducted in Topslip during the four years from 1954, the tentative conclusion is that the climate of this locality particularly its elevation is unsuitable for the species *Acacia mollissima* and *Acacia decurrens* . However the experiments are being repeated.

66. *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 XVIII—*Results of analysis of wattle bark from plantations of different years.*

Year of plantation.	*Age of tree in years.*	*Moisture. Per cent.*	*Insolubles. Per cent.*	*Tannins. Per cent.*	*Non-tannins. Per cent.*	*Colour.*		*P.H. of the analytical solution.*
						Yellow.	*Red.*	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1942–43 ..	12	8·00	44·91	33·13	13·86	6·00	2·00	4·6
1943–44 ..	11	9·40	45·28	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	29·43	16·24	4·0	1·5	4·8
1947–48 ..	7	8·44	39·39	38·27	13·90	4·1	4·5	4·8

TABLE XVIII—*Results of analysis of wattle bark from plantations of different years*—cont.

Year of plantation.	Age of tree in years.	Moisture. Per cent	Insolubles. Per cent.	Tannins Per cent.	Non-tannins. Per cent.	Colour. Yellow.	Colour. Red.	P.H. of the analytical solution.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1948–49 ..	6	..	..	..	..	..	..	..
1949–50 ..	5	7·00	41·28	38·38	12·74	5·0	3·4	4·6
1950–51 ..	4	7·54	44·07	35·43	12·96	6·8	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	16·3	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).

67. *Acacia mollissima—Manurial Experiment—Experiment plot No. 24/54—Mukurti.*—An experiment was started in 1954, to find out the effect of applying chemical fertiliser 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 to one oz. of N.P.K. Manure mixture with scraping to 3′ diameter.

B : Addition of 2 oz. of N.P.K. Manure mixture and scraping to 3′ diameter;

C : Addition of 2 oz. of N.P.K. Manure 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 XIX—*Measurement 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 Electricity Department staff cut the trees in the experimental plot on the score that the crown of the trees was disturbing the overhead transmission lines. Since final conclusions cannot be drawn, this experiment will be repeated in the coming year.

68. *Acacia mollissima—comparison of yearly and late planting—E. G. No.* 48/57*—Ootacamund Centre.*—In this experimental plot, there were 2 treatments as follows :—

A : Early planting in April.

B : Late planting in June.

60 mossed seedlings were planted for each treatment in 1′ cube pits. At the end of the year the seedlings in ' A ' were 2½′ to 3′ high while those in ' B ' were only 1½′ to 2′ high. The indications are that early planting is definitely beneficial. Confirmation of the result is necessary and so this experiment will be repeated.

69. *Acacia mollissima—Experiments with different rotation—S.P. No.* 10 *of the Nilgiris.*—In 1948, S. P. No. 10 was laid out at Muthorai in the 1941 (*Acacia mollissima*) plantation. The area was divided into 8 sub-plots which were allotted to four treatments randon. 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-plot (c) were clearfelled and the yield of bark measured. Measurements for the six sub-plots already felled show that the M.A.I. of green bark culminates at about the 10th year. But the M.A.I.of dry bark shows continuous increase up to age 13 years. Previous experiments have shown that the tannin content in the dry bark increases up to age 6 years and then decreases. Hence the M.A.I. for effective tannin content per acre will culminate somewhere between 6 years and 13 years.

The sub-plots numbers 2 and 6 due for clearfelling in 1957 at the age of 16 years were clearfelled in October and November 1957. The results are incorporated in the following statements :—

TABLE XX—*Statement showing yield of bark of Acacia millissima at different ages.*

Year of felling.	*Age in years.*	*Yield in lb. per acre.*		*Mean annual increment 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	45·0
1954	13	12,336+ 1,461 wind fallen, =13,797	7,117+ 618 wind falles, =7,735	1,061	595	4·23
1957	16	16,600 1,206 wind fallen. =17,866	8,580+ 600 wind falls. =9,180	1,041	574	48.5

The indications are that the mean annual increment of dry bark increases continuously up to 13 years and decreases thereafter. In fixing the rotation we have to consider the yield of fuel in addition to that of bark and fix the rotation in such a way that the maximum value of bark and wood is obtained. The yield of fuel obtained in the several plots had not been recorded in previous years and hence it is not possible to draw any conclusions. The present indication is therefore that a rotation of about 13 years is most advantageous from an over all point of view. The experiment will be repeated to confirm the indications obtained and opportunity will be taken to record carefully the yield of fuel also at the different ages.

70. *Sample plots for Acacia mollissima.*—Even though Acacia mollissima has been grown extensively in plantations in the Nilgiris District since a large number of years, sample plots do not exist and accurate data for the development crops in height diameter, bark yield volume yield of duel, etc., do not exist. It is proposed to start a series of sample plots in plantations of different ages with a view to study the development of crops and to draw statistical data. Progress in this respect will be shown in the next year.

71. *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 *Albissia 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.

Seeds received from Indo China were tried in Thanjavur Centre. The seeds weighed 3,200 to the lb. and had a germination per cent of 22. The plant per cent was nil, as all the seedlings died subsequently. Attempts will be made to procure the seeds again and results will be reported in future annual reports.

72. *Albizzia stipulata* (*Boiv.*)—*E.Gs. Nos.* 7/55, 8/55, 25/55, 28/55, 55/55 *and* 56/56 *Markanam*—Experiments were carried out in Markanam to observe the growth and Silvicultural characters of *Albizzia stipulata* with and without watering. The watering experiments were watered with one gallon of water on the day of planting and for 15 days thereafter. They were watered with one gallon of water on alternate days if there was no rain till the end of September. From the beginning of October till the end of March 1956 the plants were watered with one gallon of water once in three days.

The following tabular statement shows the survival per cent and mean height at the end of March 1958 :—

TABLE XXI—*Note on growth of* Albizzia stipulata (Boiv).

E.G. number and origin of seed.	*Date of planting.*	*Survival per cent by March 1958.*	*Mean height by March 1958.*	*Remarks.*
7/55 Vizag origin (with watering).	11th August 1955.	70	7.8′	..
8/55 Nilgiris origin (with watering).	Do.	47	7·7′	..
25/55 Bombay origin (without watering).	20th October 1955.	Nil.	..	This experimental garden will be closed.
28/55 Begur origin (without watering).	Do.	Nil.	..	Do.
55/56 Orissa origin (watered till March 1957).	11th August 1956	80	2·3′	..
56/56 Begur origin (watered till March 1957).	Do.	50	1·5′	..

The indications are that watering experiments have given higher survivals per cent and mean height. The above experiment will be repeated during this year with Vizagapatam, Nilgiris and Orissa origins as these show better results.

E.Gs. No. 50/56 and 52/56—*Rameshwaram.*—Experiments were carried out in Rameshwaram to study whether *Albizzia stipulata* can be successfully raised by pot plants, with watering and wind protection. The results are given below. Further observations are being continued.

TABLE XXII—*Statement showing results of Albizzia stipulata in Rameshwaram Centre.*

Serial number.	*E.G. number and year.*	*Species.*	*Date of planting.*	*Survivals.*	*Mean height.*
					PER CENT.
1	50/56	*Albizzia stipulata* (Bombay origin).	27th September 1956.	27	20"
2	52/56	*Albizzia stipulata* (Orissa origin).	Do.	70	11"

73. *Aleurites fordii and aleurties 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 5,000, elevation while *aleurites montana* is a tree of warmer localities rarely ascending higher than 1,600'.

The following plants now exist in the various Research Centres:—

TABLE No. XXIII—*Statement showing the growth statistics of* Aleurites fordii *and* Alevrites montana (Tung oil tress).

E.G. number.	*Locality.*	*Year of planting.*	*Species.*	*Number of plants.*	*Height Mean.*
..	Aramby nursery.	1950	*Aleurites fordii*..	5	2' 3"
..	Do. ..	1952	*Aleurites montana*	6	2'
..	Toplsip ..	1948	Do. ..	5	10'
	Do. ..	1949	Do. ..	7	8'

During the year, about 80 seeds collected from *aleurites montana* in the Topslip garden, were sown in nursery. Besides 12 lb. of seeds of Tung oil received from the District Forest Officer, Tirunelveli, collected in plantations at an elevation of 3,000' to 4,000' were sown in Topslip Research Centre. Results will be furnished in future reports.

74. *Bursera delpechiana (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 Denkanikotta Pot Culture Garden of heights of 12', 9', 7', 4' and 4' respectively. The plants flowered during April-May 1954, but did not yield fruits. 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 established. The experiments are being repeated. The three trees flowered again in May 1957, but the flowers withered away without forming seed. Attempts are being made to propagate the plant vegetatively by means of air layerings. Results in this direction will be reported in the coming year.

75. *Proussonetia papyrifera.*—(i) 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.

(ii) 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 (Topslip and Denkanikotta Research Centres).

(iii) 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.

(iv) 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.

(v) The species comes up well both by stumps and transplants and attains a mean height growth of 28' and 27' respectively in three years. In Denkanikotta (Noganur Reserved Forest) it has attained a height of 50' and D.B.H. of 20" in eight years.

(vi) There are over 50 trees of this species with an average height of 40 and an average B.H. girth of 25" and in maximum B.H.G. of 40" in Topslip Centre, 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.

76. *Cassia javanica (Java cassia).*—It is indigenous in the Malay Islas, Hawaii, 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 XXIV.— *Analytical data of cassia javanica.*

Particulars.	*Bark 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	8·6	3·5	8·0	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 XXV—*Statement showing percentage of tannin contentes in* cassia javanica *and* cassic siamea.

Percentage of tannin in	Cassia javanica.	Cassia siamea.
	PER CENT.	
Bark	18·97	FEET. 9
Leaves	10·61	7
Pods	24·56	6

On account of the importance of *cassia javanica* in the Tannin Industry, which is a key industry in the Madras State, experiments were started in the Research Centres at Denkanikotta, Vemburuli, Rameshwaram and Markanam. 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.

Seeds received from the Agri-Horticultural Society, Madras, and tested at Thanjavur yielded the following results :—

Seeds weight	1,612 per lb.
Germination per cent	5
Plant per cent	5
Plants per lb.	80

In 1956, three experimental gardens were opened to study the growth and silvicultural characters of *cassia javanica*. Seeds received from Bangalore, Madras Horticultural Society and Dehra Dun were tried. The results are furnished in the following tabular statement:—

TABLE XXVI—*Statement showing the results of* cassia javanica *at Rameshwaram Centre.*

Serial number.	E.G. num.	Species.	Date of sowing.	Percentage of survival.	Mean height.	Remarks.
				PER CENT.	FEET.	
1	36/56	*Cassia javanica* (Bangalore origin). ..		3	17	..
2	66/56	*Cassia javanica* (Madras origin). ..		52	16	..
3	67/56	*Cassia javanica* (Dehra Dun). ..		8	22	..

This species will be tried in other Research Centres also in the coming year.

77. *Casuarina cunninghamiana*—E.C. 510/55—*Topslip.*—Seeds of this species received from the Central Silviculturist were sown in Topslip in July 1954. One year old seedlings were planned out on 20th June 1955 at an espacement of 6′×6′. The seedlings were 30″ mean height at the time of planting. On 30th January 1956, there were 97/100 survivals with a mean height of 2′ the top being broken down and damaged by wild game particularly deer. During March 1958 there were 67/100 survivals with a mean height of 3′ to 4′ the top having been broken by wild game. Combining this with the results of E.G. 489/54 given in paragraph 121 of the Annual report on Silvicultural Research for 1955–56, the conclusion is that these species is susceptible to damage by wild game and so cannot be successfully raised in localities with extensive wild game, unless expensive game proof fencing is resorted to.

78. *Casuarina junghuhniana.*—The Thailand casuarina which was introduced into Markanam 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*, vir, *casuarina equisetifolia. Linn. X, C. junghuhniana. Mic.*

Fifty layered cuttings received from Thailand were planted in Markanam in July 1951. There are now 21 survivals, with a mean height of 52′ and mean girth of 17·8″ airlayed cuttings planted in Markanam Research Gardens on 9th May 1956 gave a mean height of 6½′ in two seasons. The species shows much faster height of growth than *C. equisetifolia.*

Markanam Centre—E.G. 117/57—*C. junghuhniana.*—Four rooted airlayered plants, obtained from the District Thailand Casuarina plantation noted above were planted on 19th May 1957 in the Markanam Research Garden. In March 1958, there were 100 per cent survivals with a mean height of 11·75″. The indication is that Thailand Casuarina shows faster height growth than *C. equisetifolia.*

79. *Cedrela odorata—Jamacia 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′ and a girth of 15′. 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 Island.

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

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 :—

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Leaves	10·61	7
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				PER CENT.	FEET.	
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3	67/56	*Cassia javanica* (Dehra Dun).	..	8	22	..

This species will be tried in other Research Centres also in the coming year.

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

80. *E.G.* 514/55—*Cedrela odorata—Topslip.*—Seeds collected from the tree near Mount Stuart bungalow were sown in nursery in April 1955. On 30th July 1955, 50 seedlings were transplanted at an espacement of 6′×6′ in a clearfelled and burnt area in the Karianshola deciduous garden. The seedlings were 6″ high at the time of planting. By 30th January 1956 there were 30/50 survivals with a mean height of 18″ and by March 1958 there were 20/50 survivals with a mean height of 3′ to 4′.

81. *E.G.* 523/55—*Cedrela odorata—Topslip.*—Ninety four seedlings of *Cedrela odorata* were planted out at 6′×6′ espacement in the Karianshola evergreen garden under a top canopy of evergreen trees after removing the undergrowth and the middle storey. The height of the seedlings at the time of planting was 4½″. By 30th January 1956 there were 73/94 survivals with a mean height of 4′. During March 1958, there were 54/94 survivals with a mean height of 8′. The seedlings show vigorous and promising growth.

Combining the result of E.Gs. 514/55 and 523/55, the tentative conclusion can be drawn that the species thrives better under the shade of evergreen top canopy than in the open. Further observations are being made.

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

The seeds were obtained from the Director of Agriculture, Cyprus, and were sown in Topslip centre, and the results are furnished below :—

Seeds weight	154 per oz.
Germinative capacity	36 per cent to 50 per cent.
Plant per cent	28 to 37.

83. *E.G.* 513/55—*Ceratonia siliqua—Topslip.*—A comparison experiment was carried out between A—Transplanting entire transplants and B—planting plants pricked into bamboo tubes. 50 plants were planted for each treatment in July-August 1955. By November 1955 there were nil survivals for A and 24 survivals for B—planting tubed plants—By end of March 1957 these seedlings also died. The experimental garden has been closed as the survivals are nil. The tentative conclusion is that naked entire transplants are not successful while tubed plants are more successful though ultimately even these die.

84. The practice in Cyprus, is reported to be, to sow the seeds in baskets and then transplant the seedlings with baskets without the least disturbance to the root system. There are now three seedlings with a mean height of 7′ in the Topslip Research Nursery. These will be allowed to grow in the nursery bed and their development will be watched.

85. *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′ in its natural habitat, where it is used for a large number of purposes, such as, furniture, joinery, coach building, paving cooperages, motor boats and yachts. It is reputed to be proof against rot and termite attack.

This species was introduced in the Madras State in Experimental Gardens in 1941, in Nilambur, Wynaad, Palghat and Topslip Research Centres. At Topslip there are now 48 plants of an age of 16 years with a mean height of 40′ and a mean girth of 32″ (Maximum height 60′ and maximum girth 48″).

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

86. *Cinnamomum camphora Nees (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 synthatic manufacture of camphor, the importance of this plant has waned in recent years. Besides the herbacious fast growing *Ocimum kilimandscharicum* also comes up well in the medium to high rainfall tracts of this State and as this can be grown comparatively easily the importance of *Cinnamomum camphora* is well nigh gone.

The following plants exist in the Research Gardens :—

TABLE XXVII—*Particulars of Cinnamomum camphora* Nees tree *in Research Gardens.*

Locality.	*Method of propagation.*	*Year of propagation.*	*Age in years.*	*Number of survivals.*	*Mean height Max. / Ave. / Min.*	*Remarks.*
Topslip 92/51.	Transplants.	1,946	11	48	9′ 9″	..
Do.	Do.	1945	12	7	25′	..
Aramby Nilgiris.	Do.	1943	14	1	24′	2′ 3″ girth.
Do.	Do.	1946	11	13	8½′	13″ girth.

87. *Cinnamomum camphora Nees—E.G.* 92/51 (*South Coimbatore*).—*Two hundred Cinnamomum camphora* seedlings were planted in 1946 in E.G. 339/1946 of Topslip at an espacement of 6′×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 Topslip it can grow to 42″ height in three years. In March 1958 there were 48 numbered plants (total number of plants surviving 97; with a mean height of 9′9″ at the age of 11 years. In Novermber 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.

88. *Cinnamomum camphoraNees—E.G.* 339/46 of *Topslip* (*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 0′9″. 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 XXVIII—*Height growth of Cinnamomum camphora Nees.*

Year.	*Age in years.*	*Mean height of 48 numbered stems.*
		FT. IN.
1952	6	7 2
1953	7	7 8
1954	8	6 8
1955	9	8 3
1956	10	9 8
1957	11	9 9

89. *Introduction of Cinnamomum zeylanicum.* (*Blume.*) (*Laterite variety*) *as an underplant in everygreen 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 stamps of two-year old plants). In each of these experiments there are two treatments, viz.—

A : Removing the shrubby growth only and planting ;

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

NOTE.—In addition there are 7 trees of this species raised in 1945 height of 25′ in the adjacent area. They too have grown bushy with about 4 shoots per stool with girths of 10″ to 12″. They have not yet flowered.

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

TABLE XXIX—*Cinnamomum zeylanicum.* (*Blume.*)—1956 *measurements.*

H.G. Number.	*Treatment.*	*Survival percent.*	*Mean height.*
		PER CENT.	FEET.
498/54 seedlings ..	Shrubby growth only removed.	70	2½
	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 high percentage of success and that stamps are not successful at all, no other conclusion can be drawn. By end of March 1958, all seedlings died.

The two experimental gardens noted above were closed during the year.

90. *Introduction of Cinnamomum zeylanicum.* (*Blume*). *Sandy variety—E.G.* 501/54—*Topslip.*—Introduction of Chinnamomum zeyanicum (Sandy variety) by stumps and seedlings as an underplant in Karianshola evergreen forests. After removing shrubby undergrowth in E.G. No. 501/54 two year old transplants and stumps from two year old plants were tried at an espacement of 12′×12′. Due topaucity of stocks there were only 12 plants for each treatment. During the year all the plants dried. Hence this Experimental Garden has been closed.

91. *Cinnamomum zeylanicum. Blume.* (*Sandy variety*) *E.G.* 534/56—*Topslip.*—Hundred seedlings of height 8″ to 13″ received from the Wynaad Research Garden, were planted out on 17th August 1956 in the Karianshola evergreen garden under top canopy after removing the middle storey and undergrowth. By March 1958 there were 71/100 survivals with a mean height of 12″.

92. *Cinnamomum zeylanicum. Blume* (*Laterite variety*) *B.G. No.* 535/56—*Topslip.*—Hundred seedlings with a height of 5″ obtained from the Wynaad Research Garden were planted out at an copacement of 6″X6′ in the Karianshola evergreen garden under top conophy after removing the middle stogrey and undergrowth. By March 1958, there were 74/100 surivals with a mean height of 12″.

93. Combining the results of E.Gs. 498/54, 500/54, 501/54, 535/56 and 535/56, the tentative conclusion can be draw that the species does not seem to thrive well in this locality with a rainfall of 75. This species has established itself well and yields fertile seeds in Kannoth with a rainfal of 150″.

94. *Copernicia cerefera* (*Carnuba wax palm*).—A handsome pinnats (leaved palm, 30'—40' high) found in abundance in parts of Brazil. On the underside of the leaves is a thin layer of wax, whose collection is an important industry of Brazil. The wax is used for the manufacture of fine quality candles, polishes, gramaphone records, etc.

Experiments with this species were continued during the year under report. No new sowings were done and only the previous years plants were kept under observation.

(i) TOPSLIP RESEARCH ONE FORESTER'S QUARTERS.

Planted in 1951—There are 3 plants, one in the Research nursery and two in the Research Forester's quarters. The leaves are 1½' in length. The over ground stem will be about 6" in height with a cluster of 8 to 12 leaves.

(ii) *E. G. No.* 482/54—TOPSLIP.

Twenty seedlings were put out in Topslip deciduous garden on 15th June 1954. By the end of March 1958 all the plants were dead. This experimental garden has been closed.

95. *Crocus Kashmiriana.*—This is a small showy bulbs plant 6"—10" high. It is a native of South Europe, cultivated in Spain, France, Turkey, Persia, Kashmir and China, for the sake of the orange coloured stingmas of the flowers. From these, the true saffron of commerce is obtained. This is employed in India, chiefly on medicine and as a colouring and flavouring agent for foodstuffs. It is propogated from bulbs (corns), which when once established, may be left in the ground, undisturbed, for 10 or 15 years.

96. *Crocus kashmiriana* (*Saffron*)—*Introduction in Topslip*—*E.G. No.* 570/55.—Nine saffron bulbs received from Kashmir through the Forest Utilisation Officer, Madras, were planted on 7th December 1955. There was no sprouting of the bulbs at all and all the bulbs died. The indications are that the plant does not thrive at low elevations, such as Topslip.

97. *Crocus kashmiriana—Introduction in Ootacamund.*—Eight bulbs of saffron obtained from Kashmir were planted in Black Bridge Research Nursery on 14th November 1956 at an elevation of 7,200'. They sprouted shortly after planting. In March 1956, only 6 plants were surviving with a mean height of 10", but none of the plants flowered. In June 1956 all the plants died up to ground level; but they sprouted again with the rains, only to die back during the winter. The plants have not flowered so far. Plants planted in the Botanical Gardens, Ootacamund have behaved in a similar fashion. The plants were in a dorment stage at the end of the year. Though it is now more than 3 years since the bulbs

were planted, they have not flowered so far. The indication is that the species is not suitable to the climate of the Nilgiris. The fate of the dormant bulbs will however be watched.

98. *Dalbergia sissoo. Roxb.*—(*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.

99. Experiments with *Dalbergia sissoo* were continued in all Research Centres except Ootacamund. Transplanting one year old seedlings with or without a kumri crop such as Ragi (*Elucine coracana*) or Thenai (*Setaria italica*) or horsegram (*Dolichos biflorus*) appears to be the best method of raising the species. Transplanting two-years old plants and stump planting of one year and two years old plants are also successful.

100. *Dalbergia sissoo. Rexb—Trial in Denkanikotta*—E.Gs. 61/47 and 62/48.—The object of the experiment was to regenerate the fire burnt Lantana area with *Dalbergia sissoo* by means of stump plants and transplants. The results are very encouraging. There is no significant difference between stumps and transplants. It can grow to a height of 28' in 9 years.

This is one of the most useful species in reafforesting areas where Lantana has invaded and suppressed all other vegetation. Seeds of this species has been procured from the Hosur Cattle Farm and supplied to almost all District Forest Officers in the State for being introduced in the Conservator's plots. The results are generally quite satisfactory.

101. *Dalbergia sissoo. Roxb—Trial in Markanam.*—The results of the experiments in Markanam Research Centre are furnished in the following table :—

TABLE XXX.—*Results of experiments with Dalbergia sissoo in Markanam.*

Species.	*E.G. number.*	*Date of planting.*	*Age in March 1958*	*Survivals in March at the end of the year.*	*Mean height.*
				PER CENT.	FEET.
Dalbergia sissoo.	9/55	11th August 1955.	3	66	4·9
Do.	57/56	11th August 1956.	2	60	2
Do.	110/57	17th August 1957.	1	40	1

The growth of *Dalbergia sissoo* in Markanam is fairly satisfactory.

102. *Dalbergia sissoo. Roxb.—Trial in Rameshwaram—E.G.*19/56 —Seeds received from Hosur Cattle Farm were sown in the nursery beds on 26th March 1955. Germination started by 1st April 1955 and was completed by 8th April 1956. In 1955 the seedlings were pricked into bamboo baskets and allowed to establish themselves. Three hundred basket plants were planted on 31st September 1955 in 1′ cube pits at an espacement of 6′ × 6′. Immediately after planting the seedlings got scorched by hot winds and the shoots dried up; but after rains the seedlings sprouted from the ground level. By March 1956 the survivals were 100 per cent. Only during the second growing season a few casualities occured. Watering was continued till 30th June 1957 in order to prevent the plants from drying due to drought. By end of March 1958, the average height was 2½′ with a survival per cent of 61.

103. *Dalbergia sissoo. Roxb—Rameshwaram—E.G.* 59/56.—Hundred stumps of 0·3″ to 0·4″ in diameter were set in Bamboo planting baskets on 12th July 1956. All the stumps sprouted well by 24th July 1956. On 29th September 1956, the above basket plants were planted in one foot cube pits at an espacement of 6′ × 6″. Watering was done on alternate days with one gallon of water from January 1957 to October 1957, without providing wind protection during wind season. At the end of March 1958 there were 100 per cent survivals with a mean height of 3′.

104. *Dalbergia sissoo. Roxb—Rameshwaram Centre—E.G.* 95/57 Seeds received from Hosur Cattle Farm were sown in nursery on 20th November 1956. One hundred seedlings of about 11″ high were planted in one foot cube pits on 24th October 1957 at an espacement of 6′ × 6′. There were 84 casualties due to cyclonic rains in December 1957. Three casualties were replaced on 15th January 1958. The plants were watered on alternate days with one gallon of water from 15th January 1958 to 31st March 1958. By end of March 1958 there was full stocking with a mean height of 12″.

Dalbergia sissoo. Roxb can be raised with good results, when planted as basket plants or as stumps. In Rameshwaram, watering and wind protection are necessary.

105. *Eucalyptus species.*—There are over three hundred 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 1956–57 and also during the current year, seeds of the following species were obtained and tried.

(1) *Eucalyptus astringens*—(Brown mallet).

(2) *Eucalyptus brockwayi*—(Dundas mahogany).

(3) *Eucalyptus camaldulcensis.*

(4) *Eucalptus cladocalys.*

(5) *Eucalyptus dundasi*—(Dundas black butt).

(6) *Eucalyptus flocktoniao.*

(7) *Eucalyptus fruithicetorum.*

(8) *Eucalyptus leucoxylon*—(Yellow gum, white iron bark).

(9) *Eucalyptus longicornis*—(Red morrell).

(10) *Eucalyptus macarthuri.*

(11) *Eucalyptus macrophylla.*

(12) *Eucalyptus melliodora.*

(13) *Eucalyptus microcarpa.*

(14) *Eucalyptus microtheca.*

(15) *Eucalyptus polyanthemos.*

(16) *Eucalyptus salmanophloea*—(Salmon gum).

(17 *Eucalypus salubris*—(gimlet).

(18) *Eucalyptus sideroxylon.*

Eucalyptus globulus (blue gum) was introduced in the Nilgiris in the year 1843. It has acclimatised itself exceedingly well in this locality. The eldest plantation now existing was raised in 1863. There is a scheme for planting very extensive areas for use of the wood as fuel and as raw material in the rayon industry.

Eucalyptus citriodora comes up well in medium elevations (1,500 to 5,000 feet and also at sea level. In Topslip Research Centre, it attains a height 30′ feet and a B.H.G. of 15″ in 3 years, producing a crop of flowers and seeds.

Eucalyptus rostrata (*Syn. Eucalyptus camaldulensis*) comes up very well in all plains, districts and also in sandy soils in the costal districts. The rate of growth is also very fast, being the fastest growing eucalyptus of the plains.

Eucalyptus hybrid of Mysore origin has given very satisfactory results in all Research Centres. In Markanam it has reached a height of 35′ and a B.H.G. of 13·4″ in 3 years. In Vemburuli it has reached a mean height of 19′ in 3 years. This species is being recommended for planting on a large scale in all suitable divisions.

The various species of eucalyptus will be dealt with in the alphabetical order of their specific names. There was considerable difficulty in getting seeds of several of these species for trials and every effort is being made to secure these seeds for furure trials.

106. *Introduction of eucalyptus species in Markanam Research Centre.*—Since 1955 experiments are being conducted in this Research Centre on the introduction of the following species of Eucalyptus :—

(1) *Eucalyptus camaldulensis.*

(2) *Eucalyptus citriodora.*

(3) *Eucalyptus gomphocephala.*
(4) *Eucalyptus grandis.*
(5) *Eucalyptus hybrid.*
(6) *Eucalyptus microtheca.*
(7) *Eucalyptus patens.*
(8) *Eucalyptus redunca.*
(9) *Eucalyptus rudis.*

The results given in the tabular statement show that *Eucalyptus hybrid* of Mysore origin comes up well with the fastest growth and *Eucalyptus rudis*, *Eucalyptus camaldulensis*, *Eucalyptus patens* comes up next best.

TABLE XXXI—*Results of trials of Eucalyptus species at Markanam.*

Species.	*E.G. number.*	*Survivals in March 1958.*	*Height in March 1958.*	*Age.*
(1)	(2)	(3)	(4)	(5)
Eucalyptus camaldulensis.	1/55	20/20	16·25′	3
E. rudis	2/55	20/20	12·55′	3
E. rudis	4/55	28/30	9·85′	3
E. camaldulensis	6/55	29/30	13·4′	3
E. hybrid	30/55	17/30	6·35′	3
E. grandis	32/55	74/74	4·63′	3
E. rudis	33/55	91/91	6·04′	3
E. rudis	34/55	180/180	5·51′	3
E. grandis	35/55	104/104	7·38′	3
E. rudis	37/55	181/181	8·5′	3
E. hybrid	41/55	167/171	3·5′	3
E. patens	42/55	2/4	0·11′	3
E. gomphocephala ..	44/55	17/17	2·17′	3
E. redunca	45/55	2/9	5·87′	3
E. rudis	47/55	29/30	14·96′	3
E. hybrid (brick planting)	48/56	24/25	7·83′	3
E. rudis	53/56	2/30	4·5′	2
E. hybrid	54/56	24/30	6·2′	2
E. hybrid	64/56	39/50	4·74′	2
E. hibrid	74/56	420/422	4·32′	2
E. citriodora	102/57	26/30	16·57′	2
E. camaldulensis	103/57	16/30	13·25′	1
E. microtheca	104/57	19/30	18″	1
E. hybrid	107/57	24/30	6·33′	1
E. hybrid	116/57	20/45	12″	1
E. camaldulensis	118/57	74/100	7·7′	1
E. citriodora	119/57	70/100	11·25′	1
E. dundi	120/57	44/100	12·54′	1
	126/56a7	2/2	41·6″	1

TABLE XXXI—*Results of trials of Eucalyputs species at Markanam*—cont.

Species.	*E.G. number.*	*Survival in March 1958.*	*Height in March 1958.*	*Age.*
(1)	(2)	(3)	(4)	(5)
E. ucalyptus salubris ..	127/57	2/2	40″	1
E. hybrid	141/57	8/30	53″	1
E. salmonophlosa	149/57	1/1	24″	1
E. microcarpa	150/57	1/1	28″	1
E. melliodora	151/57	1/1	30″	1
E. sideroxylon	152/57	2/2	44·6′	1
E. hybrid (brick planting.)	153/57	21/25	20·71′	1
E. camaldulensis	153/57	21/25	23·75′	1
E. citriodora	153/57	4/25	12″	1
E. rudis	154/57	20/20	8′	1
E. hybrid	155/57	556/556	12″	1

107. *Eucalyptus rudis.*—Seeds of western Australia origin were sown in Markanam Research nursery on 19th March 1955. Seedlings were pricked in earthernware pots in May 1955. When the seedlings had established themselves in the earthernware pots, the plants with pots were planted in one foot cube pits without the least disturbances to the root system of the seedlings.

One year old seedlings from the nursery were pricked in basket and planted during 1956 in Markanam. The growth of the seedlings is encouraging.

In 1957 also one Experimental Garden was formed with two years old seedlings from the same nursery.

The table furnished below shows the growth of the species planted in Markanam.

TABLE XXXII—*Results of trials of Eucalyptus rudis in Markanam Centre*

E.G. number.	*Species.*	*Survivals in March 1958.*	*Heights in March 1958.*	*Age.*
(1)	(2)	(3)	(4)	(5)
2/55	*Eucalyptus rudis* ..	20/20	12·6′	3
4/55	*Do.*	28/30	9.9′	3
33/55	*Do.*	91/91	6·64′	3
34/55	*Do.*	180/180	5·5′	3
37/55	*Do.*	181/181	8·5′	3
47/55	*Do.*	29/30	15·0′	3
53/56	*Do.*	2/30	4·5′	2
154/57	*Do.*	20/20	8·0′	1

In March 1956, at the age of one year the mean height was 58·2 inches. During March 1958 at the age of three years the mean height reached in Experimental Garden No. 47/55 was 15·0 feet. It is seen that this species grows very fast. But the growth is not so fast as that of *Eucalyptus hybrid*.

108. *Eucalyptus camaldulensis*—(*Syn. Eucalyptus rostrata*).—Seeds of western Australian origin were sown in nursery beds in March 1955 and seedlings were pricked into bottomless earthenware pots in May 1955, when the seedlings were three to six inches in height. When all the seedlings fully established the pots with plants were planted into one foot cube pits in June 1955. In March 1956 at the age of one year the mean height was 3½ feet and in March 1957 at the age of two years the mean height was 11½ feet. During March 1958 this species had attained an average height of 16·25 feet. This species grows very fast in Markanam.

109. *Eucalyptus grandis*.—Seeds were sown in nursery in March 1955 and seedlings were transplanted into earthenware pots in June 1955. They were 3 to 6 inches in height; when the seedlings had established themselves, they were planted out in one foot cube pits in July 1956. In March 1956 at the age of one year the average height was 2'1". In March 1957 at the age of two years the average height was 4·8 feet. During March 1958 at the age of three years the average height was 6 feet. The rate of growth of the species is therefore not encouraging.

110. *Eucalyptus hybrid*.—Seeds obtained from Mysore State were sown in nursery in 1953 and seedlings were planted around the Research Nursery in the Research Garden at Markanam on 28th January 1954. In March 1958 at the age of four years the trees havethe height of 15 to 40 feet. This species also grows very well in Markanam. Experimental planting of plants in 1956 also have given very encouraging results as shown in the tabular statement above Table XXXI.

111. *Introduction of Eucalyptus species in Rameshwaram Island*.—Eeperiments were started in 1955 with a view to determine whether various species of *Eucalyptus* can be successfully introduced in Rameshwaram Island, as a measure of increasing the production of fuel in the Island and also a measure of fixation of shifting sand due to wind action.

The following species were tried so far :—

Eucalyptus camaldulensis.
Eucalyptus gomphocephala.
Eucalyptus hybrid.
Eucalyptus hemiphloea.
Eucalyptus maculata.
Eucalyptus melanophloea.

Eucalyptus rudis.
Eucalyptus saligna.
Eucalyptus umbellata.

As per detailed notes furnished below, it is found that *Eucalyptus rudis*, *Eucalyptus saligna*, *Eucalyptus hemiphloea* and *Eucalyptus gomphocephala* are definitely unsuitable to this locality while *Eucalyptus hybrid* of Mysore origin and *Eucalyptus camaldulensis* of Australian origin have given encouraging results.

Eucalyptus maculata (seed from New South Wales), *Eucalyptus umbellata* (seed from New South Wales) and *Eucalyptus melanopholea* (seed from Queens land) have given very good results under nursery test. Results of planting out will be recorded in the next Annual Report.

The climatic factors in Rameshwaram are peculiar. From April to October, there will be strong desiccating winds from the South-west direction and plants are scorched during this season due to strong wind action and also due to the abrasive action of sand particles carried by winds. It is necessary to protect the plants from the wind action by providing wind shelter individually to the plants by planting palmyra leaves in the windward side of the plants. During November, December, there will be cyclonic and heavy rains with partial inundation of experimental plots. This too affects the growth of plants adversely. These adverse factors have to be taken into account when deciding on the suitability of several species for Rameshwaram Island.

112. *Eucalyptus hybrid trials in Rameshwaram Centre*. (i) *E. G. Nil* 33/55 *Eucalyptus hybrid—Rameshwaram Centre*.—Seeds were sown in nursery beds on 9th August 1955. The seedlings, when about 3 inches in height were pricked into planting baskets made of bamboo splits on 21st October 1955. The seedlings with baskets were planted out on 24th January 1956 at an espacement of 6′ × 6′ in 1′ cube pits. The seedlings were then 12″ to 18″ in height. Watering has done on alternate days with 1/3 pot of water (..1 gallon) on non-rainy days. By March 1958 there were 95 per cent survivals with a mean height of 6 feet.

(ii) *E. G. No.* 54/56—*Eucalyptus hybrid—Rameshwaram Centre*.—Seeds were sown in nursery bed on 23rd October 1955. The seedlings were pricked out into bamboo baskets on 7th April 1956. The basket plants were planted out on 22nd September 1956 in 1 foot cube pits, at an espacement of 6′ × 6′. Watering was done daily with 1/3 pot of water (.. 1 gallon) on all non-rainy days. By March 1958, there were 100 per cent survivals with a mean height of 3 feet.

(iii) *E. G.* 55/56—*Eucalyptus hybrid—Rameshwaram Centre*.—Seeds were sown in nursery bed on 9th August 1955. Seedlings were pricked out into bamboo baskets on 21st February 1956. They

were planted out on 9th August 1956 when they were one year old. Watering was done with 1/3 pot water (.. 1 gallon) on all non-rainy days. By March 1958, there were 100 per cent survivals with a mean height of 3½ feet.

(iv) *E.G. No. 78/57—Eucalyptus hybrid—Rameshwaram Centre.*—Seeds of Kolar origin were sown in nursery bed on 10th July 1956 and seedlings raised. In September 1956, 126 seedlings were pricked into planting baskets. When the seedlings were at a height of 10 inches the basket plants were planted in one foot cube pits at an espacement of 6 feet by 6 feet. Wind protection was provided to the plants. Watering on alternate days with one gallon of water was done from March to October 1957. By end of March 1958 there were 100 per cent survivals with a mean height of 4 feet.

(v) *E.G. No. 99/57—Eucalyptus hybrid—Rameshwaram Centre.*—One hundred naked transplants of 12 inches in height were planted in one foot cube pits at an espacement of 6 feet by 6 feet on 24th October 1957. The seedlings were taken to this experiment from Rameshwaram nursery. On 10th November 1957 all seedlings put forth fresh shoots. From 19th November 1957 to 7th January 1958 the plot was under water in cyclonic rains. In December 1957 there was 70/100 casualties. On 15th January 1958 all casualties were replaced with basket plants of the same age. Watering was done on alternate days with one gallon of water from 15th January to 31st March 1958. By end of March 1958 there were 100 per cent survivals with a mean height of 2 feet.

The above results are summarised in the tabular statement below :—

TABLE XXXIII—*Statement showing trials of Eucalyptus hybrid in Rameshwaram Centre.*

Serial number.	*E.G. number.*	*Date of planting.*	*By March 1958.*	
			Survivals.	*Mean height*
			PER CENT.	FEET.
1	33/55	24th January 1956.	95	6
2	54/56	22nd September 1956.	100	3
3	56/56	9th August 1956.	100	3½
4	78/57	March 1957.	100	4
	99/57	24th October 1957.	100	2*

* Naked transplants Cyclonic rains and flooding of plot.

From the above statement, it appears that *Eucalyptus hybrid* is well suited to sandy soils of the Rameshwaram Island, attaining a height of 3 feet in the first year and 6 feet in two years.

113. *E. G. No. 15/56—Eucalyptus rudis—Rameshwaram Centre.*—Seeds of Australian origin were sown in nursery beds on 21st March 1955. The seedlings were pricked out into bamboo baskets during June 1955, when the seedlings had established themselves in the baskets, the basket plants were planted out on 20th September 1955 in one foot cube pits at an espacement of 6 feet by 6 feet. Watering was done for a period of one month on non-rainy days with one-third pot of water (.. one gallon). The growth of the seedlings was very slow. Though wind protection was given and watering was also continued it is not able to bear the scorching wind. During the month of March 1958, the survivals were three out of 60 and the mean height was 22·6 inches.

E.G. No. 16/55—Eucalyptus rudis—Rameshwaram Centre.—Seeds of California origin were sown in the nursery beds on 21st March 1955. The seedlings were pricked out into bamboo baskets on 21st March 1956. When the seedlings had established themselves in the baskets, they were planted out without the least disturbance to the root system, in one foot cube pits on 20th September 1955 at an espacement of 6 feet by 6 feet. Watering was done on non-rainy days with one-third of water (.. 1 gallon). During the month of February 1956 seventy-five casualties occurred due to insect attack on roots. They were treated with Aldrin dust and casualties were replaced. Wind protection was also given during the month of June 1956, with palmyra leaves. During March 1958, there were 5 per cent survivals with a mean height of 29·6 inches. This species does not appear to come up satisfactorily in this locality.

114. *E.G. No. 13/55—Eucalyptus cameldulensis—Rameshwaram Centre.*—Seeds of Australian origin were sown in the nursery beds on 21st March 1955. The seedlings were then pricked out into bamboo baskets in June 1955. After the plants had attained a height of 10 inches in the baskets, 156 plants were planted out in one foot cube pits and at an espacement of 6 feet by 6 feet on 19th September 1955. Watering was done on non-rainy days at the rate of one-third pot of water (.. 1 gallon) up to 30th June 1957. Since the climate was very hot and scorching wind blow, wind protection was given by means of palmyra leaves in March 1956. By March 1958 there were 96 per cent survivals with a mean height of 3½ feet. This species appears suitable to this locality.

115. *E.G. No. 14/55—Eucalyptus gomphocaphala—Rameshwaram Centre.*—Seeds of Australian origin were sown in the nursery beds on 21st March 1955. The seedlings were set in baskets during June 1955. After they had well established themselves in the baskets, 24 basket plants were planted out on 20th September 1955 in one foot cube pits at an espacement of 6 feet by 6 feet. Watering was done for one month during non-rainy days. Watering was stopped and resumed again from 22nd December 1955 to 30th June 1957. Though wind protection was given during scorching

action of wind, all seedlings except one died. By March 1958 there was only one surviving plant with a height of 24 inches. This species is definitely not suitable to this locality.

116. *Introduction of various species of Eucalyptus in Topslip.*—Experiments were started in 1954 with a view to determine whether various species of *Eucalyptus* can be successfully introduced in Topslip Research Centre at an elevation of 2,400 feet and also at Ayirangal locality near Sethumadai at an elevation of 1,500 feet.

Six species were tried, namely :—

(1) *Eucalyptus citriodera.*

(2) *Eucalyptus rudis.*

(3) *Eucalyptus camaldulensis.*

(4) *Eucalyptus saligna* (3 origins).

(5) *Eucalyptus grandis.*

(6) *Eucalyptus terticornis.*

As per detailed notes furnished below, it is found that *Eucalyptus grandis, Eucalyptus terticornis* and *Eucalyptus saligna* are definitely unsuitable, while *Eucalyptus citriodora* has given most encouraging results. In E.G. No. 491/54, *Eucalyptus citriodora* has given 86/100 survivals with a mean height of 30 feet and a B.H.G. of 12 inches in four years. In E.G. No. 505/55 the same species has given a survival of 88/106 with a mean height of 30 feet and a B.H.G. of 15 inches in three years. No other species of Eucalyptus has given comparable results in Topslip centre.

TABLE XXXIV—*Growth of Eucalyptus species in Topslip Centre.*

E.G. number.	*Species.*	*Age.*	*Survival.*	*Mean height.*	*Mean girth.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
				FEET.	INCHES.	
491/54	*Eucalyptus citriodora.*	4	86/100	30	12	Trees are in flower.
505/55	Do.	3	88/106	30	15	Do.
507/55	*Eucalyptus rudis* ..	3	78/100	16	14	..
518/55	*Eucalyptus citriodora.*	3	95/150	8	10	Poor growth under canopy.
541/56	*Eucalyptus hybrid* ..	2	281/400	16	7½	..
542/56	*Eucalyptus terticornis*	2	21/200	3	..	..
546/56	*Eucalyptus saligna* (Australian origin)	2	5/40	3	5	..
547/56	*Eucalyptus saligna* (Belgian Congo origin)	2	3/24	2	..	..

TABLE XXXIV—*Growth of Eucalyptus species in Topslip Centre*—cont.

E.G. number.	*Species.*	*Age.*	*Survival.*	*Mean height.*	*Mean girth.*	*Remarks.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
				FEET	INCHES.	
548/56	*E. saligna* (Argentina origin)	2	4/16	10½	4½	..
549/56	*E. grandis*			Closed.		
553/57	*E. hybrid*	1	17/100	1½	..	..
557/57	*E. terticornis*	1	45/100	1	..	..
558/57	*E. hybrid*	1	39/100	1½	..	..
560/57	*E. camaldulensis*	1	66/100	2	..	..

117. *Eucalyptus camaldulensis—Dehn Syn. (Eucalyptus restrata schlecht) River gum—River Red gum—Red gum.*—It is a native of Australia where it grows in a wide geographical range. It reaches a height of 80 feet to 120 feet and a girth of 3 feet to 7 feet. It is one of the most useful species that can be grown in the comparatively dry districts of Madras State. One significant advantage of this species is that it is not browsed by cattle or even by goats. It can be grown on different kinds of soils—from allurial loam to red lateritic loam or even sea sand ; but it does not thrive in black cotton or clay soils. It can stand drought well. It thrives well with a rainfall of 30 inches and can grow in the drier regions with a rainfall of 20 inches.

Experiments were started in 1955 with this species in the Research Centre at Markanam, Rameshwaram and Topslip. The results are given in the tabular statement below :—

TABLE XXXV—*Growth statistics of Eucalyptus camaldulensis in Rameshwaram, Markanam and Topslip.*

Research centre.	*Species.*	*E.G. number.*	*Date of planting.*	*Survivals in March 1958.*	*Mean height in March 1958.*
(1)	(2)	(3)	(4)	(5)	(6)
				PER CENT.	
Markanam ..	*E. camaldulensis.*	1/55	May 1955.	100	16·3′
Markanam ..	Do.	6/55	May 1955.	100	13·4′
Rameshwaram.	Do.	13/55	March 1955.	96	3·5′
Topslip ..	Do.	506/55	11th March 1955.	90	16′ Girth 14″

Except on the sandy soil of Rameshwaram, this species has come up quite satisfactorily, reaching a height of 16 feet and a B.H.G. of 14 inches in three years. In Topslip, this species is only slightly inferior in height growth to *Eucalyptus citriodora.*

118. *Eucalyptus citriodora.*—At present only the leaves of *Eucalyptus globulus* are distilled on a commercial scale for the production of Eucalyptus oil. It is beleived that the leaves of

Eucalyptus citriodora contains 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 Sim's 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 of the leaves, wood and bark, as furnished by the Chemistry of Forest Products Branch, division of Chemical Technology of the Forest Research Institute, Dehra Dun are furnished below :—

Leaves.—(Zero moisture basis)—Contains 4·5 per cent oil. This is an exceptionally high yield.

Wood.—(Zero moisture basis)—Contains 2·36 per cent of tannins, the total solids and non-tans being 7·08 and 4·72 per cent respectively.

Bark.—Total solids—6·144 per cent. Non-tans—2·632 per cent. Tannins—3·512 per cent.

The bark is therefore very poor in tannin content and hence industrial exploitation of the bark is not feasible.

Economic exploitation of the wood and the bark in the Leather Industry, is therefore ruled out. The question of the industrial distillation of the leaves for essential oil, needs to be further investigated.

119. *Eucalyptus citriodora—Experiments—Topslip*—(i) *E.G. No.* 491/54—*Topslip.*—Seeds were sown in bamboo baskets in July 1954. When the seedlings were 3 inches to 6 inches high in September 1954, they were planted out at an espacement of 9 feet by 9 feet in hundred stakes. In February 1955, at age of one year, the survivals were 91/100 and average height was 38 inches and maximum height 64 inches. By the end of two years, the survival was 56 per cent due to breaking down of the plants by wild 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.

By the end of March 1958 there were 86/100 survials with a mean height of 30 feet and girth of 12 inches in 4 years. This species grows remarkably well in Topslip attaining mean height of 30 feet in 3 years. The canopy has closed and some trees are in flowers. Further observations are being made.

(ii) *E G. No.* 505/55—*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.

By the end of March 1958, there were 88/106 survivals with an average height of 30 feet and girth 14 inches in 3 years. Growth of this species is extremely rapid. Some trees are in flowers.

(iii) *E.G. No.* 518/55—*Topslip planted without clearfelling in Karianshola under top canopy.*—150 seedlings with height varying from 7 inches to 20 inches raised in bamboo tubes were planted at an espacement of 9 feet by 9 feet on 17th May 1955. The object of the experiment is to study the growth and development of the species and to find out whether it is possible to introduce valuable hard and softwood species in Karianshola without clearfelling, under top canopy.

By March 1958, there were 95/150 survivals with a mean height of 8 feet. In the open the species grows better than under top canopy. The plants in the open are 23 feet height with a girth of 10 inches.

120. *Introduction of Eucalyptus species in Vemburuli Research Centre.*—The following three species of Eucalyptus were tried in Vemburuli Research Centres :—

(i) *Eucalyptus hybrid.*

(ii) *Eucalyptus grandis.*

(iii) *Eucalyptus rudis..*

The details are furnished below :—

(i) *E.G. No.* 1/55—*Eucalyptus grandis—Vemburuli.*—Eucalyptus grandis was planted on 12th October 1955 as basketed plants in one foot cube pits and watered for one year on non-rainy days. The species has given 15 per cent survivals and mean height of four and a half feet in 3 years. The results are not encouraging.

(ii) *E.G. No.* 9/55—*Eucalyptus rudis—Vemburuli.*—Eucalyptus rudis was planted as basketed seedlings in one foot cube pits on 19th October 1955 and watered on non-rainy days for a period of one year. The species has given 90 per cent survivals and a mean height growth of thirteen and a half feet in 3 years. The results are very encouraging.

(iii) *E.G. No.* 10/56—*Eucalyptus hybrid—Vemburuli.*—Eucalyptus hybrid was planted on 28th May 1956 as basketed seedlings in one foot cube pits and watered with quarter pot of water equivalent to three quarter gallon of water on non-rainy days. The species have given 83 per cent survivals and a mean height growth of 13 feet 4 inches in 2 years. The species can be raised successfully in localities like Vemburuli of Madurai South division when planted as pot plants and watered on non-rainy days.

121. *Eucalyptus astringens* (*Brown mallet*).—It is a small and moderate sized tree growing to a height of 30 feet to fifty feet. It is indigenous to South Australia where the rainfall

varies from 14 inches to 22 inches and an altitude of 900 feet to 1,200 feet. It is a drought resistent tree occurring on Stoney hills.

The seeds of Australian origin were received from the Forest Research Institute, Dehra Dun and were tried in Markanam, Ulundurpet, Tanjore and Rameshwaram Research Centres of this State. No germination was noticed in any of the Centres.

122. *Eucalyptus brockwayi* (*Dundas mahogony*).—It is a big sized tree attaining a height of 80 feet under favourable conditions. The tree grows in the wood lands of Southern, Western Australia where the summer is very hot and there is very little rain say 9 inches to 15 inches, not well distributed, at an altitude of 600 feet to 1,400 feet. The tree grows in sandy soil, where the soil is alkaline or stiff sandy clay. The bark yields rich tannin, being more than 40 per cent. The timberis though, reddish in colour and can be used for mining timbers, fuel and tool hands.

The seeds (of Australian origin) were received from the Forest Research Institute, Dehra Dun and tried in Markanam, Ulundurpet, Tanjore and Rameshwaram Research Centres of this State. No germination was noticed in any of the Research Centres.

123. *Eucalyptus dundais* (*Dundas black butt*).—It is a short sized tree growing to a height of 30 feet to 60 feet with short bole which rarely exceeds one-third of the total height. The wood is dark brown, hard and dense and is used for mining timbers and fuel.

The tree is indigenous in Western Australia where the rain fall is 9 inches to 15 inches and an altitude of 750 feet to 1,250 feet. It grows both in gravelly and alluvial loams.

The seeds of Australian origin were received from the Forest Research Institute, Dehra Dun and tried in Markanam, Ulundurpet, Tanjore and Rameshwaram Research Centres of this State. No germination was noticed in the centres except Markanam Research Centre.

E.G. No. 126/57—*Markanam—Eucalyptus dundais.*—The seeds were sown in the nursery bed on 11th May 1957 and the seedlings were transplanted in pots on 15th June 1957. On 7th September 1957 the pot plants were planted in one foot cube pits During March 1958 there were 2 2 survivals with a mean height of 40 inches. This species growing well in Markanam. Further observations are being made.

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

125. *Eucalyptus globulus* (*Bluegum*)—*Tree increment plot 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 ninety five years old. The tallest tree was 242 feet high in 1951 probably the tallest tree in Peninsular India. The mean girth of the trees is 10 feet to 11 feet at age 91 years in 1954.

126. *Eucalyptus globulus Manurial experiment R. P.* 25/54—*Pykarai Nilgiris.*—This experiment was started in July 1954 to ascertain whether the growth of the plants can be accelerated by the addition of N. P. K. fertilizer mixture. There were two treatments, viz.

A: Control—no manure added;

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

Mossed blue gum Seedlings were planted in one foot cube pits. Measurements in March 1956 which are furnished below show that the addition of 2 oz. of manure mixture is definitely beneficial in promoting height growth and increasing survival per cent.

TABLE XXXVI—*Eucalyptus globulus Manurial experiment.*

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

The experimental plot was accidentally burnt by a fire which escaped from the District Plantation and hence no measurements are furnished.

127. *Eucalyptus globulus Manurial treatment E. G.* 54/57—*Ootacamund Centre.*—A similar experiment was started during 1957 in Brooks lands Ootacamund with two treatments and 10 replications.

An area of 1/3 of an acre was divided into 20 sub plots and 60 mossed *Eucalyptus globulus* seedlings were planted without manure in treatment (A) Control and 60 mossed *Eucalyptus globulus* seedlings ware planted with one oz, of wattle fertilizer in treatment (B) in one foot cube pits at an espacement of 11' x 11'. The allotment to treatments was at random. By the end of the year the results were as follows:—

TABLE XXXVII—*Eucalyptus globulus Manurial treatment.*

Locality.	*Treatment.*	*Number put in*	*Number surviving.*	*Average height.*
Brooks land	A	60	59	13·6
	B	60	60	16·9

The indication, therefore, is that additions of 1 oz. of manure in the first year is helpful in promoting increased height growth. Further repetitions of the experiment will be undertaken.

128. *Eucalyptus globulus (Bluegum) Experiment lopping of leaves more than once during the rotation.*—At present in the Government plantations, the leaves are lopped only in the year of clear felling at the rotation age of fifteen 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 mounts during the three years from 1952 53, for the Cairnhill acupe 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.

E.P. No. 32 of 1957—*Ootacamund Centre—Bluegum lopping experiment.*—An experiment was started during the year to find out whether Bluegum trees can be lopped more than once during the rotation of fifteen 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 Bluegum 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 allotted to 'A' treatment during the last year.

The object of the experiment is to find out whether lopping adversely reduce 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 of four years is 6,000 lb. 1,200 lb., of cleaned leaves fetched Rs. 9 when sold and the faggot 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.

During March 1957, lopping of leaves was done in two sub-plots allotted to Treatment 'B.' The branches were cut for two-third 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 2,000 lb. of cleaned leaves free from twigs and branches or the yield of leaves only per acre at age five years is 10,000 lb. The 2,000 lb. of cleaned leaves fetched Rs. 12·50 nP. When sold and the faggot wood when sold fetched Rs. 2·50. Hence the total revenue for this operation was Rs. 15·00 for 0·2 acre of Rs. 75·00 per acre.

So far the trees lopped in 1956 have not extended their crown down-wards by putting forth new shoots, except a few epicormic branches lower down.

In the four lopped plots of 'B' and 'D' treatments new shoots are coming up only here and there. There is not much difference between the crown development of lopped and unlopped trees. Third lopping will be done in the sub-plots 'A' and 'C' in the eighth year. Final results will be available only after the fifteenth year.

129. *Eucalyptus globulus—Lopping experiment—Ootacamund Centre.*—A similar experiment on an improved design suggested by the Chief Conservator of Forests on the lopping of Bluegum leaves was started during October 1957 in the year 1953–54 Bluegum plantation at Aramby shola.

An area of 1·2 acres was selected and divided into 12 sub-plots of 1 sq. chain each. Lopping was done in all the 12 sub-plots, i.e., two-third of the crown was lopped, leaving one-third of the crown at the top. Treatments will be allotted to the above sub-plots according to the weight of leaves obtained from the sub-plots during the preliminary lopping.

By lopping the 12 sub-plots in 1·2 acres, 11,875 lb. of green clean leaves (excluding branches and twigs) were obtained and the same were sold in public auction at Re. 1·00 per 100 lb. The brushwood obtained was sold for Rs. 25·00 and so a net revenue of

Rs. 118·75 for leaves.
Rs. 25·00 for brushwood.

Rs. 143·75 total revenue,

Rs. 143·75 was realised.

Lockspit trenches of 6 feet by 1 foot have been dug around the plot with mounds raised in between the trenches.

The design of the experiment is as follows :—

A : Lopping cycle—8, 12 and 15 years.

B : Lopping cycle—10 and 15 years.

C : Lopping cycle—15 years.

The lopping of the sub-plots has been done at the age of 4 years in all the sub-plots during October 1957, in order to secure initial comparability of all the sub-plots at the starting of the experiment.

130. *Eucalyptus globulus* (*Bluegum*)—*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 fifteen 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.

Bluegum 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 four 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 Bluegum 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 coppice shoots reduced to 3 per stool.

D : Number of coppice shoots reduced to 4 per stool.

The yield of green leaves from the felled coppice shoots in the three sub-plots aggregating one acre in extent was 1,600 lb. of green leaves. At a conservative estimate of Rs. 1–8–0 per load

of 200 lb. the leaf is worth Rs. 12 against an expenditure on the reduction of coppice shoots of only Rs. 6–4–0. Hence this operation of reduction of coppice shoots will be a source of revenue.

In March 1958, the following measurements were recorded of the mean height and mean girth of coppice shoots in the several sub-plots.

TABLE XXXVIII—*Results of experiments on coppicing of Bluegum.*

Treatment.	*Place.*	*Mean height.*	*Mean girth.*
A : Control—No reduction of coppice shoots.	Muthorai.	19′	8′ 6″
B : Shoots reduced to 2 per stool	Do.	20′ 6″	8′ 9″
C : Shoots reduced to 3 per stool	Do	18′ 9″	7′ 6″
D : Shoots reduced to 4 per stool ..	Do.	18′ 6″	7′ 4″

As suggested by the Chief Conservator of Forests an experiment was started during October 1957 on the reduction of coppice shoots on Bluegum on an improved design.

The design of the experiment is as follows :—

A : Control—All shoots left intact without reduction of coppice shoots.

B : Number of shoots reduced to 1 per stool.

C : Number of shoots reduced to 2 per stool.

D : Number of shoots reduced to 3 per stool.

An area of 1·2 acres has been selected and 120 trees of 8 inches to 12 inches in diameter were recorded in the 1945 Bluegum plantation at Aramby shola. The trees have been marked for extraction of Electric Transmission poles by the District staff. As soon as the extraction of Electric Transmission poles is completed, the treatments will be allotted. Lock-spit trenches around the plot has already been completed to demarcate the plot.

Sample plots of Bluegum.—At present there are no sample plots for Bluegum (*Eucalyptus globulus*). This is grown extensively in plantations in the Nilgiris division. It is proposed to select sample plots of different ages in crops raised both from seedlings and from coppice with a view to study the growth in height, diameter and volume of plantation crops. Progress in this respect can be expected in the next year's report.

131. *Distillation of Bluegum oil in the Nilgiris.*—The distillation of the leaves of Bluegum (*Eucalyptus globulus*) for Eucalyptus oil is a flurishing cottage industry in the Nilgiris. The oil is used extensively for internal consumption and also for export.

In February 1957, a complaint was received from the Nilgiris Eucalyptus Oil Merchants' Association that unscrupulous persons were distilling the oil of Redgum (*Eucalyptus eugenioides*) and adulterating Bluegum oil with Redgum oil.

It was therefore necessary to ascertain to what extent the properties of Bluegum oil were altered by adulteration with Redgum oil. A sample of Redgum oil was therefore forwarded to the Chemical Testing and Analytical Laboratory, Department of Commerce and Industry, Madras, for analysis.

The test report was as follows :—

SAMPLE REDGUM OIL (TEST REPORT NO. 181/57, dated 21ST AUGUST 1957.)

(*Sample Redgum leaves oil* (*Result as per specification for oil of Eucalyptus as per* 1—8—328.)

1 Colour and appearance	.. ..	Pale yellow liquid	passes.
2 Odour	.. ..	Characteristic aromatic compheraceous odour—Passes.	
3 Specific gravity at 30°C	.. ..	0·8970 ..	Passes.
4 Optical rotation	.. .. ..	1° ..	Passes.
5 Refractive index at 25°C	.. ..	1·4640 ..	Passes.
6 Limit test for aldehydes	.. ..	4·5 ml. of 0·5 N alcoholic-KOH ; exceeds by 2·5 ml.	Fails.
7 Cinecole content by weight	..	53·82 per cent (must be at least 55 per cent)	—Fails.

Though Redgum oil closely resembles Bluegum oil in several respects, Redgum oil is different from Bluegum oil as regards items (6) and (7) above and hence Redgum oil is not suitable for adulterating with Bluegum oil.

132. *Bluegum oil—Physical properties—Analytical data.*—In this connection, it will not be out of place to furnish the properties of *Eucalyptus globulus* oil of Spanish, American and Belgian Congo origin, as these are the oils which are available in International Trade.

SPANISH OIL.

(*The Essential oils by E. Guenther, Vol. IV, p.* 484.)

	Crude oil.	*Rectified oil.*
Specific gravity at 15°	0·9175 to 0·930	0·905 to 0·922
Optical rotation at 30°	+ 2° 0′ to + 7° 12′	+ 1° 48′ to + 9° 0′
Cinecole content	65·5 to 73·3 per cent.	71·3 to 84·5 per cent.
Solubility in 70 per cent alcohol ..	Soluble in 2·2 to 11 vols., frequently with separation of paraffins.	Soluble in 1·5 to 10 vols.

AMERICAN OIL.

(*The Essential oils by E. Guenther, Vol. IV, p.* 491.)

	Crude oil.		*Rectified oil.*	
	I.	*II.*	*I.*	*II.*
Specific gravity at 25°/25°.	0·910	0·901	0·907	0·900
Optical rotation ..	−9°50′	−12° 0′	−9° 37′	−10° 47′
Refractive index at 20°.	1·4647	1·4633	1·4644	1·4622
Cinecole content ..	57·9 per cent.	56·3 per cent.	61·2 per cent.	61·2 per cent.
Solubility at 25° ..	Soluble in 1 vol. and more of 80 per cent alcohol. Hazy in 10 vol. of 70 per cent alcohol.	Opalescent in 1·5 to 2 vols. and more of 80 per cent alcohol.	Cloudy in 10 vols. of 70 per cent alcohol. Soluble in 1 vol. of 80 per cent alcohol.	Turbid in 10 vols. of 70 per cent alcohol.

BELGIAN CONGO OIL.

(*The Essential oils by E. Guenther, Vol. IV, p.* 501.)

	(*Properties of medicinal Eucalyptus*).
Specific gravity at 25°/25°	0·907 to 0·909
Optical rotation at 25°	− 4° 19′ to − 5° 15′
Refractive index at 20°	1·4598 to 1·4607
Cinecole content (O-cresol method)	71 to 74·2 per cent.
Solubility	Soluble in 3 vol. and more of 70 per cent alcohol.

133. *Eucalyptus grandis* (*Flooded gum or Rose gum*).—It is a native of Australia. It closely resembles *Eucalyptus saligna* (*Sydney Bluegum*). Its timber is reported to be not durable.

Seeds obtained from Australia were tried in several Research Centres. The results are furnished below :—

TABLE XXXIX—*Growth statistics of Eucalyptus grandis.*

Serial number and Research centre.	*E.G. number.*	*Date of planting.*	*Age in March 1958.*	*March 1958.*	
				Survival.	*Mean height.*
				PER CENT.	FEET.
1 Markanam	5/55	22nd June 1955.	3	43	3
2 Do.	22/55	10th August 1955.	3	20	3
3 Do.	32/55	24th July 1955.	3	100	4·6
4 Do.	35/55	9th October 1955.	3	105	7·4
5 Vemburuli	1/55	12th October 1955.	2	15	4·5

134.—*Eucalyptus longicornis* (*Red morrell*).—It is a moderate sized tree attaining a height of 60′ to 80′. The wood is of good quality and is used as sawn timber and for firewood. It is an indigenous tree of Western Australia. It can grow in locality with a rainfall of 10″ to 25″ and an altitude of 1,000′ to 1,400′. It grows on red brown earth or acid gravelly soils.

The seeds of Australian origin were received from the Forest Research Institute, Dehra Dun and were tried in Markanam, Ulundurpet, Tanjavour and Rameswaram Research Centres of this State. The seeds have not germinated in any of the centres.

135. *Eucalyptus leucoxylon* (*Yellow gum*) *White iron bark*.—It is a moderate sized tree, often crooked and stunted, attained a height of 60′ to 90′. The wood is hard, strong and durable used for sleepers, posts, wagons and floors. It is indigenous tree of Victoria and South Australia. It grows in regions with a rainfall of 20″ to 30″ and altitude 500′ to 1,200′. It grows on slopes and flats with compact soil.

The seeds of Australian origin were got from the Forest Research Institute, Dehra Dun and were tried in Markanam, Ulunderpet, Tanjavour and Rameswaram Research Centres of this State. No germination was noticed in any of the Centres.

136. *Eucalyptus salmonophloea* (*Salmon gum*).—It is a moderate sized to fairly large tree attaining 80 feet to 100 feet under favourable conditions. The wood is reddish, straight grained, strong and durable used for sleepers, mine props, telephone poles and fuel. It is a native plant of Western Australia extending into regions with a low rainfall of 9″ and an altitude of 1,000′ to 1,400 feet. It grows in sand, sandy loams, and fertile red clay loams.

The seeds of Australian origin were received from the Forest Research Institute, Dehra Dun and were tried in Markanam, Ulundurpet, Tanjavour and Rameswaram Research Centres of this State.

Markanam E. G. No. 149/57—*Eucalyptus salmonophloea*.—The seeds were sown in Marakanam Research Nursery on 7th July 1957. The seedlings were pricked in earthenware pots on 13th September 1957. On 26th November 1957 the seedlings were planted in one foot cube pits. In March 1958 there were 1/1 survivals with a mean height of 2 feet. The surviving one plant is growing well. Further results are being watched.

137. *Eucalyptus salubris* (*Gimlet*).—It is rather a small sized tree attaining a height of 40 feet to 60 feet. The wood is strong, hard and heavy, used for mine props, building fencing and firewood. The tree grows in the Eastern Goldfields of Western Australia in regions with a low rainfall of 8″ to 18″ and an altitude of 900′ to 1,200′. It grows in red brown neutral sandy loams. It is not hardy to frost.

The seeds of Australian origin were received from Forest Research Institute, Dehra Dun and were trained in Markanam, Ulundurpet, Tanjore and Rameswaram centres of this State. No germination was noticed in any centres except Markanam Research Centre.

Markanam—E.G. No. 127/57—*Eucalyptus salubris*.—Seeds of Australian origin were sown in the nursery bed on 11th May 1957. The seedings were set in earthen aware pots on 15th June 1957.

After they had well established themselves two pot plants were planted out on 7th September 1957, in one foot cube pitsm In March 1958 there were 2/2 survivals with a mean height of 4 feet. The growth is encouraging.

138. *Eucalyptus rudis—Endl.* (*Flooded Gum*).—This tree is indigenous solely in Western Australia. It has many features which link it with *Eucalyptus Nostrata* (Red gum).

This is a small to moderate tree which is useful only as fuel. It comes up well with a rain all of 25″ to 40″, but can tolerate annual rainfall of 15″ to 25″.

Topslip—E.G. No. 507/55 *Eucalypnts rudis*.—Seedlings from hursery bed were pricked out into bamboo tubes when they were two months old and 3″ in height. In June 1955, they were planted out in Topslip decidous Research Garden. In March 1956, about a year after planting there were 85 per cent survivals, with a mean height of 3′ 4″ and a maximum of 6½′.

In March 1958 there were 6/40 survivals with a mean height of 3 feet. The poor result is due to damages by wild game which damaged and broke the leading shoots.

Eucalyptus rudis has beesn tried with greater success in the Rameswaram, Vemburuli and Markanam centres. The results are given in the previous paragraph; they are summarised below:

TABLE XI.— *Summarised growth statistics.*

Serial number and Research centre.	*E.G. number.*	*Date of planting.*	*In March 1958.*	
			Survival.	*Mean height.*
			PER CENT.	FEET.
1 Rameswaram	16/55	20th September 1955.	5	29·6
2 Vemburuli	9/55	19th October 1955.	90	13·5
3 Markanam	2/55	..	20/20	12·6

139. *Eucalyptus saligna-Topslip Centre—EGs. Nos.* 546, 547 *and* 548 *of* 1956.—Seeds of Australian, Belgian Congo and Argentina origins were sown in nursery in April 1956. The young seedlings were pricked out into bamboo tubes. The seedlings were planted out in November 1956 in the Ayirangal locality at an espacement of 6′ × 6′. The development of the seedlings was shown in the table below. Further observations are required.

TABLE XLI—*Development of Eucalyptus saligna seedlings.*

Serial number, species and origin.	*E.G. number.*	*Number planted.*	*Date of planting.*	*Survival on*		*Mean height in March 1958.*
				9th Jan. 1957.	*March 1958.*	
						FEET.
1 Eucalyptus saligna (Australian oirgin).	546/56	40	23rd November 1956.	21/40	5/40	3
2 E. Saligna (Belgian longo oirgin).	547/56	24	Do.	14/24	3/24	2
3 E. Saligna (Argentina origin).	548/56	16	Do.	10/16	4/16	10½

140. *Grevillea robusta—A. cunn.* (*Silver Oak*).—This has been introduced into India from Australia and has been extensively cultivated, particularly as a shade tree for the Tea crop. The pretty bipinnate fernlike leaves, silvery white beneath, render the tree very ornamental.

Grevillea robusta (*Noganur R.F. Salem North Division*).—There is a plantation of *Grevillea robusta* raised in 1947. The average height growth is 50 feet and the mean D.B.H. is 27 inches. Within the plot there are scattered paper mulberry trees of size 50 feet high and 20 inches D.B.H. There are also a few *Melia dubia* trees of size 50 feet high and 22 inches D.B.H. The growth of the three species is remarkably good. Paper Mulberry, seeds profusely, and natural seedlings are found.

141. *Hyphaeni thabaica* (*Dum nut*).—This is an exotic palm of Egypt and the Sudan, valued for its fruit. The kernel of the fruit is hard white and of a very fine texture, suitable for making 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 the following plants exist.

Topslip Research Nursery—Hyphaeni thebaica.—(Dum nut) ated in 1957. There are three plants in the compound of the earch Forester's quarters. The leaves are 1½ feet long. No a has emerged from the ground. The conclusion is that this never become a profitable plant to grow here.

142. *Morus alba—Linn.* (*Mulberry*).—This is probably a native China. This species has attained great importance on account he keen demand for the wood in the sports goods industry and because it is a good host to the silk worms in the Sericulture ustry. This has been cultivated extensively in irrigated plan- ons in the Punjab for use in the Sports Goods Industry.

According to Research experiments carried in Madras in pre- us years the best method of raising the plant is by transplanting year old plants.

During 1954–55 seeds were obtained from Sericultural Expert llegal and from Meerut and supplied to District Forest Officers, llore East, Vellore West, Salem South, Coimbatore South, durai West and Salem North divisions for raising plantations.

Morus alba was tried in the Research Centres at Topslip, Den- nikota, Markanam and Tanjore. The results are furnished in following paragraphs :

143. *Morus alba. Linn., Topslip, E. G. No.* 511/55.—Eight nths old entire transplants of an average height of 15 inches re transplanted in one foot cube pits in Topslip, in June 1955. March 1956 there were 97 per cent survivals. The seedlings re very badly browsed by deer and Sambhur and the survivals re bushy with an average height of only 9 inches. Hence ade- ate game proof fencing is necessary for its development in a ality like Topslip.

By March 1958, there were 91/100 survivals with a mean height 6 inches. The tops of all the seedlings were broken due to wild me. Hence this experimental garden has been closed.

144. *Morus alba. Linn.* (*Denkanikota*)—*E.G. No.* 133/55.— this, a comparison experiment was made between—

(i) naked seedlings.

(ii) stumps.

(iii) cuttings.

(iv) direct sowings.

Direct sowings were a complete failure. At the end of two years, the results were as follows :—

TABLE XLII—*Results of trials of Morus alba in Denkanikotta.*

	Survivals.	Mean height in the year.
	PER CENT	FEET.
(i) Number of transplants	85	5·3
(ii) Stumps	100	7·9
(iii) Cuttings	56	10·5
(iv) Direct sowings	Nil.	Nil.
(v) Basket plants	98	6·0
(vi) Naked transplants	98	6·2

145. *Morus alba. Linn., Introduction in Tanjore District E.G. No.* 1/56—*Vennan Vettar Regulator areas.*—Seventy stumps received from Markanam Research Garden were planted in crow bar holes at an espacement of 6′ × 6′ on 6th May 1956 and watered daily with 1/3 pot of water (equivalent to one gallon) till end of September 1956. By March 1958, there were 40 per cent survivals with a mean height of 14 feet. Further observations are being made.

146 Table—*Morus alba. Linn., Introduction in Markanam*—The of trials of *Morus alba* in Markanam are furnished below :—

TABLE XLIII—*Results of Morus alba Linn., Trials—Markanam.*

Species.	E.G. number.	Date of planting.	Survivals.	Mean height.
Morus alba	13/55	27th August 1955.	Nil.	
Morus alba.	58/56	11th August 1956.	Nil.	

This species is not suitable in coastal regions in sandy tracts.

147. *Ochroma lagopus* (*Balsa*).—This is a tree which is a native tropical America. It has an extremely soft light wood much used in air-craft manufacture. Wood of this species was sent to the Hindustan Air Craft, 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 requied. Hence the trees in the plantations have to be thinned so as to promotes rapid growth with consequent lower density.

The best method of raising this species is through planting out with containers (Bamboo tubes). The seeds are sown in Bamboo tubes filled with earth and seedlings raised. When they are 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 with a table or chair or in which a house collapses over any person, the furniture, etc., are made of Balsa wood. Of the two film companies, i.e., Pakshiraja Studios and The Modern Theatres who were supplied with Balsa logs for trial the Modern Teeatres have reported that the Balsa wood is not suitable for their purpose as it was found difficult to work on it, as it chips off when cut with a saw or chisel The report from the Pakshiraja Studio is awaited.

Small consignment 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 ominently useful for this purpose and the question of undertaking extensive plantations the Madras State for supply to this manufacture is under consideration.

E.G. No. 387/49—*Topslip—Ochroma lagopus.*—The plants are now nine years old. There are 33 trees, 35 feet high and 20 inches in girth on an average. Biggest girth is 36 inches. The trees are useful for seed production only. Hence this Experimental Garden has been closed.

E.G. 403/50—*Topslip.*—There are now 23 trees of an average height of 45 feet and girth of 36 inches. Each tree will yield two logs of about 6 feet long, due to branching at a height of 6 feet to 10 feet from ground level. Some trees have been badly debarked by wild elephants. These trees are useful for seed production only. Hence this experimental Garden has been closed.

148. *Ocimum camphora* (*Syn. O. Kilimands—charicum*).—This species was tried in Topslip. The result is as follows :—

During 1954–55 a plot of ½ of an acre was divided into two sub-plots. In one, the existing growth was clearfelled, burnt and seeds of *Ocimum camuhora* sown and broad cast at the rate of two lbs per acre and at the same time teak stumps were put at an espacement of 6 feet X 6 feet. In the other sub-plots, 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 Topslip Research Centre 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. 525/55 of Topslip, by boradcast 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 waere separately graded as nature and tender and after drying they were sent to Dehra Dun for analysis. The figures are furnished below for all the three plucking taken together.

TABLE XLIVI—*Seeds sown after raking the soil.*

Serial number.	*Matures leaves or tender leaves.*	*Green weight per acre in lb.*	*Dry weight per acre in lb.*	*Total Distillate in dry weights in lb.*	*percentage of camphor in total distiate.*	*percentage of cophor on dry weight of leaves.*
1 Topslip ..	Mature.	14,050	1,893	5·11	40 to 50	2·3
2 Do. ..	Tender.	3,920	710	6·48	Do.	2·9

TABLE XLVII—*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

NOTE.—In top slip, the raked plot and the unraked plot were one above the other in a hill slope. Hence they were not comparable and hence results cannot be analysed for raked and unraked plot seperately.

From the above, it is clear that the yield of leaves is greater at higher elevation (Topslip 2,500 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.

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

TABLE XLVI—*Comparative statement on the yield of Camphor.*

Centre.	*Particulars of soil working.*	*Tender leaves.*	*Mature leaves.*
Topslip	Raked	2·9	2·3
Do.	Unraked	2·7	2·2

The dry weight of Ocimum leaves is about 1/5 to 1/6 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. Further observations are therefore necessary.

One acre of *Ocimum camphora* will yield about 18,000 lb of mature and tender leaves (Green weight) yielding 3,300 lb of air dried leaves. As per the analysis conducted by the officer-in-charge, M.F.P. Branch, Forest Research Institute, Dehra Dun the per centage of total distillate, 0 moisture basis varies from 4 to 6. Of this total distillate, the Camphor content is 40 to 50 per cent. So the Camphor content in the air dried leaves is of the order of 2·5 per cent or one acre yielding 3,300 lb of air dried leaves will yield on distillation, about 82.5 lb of Camphor.

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

The cost of cultivation if undertaken on a large scale, will be about Rs. 20 per acre. The cost of collection of leaves by the pollarding method will be about Rs. 10 per acre. The cost of distillation of 80 lb at oil on a cottage industry basis will be Rs. 100 at Rs. 1—1—0 per lb. of Camphor (Annas ten per lb. of total distilate 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 lbs of Camphor will be Rs. 130 or the rate per lb. will be Rs. 1–10–0. The ruling price of Camphor at present is about Rs. 4 per lb. and hence it is believed that the cultivation of *Ocimum camphora* and distillation of the leaves for Camphor on a cottage industry basis is commercially profitable.

E.G. No. 480/54—*Ocimum Camphora—Topslip.*—This experimental garden was maintained but closed towards the end of the year. The teak has been badly damaged by Bison and Elephants. The area is full of *Ocimum comphora.* In fact this has spread naturally outside the plot. This will be maintained in future as "*Ocimum camphora seed collection plot.*"

E.G. No. 564/57—*Ocimum camphora—Topslip.*—The Experimental Garden was formed during the year with the object of finding out the yield of *Ocimum camphora* in one acre in a Teak Regeneration area.

One chain square plot was laid out and the intervals in between the planting rows were scraped and soil worked. One lb. of seeds were sown by broadcast sowing on 9th November 1957 in 1957 Regeneration area of Anakunthy. The seeds started germination but subsequently died. The sowing will be repeated again in the same area and the results incorporated in the next year's report.

149. *Pinus caribae* (*Slash Pine*) *E.G. No.* 17/55 *and E.G. No.* 20/56 *Octacamund.*—A tree of the sub-trophical region of the U.S.A. Cuba Honuuras, growing in a 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 a Aramby Research Nursery in 1953–54 and two years old seedlings about 2 inches to 4 inches in height were planted out in Brooks lands 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.

Subsequently all of them died due to severe frost. The tentative conclusion can be drawn that this species is not suitable for the climate of Ootacamund and that it is very tender to damage by frost. This experimental garden is proposed for closure.

150. *Pinus taeds* (*Loblolly Pine*).—This is a native of Southern and Eastern U.S.A. It yields timber for general purposes and is sometimes tapped for resin.

Seeds obtained from U.S.A. were sown in nursery and two seedlings were planted in the Aramby Research Garden during 1950. In March 1958, their heights were 10 feet 9 inches and 8 feet respectively, after 7 years.

151. *Prosopis juliflora* (*Mescuite*).—*Prosopis juliflora* is indigenous to sub-tropical North and South America. In North America it is one of the characterstic trees of the lower Senaran zone, an area where conditions of rainfall and climate range from arid to semi arid, i.e., rainfall varies from 10 inches to 25 inches per annum.

In Jamaica, it is described as an admirable tree to grow in dry gravelly soil, in situations where rain does not fall for several months together. In Hawii, it flourishes in semi arid regions with scanty rainfall. It has done well in the Anglo Egyptian Sudan with an extremely low rainfall (48" inches).

It has succeeded admirably in India in dry regions. It is a useful sand binder in Sind.

It was first introduced into India in 1877, from seed obtained through Kew. In some of the drier parts of India it has proved of great importance in afforestation work.

It was first introduced into South India in a large scale in the years 1930 to 1940, since then it has been used with more and more success in the afforestation of Panchayat forests and denuded fuel forests.

152. *E.G.* 10/56 *and* 62/56—*Prosopis juliflora Markanam.*—The experiments were started to find out the Silvicultural characters of the species in Markanam. Pot plants were planted in one foot cube pits on 17th August 1955 and 11 August 1956 respectively and they were watered as in district practice. The two Experimental Gardens have been closed during the year. The experiment will be repeated during next year.

153. *Introduction of Prosopis juliflora in Rameshwaram.*—Experiments were started in 1955 and continued in 1956 and 1957 on a larger scale, to find out whether *Prosopis juliflora* can be successfully raised in the sandy soils of Rameshwaram and if so whether it will be an effective soil binder.

E.G. No. 24/55—*Prosopis juliflora—Rameshwaram.*—Seeds of Thiruchirappalli origin, were sown in nursery on 25th March 1955. They were pricked into bamboo baskets in June 1955. The seedlings, 10 inches in height were planted with baskets, in 1 foot cube pits at 6 feet to 6 feet espacement on 19th September 1955. They were hand watered once in 3 days with one gallon of water from April to October 1956 and on alternate days from April to October 1957. Wind protection was also provided. In March 1958 there were only 30/255 survivals with a mean height of 4 feet.

E.G. 69/56–*Prosopis juliflora—Rameshwaram.*—Seeds of Jaipur origin were sown in nursery on 26th June 1956. One thousand two hundred and ten transplatns, about 5 inches in height were planted in 1 foot cube pits on 28th October 1956 and 29th October 1956, at an espacement of 6 feet to 6 feet, in an area of one acre. On 18th June 1957, wind protection was also provided, by planting palmyrah leaves with stalks. Watering with one gallon of water on alternate days was done from January to October 1957. In March 1958, there were 1,180/1,210 survivals with a mean height of 5 feet. The results are very encouraging.

E.G. No. 89/57—*Prosopis juliflora—Rameshwaram.*—One thousand two hunr ded and ten seedlings raised from seed of Amritsar origin, were planted on 17th November 1956 on one foot cube pits in 1 acre, at 6 feet to 6 feet espacement. The seedlings suffered damage in the cyclonic rains of December 1957, due to inundation. In January 1958, 475 casualties were replaced on 15th January 1958. The plants were watered on alternate days with one gallon of water from 15th January to 31st March 1958. By the end of March 1958, there were 1,180/1,210 survivals with a mean height of 12 inches. Further observations are being made.

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 twelve years. This is based on the results of E.Ps. 64/39 and 32/41. In order to collect further data on the growth and development of the species, an area of 0·75 acre in E.G. 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 fifteen years.

E.G. No. 459/53—*Topslip—Pterocarpus dalbergioides.*—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. This Experimental Garden has been closed.

E.G. No. 512/55—*Topslip—Pterocarpus dalbergioides.*—Hundred seedlings with a mean height of 20 inches were transplanted at an espacement of 6 feet to 6 feet on 20th June 1955 in the open in the Karianshola deciduous garden. By 30th January 1956 there were 36/100 survivals with a mean height of 18 inches. The seedlings were damaged by browsing by wild game. By the end of March 1958 there were nil survivals. Hence this Experimental Garden has been closed.

E.G. 522/55—*Topslip—Pterocarpus dalbergioides.*—Hundred seedlings with a mean height of 40 inches were transplanted at an espacement of 6 feet to 6 feet in the Karianshola evergreen garden under the shade of top canopy after removing the middle storey and undergrowth. By 16th March 1956 there were 89/100 survivals with a mean height of 2 feet. The seedlings were badly browsed by wild game. By the end of March 1958, there were 12/100 survivals with a mean height of 24 inches, all top broken and browsed heavily. The seedlings were considerably damaged by wild game. This species cannot be established in localities such as Topslip, where there is considerable damage by browsing animals.

E.G. No. 565/57—*Topslip—Pterocarpus dalbergioides.*—This Experimental Garden was formed during the year with the object of finding out the growth and development of the species in the localities in Ayirangal fuel coupe IV. One hundred plants were planted. But subsequently all the plants were dead due to unfavourable rainfall. Hence the Experimental Garden has been closed.

155.—*Salix babylonica* (*Willow*).—The willow plot in Double Crossing, Ootacamund has been maintained. Out of 82 cuttings planted in 1936, there are now only 9 with an average height of 43 feet and a mean D.B.H. of 14·1 inches. The statement below shows the rate of growth of the trees since 1944 :—

TABLE XLVII—*Rate of growth of Salix babilonica.*

Year.	Age in years.	Survivals.	Mean height in feet.	Mean D.B.H. in inches.
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	9	41·0	13·6
1957	21	9	43·0	14·1

The Chief Conservator of Forests issued instructions on 6th July 1956, as a result of his visit to Kashmir, that cuttings prepared from mature branches with thick hard bark do not strike root easily and that if the trees are lopped they will throw out french succulent shoots, which in time will yield cutting which will strike root more easily, with greater survival per cent and faster height growth. Accordingly, some trees were lopped in double crossing Willow plot on 7th July 1958. The new shoots which have come from the lopped branches are not ready for use as cuttings. The new shoots are about 3 feet in length but not thick enough for use as cuttings in vegetative propagation. Cuttings from these new shoots will be planted in the coming year and results reported.

156. *Swietenia macrophylla—Introduction in Tanjore District E.G.—No.* 5/56—*Vennar-Vettar Regulator area.*—Five hundred and eleven natural seedlings uprooted from the established plantations in Topslip Reasearch Centre, were planted in crow-bar holes on 28th and 29th September 1956 at an espacement of 22 feet by 22 feet in four rows along the bank of the Vennar River. Most of the seedlings were damaged in transit. After planting, watering was done at the rate of $\frac{1}{4}$ pot of water (equivalent to $\frac{3}{4}$ gallon of water) daily till end of March. By March 1958, after about $1\frac{1}{2}$ years, there were only one per cent survival with a mean height of 18 inches. The heavy casualities are due to partial drying up of seedlings during transit from Topslip to Tanjore prior to planting in Tanjore. Further observations are being made. But the initial inference is that the species is not likely to be successful in Tanjore.

157. *Terminalia superba—Trial in Tanjore Centre—*

Seed weight	40 seeds per ounce or 640 to the lb.
Germination per cent ..	50.
Plant per cent	50.
Plants per lb.	320.

Seeds of Tanganyika origin were received in Tanjore in March 1957 and sown in nursery bed. Fifteen seedlings are available. These will be planted in the following year and results will be observed.

158. (*e*) *Bamboos and canes—Dendrocalmus strictus—E.P. No.* 71/37—*South Coimbatore.*—E.P. No. 71/1937 of South Coimbatore was started in 1937 to find out the best method of raising *Dendra calamus strictus* after clear felling and burning a mixed deciduous forests 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 eleven 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, *Dendra calamus strictus* can grow to a height of 30 feet in 17 years and that it can be raised from rhyzomes or from nursery seedlings.

159. *Dendracalamus 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 (*Eleusine coracana*) in a poor mixed deciduous forest. One year old rhizomes were planted at 9 feet by 9 feet espacement. Due to heavy and repeated damage by elephants, there are only 15 survivals with a mean height of 19 feet after ten years. This was closed during 1955-56, as due to heavy damage by wild elephants, no conclusion could be drawn.

160. *Bambusa arundinacea—E.P. No. 85/41 of South Coimbatore.*—This was started in 1941 to raise the species with a taungya crop in a deciduous forest of good quality. Bamboo has grown to a mean height of 30 feet with an average of 22 clums per clump. This result may be considered fairly satisfactory.

Measurements were discontinued from 1947 onwards. This experimental plot has been closed.

(f) Plants yielding minor forest produce including medicinal plants.

161. *Anacardium occidentale (Cashew).*—It is a medium sized tree indigenous to Brazel in South America. It was introduced into Malabar, about 400 years ago, by Potuegese travellers primarily to check soil erosion. It is now cultivated extensively along the east and west Coasts of South India and also in inland localities. In Madras State large scale plantations exist in the Chingleput, South Arcot, Tanjore, Tiruchirappalli and Tirunelveli districts. India holds a virtual monopoly of the trade in Cashew kernels and Cashew shell oil. It is also a valuable Dollar earner, the average annual export being about 15 to 20 million Dollars.

162. In Madras State there is a programme for planting of 42,250 acres with Cashew (*Anacardium occidentale*) under the Second Five-Year Plan. During 1956-57, 9,060 acres, and during 1957-58, 9,000 acres were planted. During 1958-59, it has been proposed to take up about 9,000 acres for planting.

163. Research on the artificial regeneration of Cashew is therefore of vital importance to Madras State and hence several Research projects were started in different centres during the current year.

164. *Silvicultural characters of the species.—Anacardium occidentale* can be grown on any kind of soil. Even on soils unsuitable for most other crops, it can be grown. It grows well in the barren sandy soils of the East Coast as also in the hard laterita soils of the West Coast. It does not thrive on clay. It does not stand frost and so does not grow at elevations above 3,000 feet. It can adopt itself to varying conditions of rainfall from 150 inches, though a rainfall of 35 inches to 40 inches favours optimum development. It is a strong light demander and should be grown in the open. It is hardy and drought resistant and thrives under a diversity of soil and climatic factors.

The seed weighs 85 to the lb. The germination capacity is 98 per cent; plant per cent is 98. No pretreatment of the seed is necessary. The seed retains its viability for long periods.

165. *Artificial Regeneration of Cashew.*—Artificial Regeneration of Cashew is generally done in Madras State, by direct dibbling of seeds in situ followed by replacement of casualties through planting of nursery raised seedlings in baskets (with baskets without disturbance to the root system). Basket seedlings are raised by dibbling a nut in a basket filled with earth and watering. In Madras State, the espacement adopted is 33 feet by 16½ feet, equivalent to 80 plants per acre. One foot cube pits are dug, soil clods broken and seed is sown at a depth of 2 inches to 30 inches to prevent damage by rodents either to the nuts before germination or to the fleshy coteledons after germination. Sowing is done after the first showers of the South West monsoon between the middle of May and middle of June. Once a fortnight, redibbling is done where germination is absent. In October, when the rains of the north-east monsoon have commenced, replacement of casualties will be done by planting container plants raised in bamboo baskets. The first soil working for the young plants will be done in November-December when the plants are 6 inches to 1 foot height. After the close of the north-east monsoon, the area round the plants is scraped clean with a mammooty. The idea is to break the sealing of the soil pores which occur during the rains.

166. *Introduction of Anacardium occidentale (Cashew) in Rameshwaram Island.*—Experiments were started in June 1955, to determine whether *Anacardium occidentale* can be successfully established in Rameshwaram Island, with watering of the plants, on the same lines as is done for Casuarina during the first year and if so whether the species can be effective as a soil binder in sandy soils subject to severe wind erosion.

167. *Growth and Development of Anacardium occidentale—E.G. No. 9/55, 42/56 and 85/57—Rameshwaram Centre.*—(i) *E.G. No. 9/55—Anacardium occidentale—Rameshwaram.*—Seeds were dibbled in bamboo baskets on 15th July 1955 and the seedlings with baskets were planted on 20th August 1955 in one foot cube pits at an espacement of 11 feet by 11 feet. Watering was done with one gallon of water daily for the first 15 days and thereafter on alternate days with ⅛ pot of water equivalent to one gallon of water till 30th June 1957; wind protection was also given. By end of March 1957,

there were 347/375 survivals with a mean height of 9·2 inches. By end of March 1958 there were only 61/375 survivals with a mean height of 18 inches. The heavy casualties were due to cyclonic rains in November-December 1957 and partial inundation of the plot.

(ii) *E.G. No.* 42/56—*Anacardium occidentale—Rameshwaram.*—The above experiment was repeated in 1956-57. One hundred and eighty basketed seedlings were planted on 10th August 1956 at an espacement of 11 feet by 11 feet. Watering was done and wind protection by means of palmyrah leaves was also provided. By end of March 1957, there were 176/180 survivals with a mean height of 9 inches. Watering was continued on alternated days from April to October 1957 with one gallon of water and wind protection was continued. By end of March 1958 there were 90/180 survivals with a mean height of 18 inches.

(iii) *E.G. No.* 85/57—*Anacardium occidentale—Rameshwaram.*—Direct sowing of seeds was done in soil worked patches at two seeds per patch at an espacement of 11 feet by 11 feet, on 17th October 1957. Full germination was secured by 10th November 1957. Watering was done between 15th January 1958 and 31st March 1958. By end of March 1958, there were 180/180 survivals with a mean height of 10 inches.

The results obtained in the above three experiments are summarised in the following table.

TABLE XLVIII—*Results of trials of Anacardium occidentale in Rameshwaram.*

E.G. number.	*Date of direct sowing.*	*Date of planting basket seedlings.*	*In March 1958*	
			Survivals.	*Mean height.*
(1)	(2)	(3)	(4)	(5)
				INCHES.
9/55 ..	....	20th August 1955.	61/375	18
42/56 ..	....	10th August 1956.	88/180	18
85/57 ..	17th October 1957.	....	180/180	10

The general indications, therefore, are that—

(i) the species can be established successfully both by direct owings and by basket plants,

(ii) due to desiccating effect of hot scorching winds, in spite of wind protection, plants suffer damage in the second and subsequent years, resulting in poor survivals and poor height growth.

168. *E.G. No.* 43/56—*Anacardium occidentale—Rameshwaram Centre.*—In this experiment, consisting of 60 Cashew seedlings, 30 were watered in the usual manner namely pouring water on the surface in saucer like depressions round the plants. Thirty seedlings were watered by pouring water in earthen-ware pots with

holes in the bottom, burried near the plant so that there was sub-soil watering; but no surface watering. By end of March 1958 there were 43 per cent survivals and 11 inches mean height in normal watering as against 50 per cent survival and 8 inches mean height for sub-soil watering. The indications are that sub-soil watering does not appear to be superior to normal watering.

169. *E.G. No.* 76/56 *and No.* 104/57—*Anacardium occidentale—Best method of raising—Rameshwaram.*—In these two experiments a comparison was made among the three methods of raising the species, namely :—

(i) Direct sowing of nuts,

(ii) Stump planting, and

(iii) Planting basket seedlings.

The experiment was started on 9th November 1956 and 7th December 1957 respectively. The plants were watered as usual and wind protection was also provided. At the end of March 1958, the results were as follows :—

TABLE XLIX—*Results of E.G. No.* 76/56 *and No.* 104/57

E.G. number.	*A. Direct sowing.*		*B. Stumps.*		*C. Basket plants.*	
	Survival.	*Mean height.*	*Survival.*	*Mean heights*	*Survival.*	*Mean height.*
	PER CENT.	INCHES.	PER CENT.	INCHES.	PER CENT.	INCHES.
76/56 March 1957	100	12	30	12	100	12
76/56 March 1958	67	9	3	2	63	9
104/57 March 1958	67	6	45	3	97	9

The indications are therefore that stumps planting gives poor survival percentage and height growth and that direct sowing and planting basket plants are definitely satisfactory.

170. *General conclusions on Cashew in Rameshwaram Centre.*—The results of the various experiments on cashew, detailed above are summarised in the following table :—

TABLE L—*Growth of Anacardium occidentale in Rameshwaram Centre.*

E.G. number.	*Date of planting.*	*Method of raising.*	*March 1958.*	
			Survival.	*Mean height.*
(1)	(2)	(3)	(4)	(5)
			PER CENT.	INCHES.
9/55 ..	20th August 1955.	Basket plants	16	18
42/56 ..	10th August 1956.	Basket plants	44	18

TABLE L—*Growth of Anacardium occidental in Rameshwaram Centre*—cont.

E.G. number.	*Date of planting.*	*Method of raising.*	*March 1958.*	
			Survival.	*Mean height.*
(1)	(2)	(3)	(4)	(5)
			PER CENT.	INCHES.
85/57 ..	17th October 1957.	Direct sowing in patches.	100	10
76/56 ..	9th November 1956.	(1) Direct sowing ..	67	9
		(2) Stumps	3	2
		(3) Basket plants ..	63	9
104/57 ..	7th December 1957.	(1) Direct sowing ..	67	6
		(2) Stumps	47	3
		(3) Basket plants ..	97	9

The general indications that can be drawn from the above experiments are :—

(i) the species can be raised successfully both by direct sowing and by planting basket seedlings; but stump planting is not successful and is therefore not recommended,

(ii) in Rameshwaram Island, due to prevelence of strong desiccating winds, in spite of affording wind protection, the plants suffer damage in the second and subsequent years resulting in poor survivals and poor height growth. Further experiments are needed to corroborate the above indications.

171. *Research on the artificial regeneration of cashew.*—In view of the extensive plantations of *Anacardium occidentale*, undertaken in the Madras State, under the Second Five-Year Plan, in the degraded fuel forests, research on the artificial regeneration of cashew was undertaken in the Ulundurpet centre during the year. The experiments carried out during the year in Ulundurpet centre are described below and tentative indications have been drawn. It is needless to add that these experiments have to be repeated in order to draw definite conclusions.

172. *E.G. No. 1/57—Ulundurpet—Best method of raising Cashew.*—This is a comparison experiment to determine the best method of artificially raising Cashew. There were two treatments, namely :—

A : Direct dibbling of seeds in July.

B : Sowing seeds in bamboo baskets on the same date as treatment A and planting the basket seedlings in situ in September. Direct dibbling was done actually on 27th July 1957 and planting of basket seedlings was done by September 1957. By March 1958 there were 24/45 survivals with a mean height of 12 inches in treatment A and 43/45 survivals with a mean height of 12 inches in treatment B. The indications therefore are that there is no difference in height growth between the two treatments. But survival percentage is appreciably higher for basket plants as against direct dibbling.

173. *E.G. No. 3/57—Optimum time for direct dibbling of Cashew, Ulundurpet.*—This experiment was started in 1957 with a view to determine the optimum time for direct dibbling of cashew seeds in the artificial regeneration of cashew. There were four treatments as follows :—

A : Direct dibbling on 17th June 1957.

B : Direct dibbling on 29th July 1957.

C : Direct dibbling on 17th August 1957.

D : Direct dibbling on 17th September 1957.

By March 1958, the mean height and survivals were as below :—

TABLE LI—*Results of E.G. No. 3/57—Ulundurpet in March* 1958.

Treatment.	*Date of sowing.*	*Survival.* PER CENT.	*Mean height.* INCHES.
A	17th June 1957	3/36	18
B	29th July 1957	15/36	15
C	17th August 1957	28/36	12
D	17th September 1957	15/36	10

The indication is that July, August sowings are better than sowings in June or September.

174. *E.G. No. 16/57—Anacardium occidentale—Ulundurpet.*—In this experiment, comparison was made between two methods of raising basket plants for planting out, namely :—

A : Sowing seeds directly in baskets.

B : Sowing seeds in nursery bed and notching germinated seeds in baskets.

The results by end of March 1958 were as follows :—

A : Sowings in baskets—21/30 survival, 18 inches mean height.

B : Notching germinated seedlings—15/30 survival, 15 inches mean height.

The indication is that it is better to sow directly in baskets for raising basket seedlings.

175. *E.G. No. 16/57—Anacardium occidentale—Method of raising basket seedlings—Ulundurpet.*—In this experiment, a comparison was made between the following two methods of raising basket seedlings for artificial regeneration work :—

A : Direct sowing of seeds in baskets.

B : Sowing seeds in a nursery bed on the same date and notching germinated seeds in baskets.

Sowing of seeds in baskets and in nursery bed was done on 5th November 1957. Notching germinated seeds in baskets was done on 18th November 1957. In March 1958, the results were as follows :—

A : Survival 21/30—Mean height 18 inches.

B : Survival 15/30—Mean height 15 inches.

Direct sowing of seeds in baskets is superior to sowing in nursery bed and notching germinated seeds. On occasions when bamboo baskets or other containers for preparing container seedlings are not ready, it is possible to save time by sowing seeds in a nursery bed and notching germinated seeds in baskets or other containers after 10 or 15 days when they become available. Thus valuable time in artificial regeneration work can be saved.

176. *E.G. No.* 17/57—*Optimum time of planting basket seedlings of Anacardium occidentale—Ulundurpet.*—This is a comparison experiment to determine the optimum time for planting basket seedlings of *Anacardium occidentale*. There were four treatments, namely ; planting in the months of August, September, October and November, respectively. By end of March 1958 the results were as follows :—

TABLE LII—*Results of different dates of planting basket plants of Cashew.*

E.G. number.	*Month of planting.*	*In March 1958.*	
		Survival.	*Mean height.*
		PER CENT.	INCHES.
17/57 ..	August	20/36	10
	September	20/36	10
	October	30/36	9
	November	24/36	6

The indication is that early planting in August, September, is better than late planting in October and November.

177. *E.G. No.* 18/57—*Anacardium occidental—Basket plants versus Notching germinated seeds—Ulundurpet*—In this experiment, a comparison was made between :—

A : Planting basket seedlings ; and

B : Notching germinated seeds.

The planting of A B, was done on 15th September 1957. In March 1958, it was found treatment A gave a mean height of 7 inches with a survival of 27/45 while treatment B gave a mean height of 6 inches with a survival of 14/45. The indication is therefore that notching germinated seeds is not suitable and that planting basket seedlings is generally satisfactory.

178. *E.G. No.* 17/57—*Selection of suitable containers for container plants—Ulundurpet.*—This experiment was started in 1957 to find out the most suitable container, for raising container plants of *Anacardium occidentale*, in artificial regeneration work. Four different types of containers were tried. Seeds were dibbled on 27th October 1957 and 4th November 1957 in the containers and the seedlings were planted out on 20th November 1957. In March 1958, the results were were as follows :—

TABLE LIII—*Results of using different containers for Cashew plants—March* 1958.

E.G. number.	*Type of container.*	*March 1958.*	
		Survival.	*Mean height*
		PER CENT.	INCHES.
19/57 ..	Bamboo basket	36/36	10
	Palmyra Donnai	26/36	9
	Palmyra basket	28/36	10
	Earthenware pot	32/36	8

As the experiment was started only late in the year, no definite conclusions can be drawn.

179.—*E.G. No.* 21/57 *Different types of soil working for raising Cashew—Ulundurpet.*—This is a comparison experiment on different types of soil working and soil preparation in the artificial regeneration of cashew. On account of low and uncertain rainfall, it is necessary to conserve moisture in the soil and different types of soil working behave different as regards moisture conservation. There were four treatments, namely :—

A : Digging one foot cube pits and soil working for a radius of 3 feet.

B : Digging one foot cube pit and soil working in a semi circle of 3 feet diameter and forming a half saucer.

C : Digging one foot cube pit and soil working for a radius of three feet and forming a shallow saucer.

D : Sunken Mound formed from a trench of 8 feet by 1 foot by 1 foot.

Basketed cashew seedlings were planted on 3rd December 1957 for all treatments, at 36 seedlings per treatment. In March 1958 the results were as below :

TABLE LIV—*Different types of soil working for Cashew.*

E.G. number.	*Treatment.*	*Survival.*	*Mean height.* INCHES.
21/57 ..	A	33/36	8
	B	26/36	7
	C	31/36	7
	D	36/36	10

The indication is that sunken mound system of soil working is best while the treatments A and C have also given good results.

180. *E.G. No. 22/57—Different methods of preparation of site for raising Cashew—Ulundurpet.*—This is a comparison experiment on different methods of preparing the site prior to planting of Cashew in a dry scrub forest. There were three treatments, namely :—

A : Clearfelling and burning and planting at an espacement of 11 feet by 22 feet.

B : Clearfelling stripes 6 feet wide and spaced 22 feet apart (centre to centre) and planting at an espacement of 11 feet in the middle of the strips.

C : Clearfelling strips 6 feet wide and spaced 33 feet apart (centre to centre) and planting at an espacement of 11 feet in the middle of the strips.

Basket seedlings were planted for all treatments on 4th December 1957. By end of March 1958, the results were as follows :—

TABLE LV—*Different methods of preparation of site for Cashew.*

E.G. number.	*Treatment.*	*Survival.* PER CENT.	*Mean height.* INCHES.
22/57 ..	A	18/90	6
	B	20/90	6
	C	14/60	6

Due to late planting on 4th December 1957 no definite conclusions can be drawn. This experiment will be repeated.

181. *Anacardium occidentale—Experiments on Artificial Regeneration—General Indications.*—The above experiments in various aspects of the artificial regeneration of cashew were started for the first time in the 1957–58, in the Ulundurpet centre. Some of the experiments were started late and so the results were somewhat vitiated. However, the following general indications are available. These require corroboration from repetitions of the experiments to be undertaken in future years.

(i) Direct sowings are quite successful. But planting basket seedlings seems to give higher survival per cent.

(ii) Early sowings in July, August are superior to late sowings in September, October.

(iii) Basket seedlings are best raised by dibbling directly in baskets.

(iv) The optimum time for planting basket seedlings is early in the rains in August-September.

(v) Notching germinated seeds in baskets can be done with 50 per cent success. This method can be adopted to save time on occasions when containers are not readily available.

182. *Experiments on Artificial Regeneration of Cashew—Markanam Centre.*—Several experiments were also started in the Markanam Research Centre on the artificial Regeneration. These are detailed below :

183. *E.G. No. 20/55 and No. 31/55—Comparison of watered and unwatered planting—Markanam Centre.*—In E.G. No. 20/55, 180 pot plants of *Anacardium occidentale* were planted out on 17th July 1955 in one foot cube pits and these were watered for 15 days after planting. In March 1958, they reached a mean height of 3·5 feet with a survival of 110/180.

In E.G. No. 31/55, 180 basket plants of *Anacardium occidentale* were planted out on 20th October 1955 in one foot cube pits, during rainy weather. No watering was done. In March 1958, they reached a mean height of two feet with a survival of 40/180.

These two experiments are not comparable as planting was done on 17th July 1955 in the former case and on 20th October 1955 in the latter case. However, there is the indication that watering for 15 days after planting in July, gives better survivals and increased height growth than October (late planting in rains) planting without watering.

184. *E.G. No. 112/57, No. 124/57, No. 143/57—Markanam—Growth and Development of Anacardium occidentale—E.G. No. 112/57—Anacardium occidentale.*—Ninety pot plants were planted on 25th August 1957 and watered as follows :—

(i) Watering for 15 days with ½ pot of water per plant, from the date of planting.

(ii) watering with ½ pot of water on alternate days till December 1957 and thereafter with ½ pot of water once in 3 days till end of March 1958.

At the end of March 1958, there were 77/90 survivals with a mean height of 13 inches.

E.G. No. 124/57—Anacardium occidentale.—One hundred-eighty pot plants of cashew were planted on 15th October 1957 at an espacement of 22 feet by 22 feet. No watering was done. In March 1958, there were 82/180 survivals with a mean height of 12 inches.

E.G. No. 143/57—Anacardium occidentale.—One hundred eighty pot plants were planted on 12th December 1957. No watering was done. By end of March 1958, there were 67/180 survivals with a mean height of 9 inches.

Combining the results of the three experiments detailed above, the indications are that—

(i) watering the plants in the first year is beneficial.

(ii) plants can be established without watering *with about 50 per cent survival and a height growth of 9 inches to 12 inches by the end of March in the first year.*

185. Rouwolfia serpentina.—This is a small shrub found in the forests of the Westerns 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 recent years for the medicinal value of the root of the plant. Two varities 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 root section is also found occasionally. It is believed that botanically there is no difference between the two. The species are 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 of 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. In the Madras State forests, there will be about 5,00,000 acres of forests which may yield 1,00,000 lb., annually. The maximum practicable yield may be taken as 1/4 of the potential yield. Hence the sustained annual yield in practice may be about 25,000 lb.

186. It is used as an ingredient in very small quantities in the preparation of Ayurvedic medicines, but this quantity is negligble 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, the 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, Madras, had forwarded samples of dried roots to all Customs officers in the country.

As a large part of the area with natural growth of *Rauvolfia serpintina* had gone to Kerala State, due to re-organization of States with effect from November 1956, attempts are being made to take up artificial regeneration of the species in suitable places, in all Divisions.

187. *E.G.* No. 517/55—*Topslip—Rauwolfia serpentina.*—One hundred and fifty-six nursery seedlings raised from seed collected locally from natural forests were planted out in June 1955 at an espacement of 3′ × 3′. By 27th November 1955 there were 137/156 survivals and the seedlings were in flowers. By the end of March 1958, there were 61/156 survivals with a mean height of 1 foot. The top of the plants get dry and broken during the hot weather. It produced a crop of flowers and good seeds.

188. *Rauwolfia canescens—Topslip.*—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 3′ height growth in 3 years (E.G. No. 516-A/55 Topslip). By the end of March 1958 the plants are in fruits. The seedlings can be transplanted successfully with 96 per cent survival (E.G. No. 516-B/55 Topslip). Planting stem cuttings give 19/30 survivals at the end of two years and the plants bear flowers and fruits abundantly from the first year onwards. In one year it reaches a height of 12″ but natural plants are as high at 3′ to 4′ in height as compared with *Rauwolfia serpentina* which grows to a height of only 18″.

189. *E.G. No. 516/55-A—Rauwolfia canescens—Topslip.*—Seeds were dibbled in one hundred stakes at an espacement of 3′ × 3′ on 10th May 1955, at the rate of 20 seeds per stake. By 1st July 1955, there were 772 seedlings in the hundred stakes or the germination per cent was 39. Surplus plants were transplanted elsewhere. There was profuse flowering in September 1955 and fruiting in October 1955. By end of March 1958, there were 95/100 survivals. The plants are in fruits with a mean height of 3 feet.

190. *E.G. No. 516/55-B—Rauwolfia canescens—Topslip.*—Five hundred transplants obtained from E.G. No. 516-A of Topslip, were planted in September 1955 at an espacement of 3′ × 1½′. By March 1956, there were 97 per cent survivals. In March 1957, there were 481/500 survivals with a mean height of 30″. By the end of March 1958, there were 90 per cent survivals with a mean height of 36″. The plants are in fruits.

The tentative conclusion is therefore, that the species can be successfully established both by direct sowing and by entire transplanting. If direct sowing is to be done, it is enough if four or five seeds are sown per patch.

(*g*) *Experiments on fodder grasses.*

191. *Fodder resources in Madras State.*—The question of forest grazing in Madras State has not been adequately studied in the past. Data available in the Animal Husbandry Department, roughly shows that the fodder resources of the Province, amount only to about 50 per cent of the total requirements of the cattle population of the State and hence it is imperative to concert measures for developing the fodder resources of the State.

Fodder from forests comprise only a small, part of the total fodder resources of the State. Hence the main burden of increasing the fodder resources must fall on agricultural lands. That is to say the ryots should be educated to set apart a small part of their (holding say 10 per cent of their holding) for growing exclusively fodder crops with or without irrigation, according to circumstances. Only by this method can be fodder resources of the State be substantially increased.

192. *Need for research on fodder grasses.*—The Forest department can also make an appreciable contribution to increase the fodder resources from the forest areas, by raising desirable species of grasses artificially in regions suitable to them. With this object, certain experiments were started in the Markanam and Rameshwaram Research Centres to study the growth and Silvicultural characters of certain grasses for which planting materials were received from the Systematic Botanist of the Agricultural College and Research Institute, Ciombatore. These experiments are briefly described in the following paragraphs.

(iii) Notes on Grasses.

193. *Panicum antidotale—Markanam E.G. No* 82/56—*Sets of Panicum antidotale,* received from the Systematic Botanist of the Agricultural College and Research Institute, were planted at Markanam Research Garden on 10th November 1956. They established themselves quickly with a survival of 30/35. In March 1958, there were 20/35 survivals with a mean height of 4 feet.

194. *Digitaria (Blue digitaria)—E.G. No.* 83/56 *Markanam.*—Seedlings received from the Agricultural College and Research Institute were planted on 12th November 1956. By March 1958, there were 26/35 survivals with a mean height of 3 feet.

195. *Cenchrus ciliaris (Kolukkattai)—Markanam E.G. No.*84/56—Sets of *Cenchrus ciliaris* were brought by the Agricultural Botanist of the Agricultural College, Coimbatore, to Markanam and they were planted on 12th November 1956. The sets established themselves and the survivals in March 1957 were 17/35. There was partial seedling also. By March 1958—there were 24/35 survivals with a mean height of 3 feet.

166. (*Cenchrus Blou buffel*). *Markanam—E.G. No.* 85/56.—Seedlings received from the Agricultural College and Research Institute, Coimbatore, were planted on 12th November 1956. By March 1958 there were 24/35 survivals with a mean height of 3 feet.

197. *Penneserum purpureum (Napiar grass)—Markanam—E.G. No.* 86/56.—Seedlings received form the Agricultural Research Station, Tindivanam, were planted on 7th Decrmber 1956. By

march 1958, there were 5/30 survivals with a mean height of 4 feet This experimental garden has been closed. This grass does not appear to be suitable to this locality.

198. *Thin Napier grass—Markanam E.G. No.* 87/56.—Seedlings received from the Agricultural Research Station at Tindivanam were planted on 7th December 1956. By March 1958, there were 23/35 survivals with a mean height of 6". The growth of the grass is satisfactory.

199. *Thin Napier grass—Markanam E.G. No* 90/57, 96/57.—The above experiments were opened during 1957 with a view to study the growth and development of the species (thin Napier grass) when plan ted as sets in Markanam Research Centre.

E.G. No. 90/57.—Thirty-five sets of thin Napier grass were planted on 31st July 1957 at an espacement of 3′×3′ in 1′ cube pits. The same sets were taken from the established seedlings in E.G. No. 87/56. The sets were about 1′ to 2′ in height at the time of planting. The plants were watered regularly.

E.G. No. 96/57.—The experimental garden was formed with the same object as in E.G. No. 90/57. Forty-five sets of thin Napier grass were planted on 31st July 1957 at an espacement of 3′×3′ in one-foot cube pits. The sets were watered till establishment.

By end of March 1958, the results were as follows : —

TABLE LVI—Markanam E.G. Nos. 87/56 90/57 and 96/57 Results in March 1958.

Species.	*E.G. number.*	*March 1958.*	
		Survival.	*Mean height.*
			FEET.
Thin Napier	87/56	23/35	6
Do.	90/57	35/35	5
Do.	96/57	40/45	5

200. *Panicum maximum (Gunea grass).—Markanam E.G. No.* 88/56.—Seedlings received from the Agricultural Research Station, Tindivanam, were planted on 7th December 1956. During March 1958, there were 5/30 survivals with poor growth. Hence this experimental garden has been closed. The growth of this species is not satisfactory.

201. *Cenchrus echinoides—(Island grass)—E.G.No.*75/56—*Rameshwaram*—Fifty rooted slips of *Cenchrus echinoides* (Island grass) were received from the Agricultural College and Research Institute, Coimbatore, on 8th November 1956. They were planted at an espacement of 3′×3′. Watering was done except in rainy days. After 3 weeks there were only 40/90 survivals and by end of March 1957, there were only 38/80 survivals, with a mean height of 10". By March 1958, there were only 36/80 survivals. Growth of the grass was not satisfactory.

(iv) Reclamation and Afforestation including Irrigated Plantations.

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

203. *Irrigated teak plantations.*—Irrigated teak plantations are being raised in the Meettupalayam Range in the Coimbatore North Forest Division. The hill stream passing over a compact block of 46.0 acres is made use of for irrigation. On account of gently undulating nature of the country, it is possible to take the water to any part in the plantation. Irrigation is done by percolation. Two sample plots, namely, S.P. No. 1 and S.P. No. 3 of Coimbatore North Division exist in this area.

Owing to the sustained and heavy demand for electric transmission poles, it has been decided to work the area on a short rotation of 20 yards for production of electric transmission poles. This has been rendered necessary be extensive developments in rural electrification in the Madras State.

Site quality.—Mean diameter and mean heights of trees on all the age classes were again recorded by the State Silviculturist in August 1957. Two curves showing diameter and height increment of teak with age are attached. These curves also show the corresponding curve for all India IV and III quality (Yield and stand Tables for Teak by Laurie and Santa Ram). The Hulical drug palntations correspond to below IV quality as regards height increment and to All-India III–IV quality as regrds girth increment.

Irrigation regime.—The area to be planted will be irrigated for three to five days before planting. After planting no irrigation need be done till the stumps sprout, when irrigation should be resumed and done once a week for eight hours. The frequency of watering should be gradually reduced and by September an 8 hour day irrigation once a fortnight should suffice. Wherever rainfall is appreciable, irrigation can be reduced accordingly. During a normal North-east monsoon, irrigation may even be suspended. The watering may be resumed thereafter and continued in this manner till the 6th monsoon after planting when it can be stopped.

Irrigation will be done again at the ages of 8, 11, 14, 17 in order to prevent the dying of trees due to drought.

Thinnings.—Ordinary D grade thinning will be done at the ages of 7 and 13 years. The number of stems to be retained after thinning will be as follows :—

Number of stems to be retained after thinning at age 7 years 320

Number of stems to be retained after thinning at age 13 years 310.

As the area is small, it is possible to check the actual number of stems after thinning and record the same in the plantation journal.

Phenomenon of top dead trees due to drought.—It is commonly observed in all plantations of ages 7 to 20, particularly in the age classes 15 to 20 years, that trees far away from irrigation channels and in poor shallow soils, show the phenomenon of top dead trees. The drying of these trees is due to physiological drought as the rainfall in the area is insufficient to support the crop in good condition. Till 1957–58 irrigation of the crop was being done only for the first 6 years with no irrigation between the 7th and 20th years with a view to prevent the drying of trees noticed above, further irrigation at the ages of 8, 11, 14, 17 are being given.

204. *Experiments on irrigation in teak plantations.*—A series of experiments were conducted from 1932 onwards to determine :—

(i) how far irrigation helped the crop ;

(ii) the best method of irrigation by

(*a*) flooding or

(*b*) percolation.

(iii) the optimum frequency of irrigation.

The results of the experiments may be briefly summarised as follows :—

(1) Irrigated crops put on definitely better growth ; but ceased to be effective after 6 years including the year of planting.

(2) Irrigation by percolation is not only more economical but is as effective as irrigation by flooding.

(3) With irrigation by percolation for a period of 8 hours at a time, a frequency of irrigation once a fortnight appears to be sufficient. Irrigation once a month on three successive days, each day for 8 hours, gives more or less the same results.

205. *S.P. No. 3. Tectona grandis—Coimbatore North Division —Effect of stopping irrigation in a teak plantation after 4th, 5th and 6th years after planting.*—This experiment was started in 1939 in the Hulicaldrug irrigated teak plantations. In a clear-felled and burnt area, one year old teak stumps were planted in April 1939. The whole area of 2.25 acres was divided into 6 blocks. The whole area was irrigated by percolation till the end of the 4th monsoon (about November 1942).

In November 1943, the mean height of trees in the different blocks was measured and they were allotted to three treatments as follows at randum :—

Treatment A—Irrigation for 4 seasons only. Blocks I and II—Mean height in April 1943—27.3'.

Treatment B—Irrigation for 5 seasons only. Blocks III and VI—Mean height 27.3".

Treatment C—Irrigation for 6 seasons only. Blocks IV and V—Mean height 27.8".

Measurements of the mean heights of trees in the different blocks were recorded from 1945 onwards and it was noticed that there was no significant difference between the three treatments. The figures are furnished in the following table.

TABLE LVI—Effect of stopping irrigation after 4, 5, 6, year after planting.

Blocks.	Watering stopped after.	Annual measurements.			1956.	
		28th March 1945 mean height.	1946 mean height.	1947 mean height.	Mean height.	Mean girth.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
		FEET.	FEET.	FEET.	FEET.	FEET.
I and II	.. .. Six monsoons	34·6	36·3	38·3	39·8	6·3
III and VI	.. .. Five monsoons	35·3	36·0	39·7	40·9	6·4
IV and V	.. .. Four monsoons	35·9	37·1	39·2	39·2	6·5
Significance in height growth between treatments.	....	N.S.	N.S.	Between six monsoons and five monsoons only.	N.S.	N.S.

There is no significant difference in the height growth or diameter growth. This result is maintained uniformly throughout the period under observation. Hence irrigation for 4 monsoons is sufficient for raising teak in Hulicaldrug. But in the sub-plots allotted to irrigation for 6 seasons, the number of trees after thinning in 1944 is 80, against 63 trees and 64 trees respectively in the other two treatments. Further observations are being made.

206. *E.P. No. 5/38—Effect of irrigation and thinning on teak coppice-Hulicaldrug teak plantation.*—In 1938, an experiment was started to observe the growth and development of teak coppice and to determine :—

(i) whether thinning of the coppice shoots is beneficial for production of teak poles on a short rotation,

(ii) the comparative effects of irrigating the coppice crop once a week and once a fortnight.

1·3 acres in the 1938 teak plantation of Hulicaldrug was clear-felled in November-December 1938. The area was divided into four blocks and allotted to 4 treatments as follows :—

A1 : Irrigated once a fortnight and coppice shoots thinned to 2 per stool.

B1 : Irrigated once a fortnight, coppice left unthinned.

A2 : Irrigated once a week and coppice shoots thinned to 2 per stool.

B2 : Irrigated once a week and coppice shoots left unthinned.

Treatments in Blocks A2 and B2 (i.e. reduction of coppice shoots to 2 per stool) were applied in April 1940.

During February 1940 a thinning was carried out and the number of trees was reduced to 50 per cent in each sub-plot.

Observations and conclusions.—Height measurements of trees in lines 3, 4, 5 and 6 were taken from 1941 to 1946. In 1949 the height measurements of 20 trees at random from each block were taken. The mean heights are tabulated below :—

TABLE LVIII—Height measurements of trees in lines 3, 4, 5 and 6 from 1941 to 1949.

Block number.	Treatment.	1941.	1942.	1943.	1944.	1945.	1946.	1949.
A1	Irrigated once a fortnight and coppice shoots thinned.	24·32	27·63	32·26	35·4	37·4	43·0	41·8
B1	Irrigated once a fortnight and coppice shoots unthinned.	23·60	26·69	27·94	32·1	36·4	39·78	47·65
A2	Irrigated once a week and coppice shoots thinned.	26·69	24·56	28·57	34·2	35·8	43·07	46·3
B2	Irrigated once a week and coppice shoots unthinned.	23·70	26·83	30·48	35·3	32·8	44·0	47·25

TABLE LIX—Comparison between weekly and fortnightly irrigation (ignoring thinning).

Height in feet.

Treatment.	1941.	1942.	1943.	1944.	1945.	1946.	1949.
Irrigated once in a fortnight	23·96	27·16	30·10	33·75	36·9	41·39	45·92
Irrigated once in a week	22·69	25·69	29·57	34·75	34·10	43·98	46·77

TABLE LX—Comparison between thinned and unthinned plots (ignoring irrigation).

Height in feet.

Treatment.	1941	1942	1943	1944	1945	1946	1949
Coppice shoots thinned	23·00	26·01	30·46	34·3	36·5	42·43	45·55
Coppice shoots unthinned	23·65	26·76	29·21	33·7	34·6	46·89	47·15

In the early years, irrigation once a fortnight with thinning gives better growth than any of the other three treatments. But this difference is not uniformly maintained in later years and in 1949, for which latest height measurements are available, irrigation once a fortnight without thinning gives the maximum height growth.

Analysing the results for weekly and fortnightly irrigations, ignoring the thinning treatment (*vide* Table LIX above) it is found that there is no significant difference between the two treatments.

Similarly analysis of the results for "thinning" and "no thinning", ignoring the irrigation treatment (*vide* Table LX above) it is found that there is no significant difference between the two treatments.

The object of management is the production of Electric Transmission poles with a rotation of 20 years. It is a point to be considered whether the poles of the unthinned plots are better in girth increment. Since the diameter measurements were not taken at any time during the course of the observation, this fact cannot be ascertained. The experiment has not given any definite conclusion except that the difference between the fortnightly irrigated plots and weekly irrigated plots is not significant.

The indications therefore are that :

(i) thinning of the coppice shoots in an irrigated teak coppice crop are not beneficial.

(ii) fortnightly irrigations are quite as good as weekly irrigations.

This experimental plot was closed in 1956 ; but as the results were omitted to be included in the Annual Report on Silvicultural Research for the year, the conclusions drawn from this Experimental plot are given in this report.

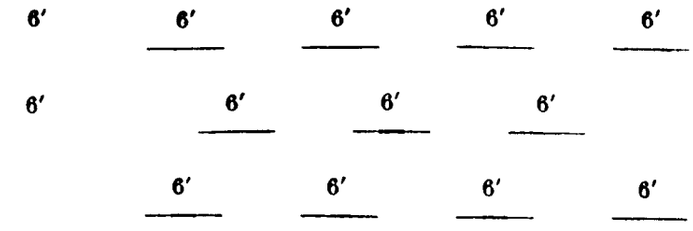
207. *Afforestation of sandy waste lands in Rameshwaram Island and fixation of shifting sand—Experiment on fixation of shifting sand near Rameshwaram Road, Railway Station in E.G. No.* 12/1956.—With the co-operation of the District Engineer, Southern Railway, Madurai, an experiment was started within the Stationyard of Rameshwaram road Railway Station. This section of the Railway Track is subjected to severe wind action and deposition of sand on the Railway track and making the track unfit for traffic. This involves an expenditure of 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 enormous.

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 :—

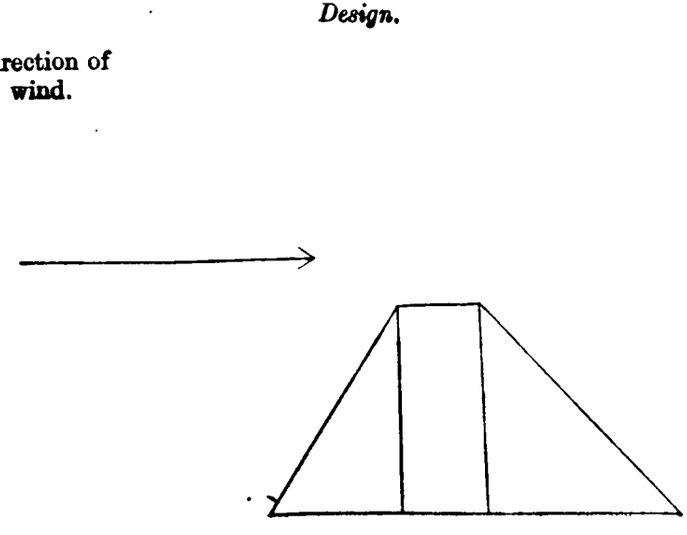
Baffle walls consisting of condemned railway sleepers were erected for a length of 6 feet and a height of 3 feet as per design below :—

Design.



When baffle walls are constructed in this way the effect of wind carrying sand particles is to deposit the sand on either side of baffle wall and to form a sand mound as shown below :—

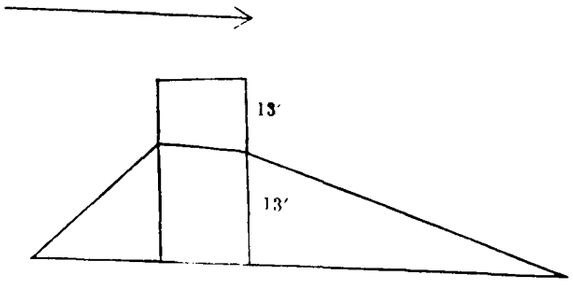
Design.



The mound formed, as per theoretical considerations, will be three times the height of the baffle wall on the windward side and the height of the baffle wall on the Iceward 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 1956 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 cuttings of Pandanus with leaves, were planted 1½′ apart in lines. Farthest away from the Railway track Palmyra nuts were dibbed 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 the very severe winds actively, and erection of baffle walls was immediately effective.

During the year 1955–56, the baffle walls that were erected, and the plants and cuttings planted on the mound formed, produced very encouraging results. But during 1956–57, the Railway authorities who had maintained a watchman to look after this plot dispensed with the services of the watchman without intimating this department. Hence the cuttings and seedlings planted were badly damaged, mostly by cattle, and partly also by natural causes, for want of moisture in the ground and hence the results in 1956–57 were inconclusive.

During 1957–58, due to unrestricted trampling by men and cattle, all the seedlings raised in 1955–56 died. Wind drift on the railway track, which was under control in 1955–56, and in 1956–57, started again vigorously during 1957–58, necessitating the employment of a large gang of mazdoors to clear the sand off the railway track. The conclusion can therefore be drawn and erecting baffle walls and planting the sand mounds on the wind ward and leeward sides can successfully stop adverse effects of wind erosion.

208. *E.G. No. 77/56—Sand fixation by means of baffle walls—Rameshwaram.*—A similar experiment on fixation of shifting sand, by means of baffle walls was started in 1956–57 in the section 376/9 to 379/10 on the Pamban-Dhanushkodi main Railway line—about one mile east of Rameshwrama Road Railway station. This section was selected as it was subject to severe sand deposition on the railway track. Every year in the past, gangs of mazdoors up to 30 per day were being employed during the wind season from April to October for removing the sand to enable the trains to pass.

A continuous baffle wall 4 chains long and 3 feet high was erected in November 1956 making use of condemned sleepers supplied by the Southern Railway Administration, at a distance of 35 feet south of the railway track. Sand deposition commenced in June 1957 and by October 1957, the sand dune to a height of 3′ was formed on eitherside of the baffle walls for a length of 2 chains only. In the remaining portion of 2 chains, there was no sand deposition, due to peculiar local circumstances and orientation of the ground.

Planting of the following species was done on the windward side of the baffle wall for a length of two chains in the month of November 1956 :—

(i) *Acacie arabica*—50 pot plants.
(ii) *Prosopis juliflora*—50 plants.
(iii) *Pandemus cuttings*—50 cuttings.

Ioomea biloba cuttings were planted at an espacement of 2′ × 2, on either side of baffle wall on 8th December 1957 to 13th December 1957 for a width of 35′ on either side of the baffle wall.

By March 1958, it was found that the tree species planted had become successfully established. *Acacia arabica* had reached 6′ high with full stocking and spreading crown. *Prosepis juliflora* had reached a height of 7′ with full stocking. *Pandamus* cuttings were also successful, though not very vigorous, due to browsing by cattle. The *Ioomea biloba* cuttings planted in December 1957 had become fully established and were beginning to spread.

The experiment for sand stabilisation at this point was a grand success during the year 1958. At this point a gang of 30 to 40 mazdoors used to be engaged every day during the months of April to October, but during 1958, the employment of such labour gangs was not at all necessary due to sand stabilisation as a result of the experiment.

209. *Sand fixation through Baffle walls and planting on mounds formed—Conclusions drawn.*—From the experiments detailed and observations made in the above two paragraphs, the following conclusions can be drawn :—

(i) Erection of baffle walls in a direction at right angles to that of the prevailing wind, leads to deposition of sand on both sides of the wall and formation of a sand dune.

(ii) Planting seedlings of *Acacia arabica*, *Prosopis juliflora* and cuttings of *Pandamus*, result in a well established crop up to 6′ high at the end of two years. This crop covers the ground completely and puts a stop to wind erosion. Planting of cuttings of *Ioomea biloba* establish themselves within one year and send spreading shoots. This also helps considerably in stabilising sand and preventing wind erosion.

(iii) The Railway track can be successfully protected from deposition of sand by erecting baffle walls and planting vegetation as described above on the sand dune formed. The cost of such operations is likely to be much cheaper than manual removal of sand from the track by engaging gangs of mazdoors throughout the wind season.

210. *Experiments on sand fixation through Afforestation—Rameshwaram.*—In Rameshwaram, 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 sowing [illegible]

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′ 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 three 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, Tiruchirappalli and Ramanathapuram. There was 14·42″ of rainfall in November and 20·32″ in December 1955 in Rameshwaram 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 experiments were continued during 1956–57 and 1957–58. The results of all experiments carried out at Rameshwaram during the last 3 years are summarized below :—

TABLE LXI—Statement showing Species tried in Rameshwaram Centre.

Serial number and species. (1)	E.G. number. (2)	Date of planting. (3)	Method of introduction. (4)	Survival. (5)	Mean height. (6)
				PER CENT.	
1 *Anacardium occidentale*	9/55	15th July 1955	Pot plants	16	18″
2 *Acacia ferruginea*	23/55	19th September 1955	Basket plants	82	3′
3 *Albizzia lebbeck*	18/55	21st September 1955	Do.	70	2′
4 *Acacia decurrens*	21/55	23rd September 1955	Mossed seedlings	Survival, nil.	
5 *Acacia leucophloea*	30/55	28th October 1955	Naked seedlings	14	15″
6 *Acacia mollissima*	22/55	23rd September 1955	Mossed seedlings	No survival.	
7 *Acacia planifrons*	20/55	22nd September 1955	Basket plants	73	12″
8 *Azadirachta indica*	29/55	6th November 1955	Transplants	30	9″
9 *Casuarina equisetifolia*	17/55	23rd May 1955	Do.	96	16″
10 *Dalbergia sissoo*	19/55	21st September 1955	Basket plants	17	24″
11 *Eucalyptus camaldulensis*	13/55	21st March 1955	Do.	96	3½′
12 *Eucalyptus gomphocephala*	14/55	Do.	Do.	1	24″
13 *Eucalyptus rudis*	15/55	Do.	Do.	5	22″
14 *Eucalyptus hybrid*	33/55	24th January 1956	Do.	54	65″
15 *Cassia javanica*	36/55	19th July 1956	Do.	3	17″
16 *Pongamia glabra*	32/55	19th November 1955	Direct sowing	9	10″
17 *Pithecolobium dulce*	20/55	20th September 1955	Basket plants	31	37″
18 *Anacardium occidentale*	43/56	10th August 1956	Do.	21	13″
19 *Prosopis juliflora*	24/55	19th September 1955	Do.	5	51″
20 *Albizzia stipulata*	50/56	27th September 1956	Do.	27	20″
21 *Swietenia macrophylla*	58/56	29th September 1956	Do.	45	6″
22 *Dalbergia sissoo*	59/56	29th September 1956	Do.	83	46″
23 *Acacia arabica*	53/56	28th September 1956	Do.	76	42″
24 *Inga dulce*	57/56	Do.	Do.	76	42″
25 *Eucalyptus hybrid*	56/56	27th September 1956	Do.	73	37″
26 *Eucalyptus hybrid* (Mysore origin)	54/56	22nd September 1956	Do.	73	31″
27 *Pongamia glabra*	60/56	1st October 1956	Do.	63	21″
28 *Acacia planifons*	62/56	2nd October 1956	Do.	98	28″
29 *Acacia leucophloea*	63/56	Do.	Do.	81	35″
30 *Coconut and Casuarina Equisetifolia*	64/56	5th October 1956	Coconut Casuarina	81 72	38″ 35″
31 *Cassia javanica*	66/56	20th October 1956	Basket plants	52	14″
32 *Albizzia lebbeck*	65/56	18th October 1956	Do.	55	21″
33 *Prosopis juliflora*	69/56	28th October 1956	Naked seedlings	80	27″
34 *Eucalyptus hybrid* (Kolar origin)	78/57	Do.	Basket seedlings	99	40″
35 *Borassus flabellifer* (Palmyra)	80/57	2nd October 1957	Seeds sown	100	Stem not yet come up above the ground.
36 *Adansonia digitata*	93/57	24th October 1957	Basket plants	98	6″
37 *Colophyllum moptyllum*	94/57	Do.	Do.	100	11″
38 *Prosopis juliflora*	89/57	23rd October 1957	Naked seedlings	97	12″
39 *Inga dulce*	92/57	24th October 1957	Do.	100	1½′
40 *Dalbergia sissoo*	95/57	Do.	Do.	72	9″
41 *Acacia arabica*	96/57	Do.	Do.	99	15″
42 *Pongamia glabra*	97/57	Do.	Do.	100	12″
43 *Bombax malabaricum*	98/57	Do.	Do.	100	8″
44 *Eucalyptus hybrid* (Ootacamund origin)	99/57	Do.	Do.	100	2′
45 *Albizzia lebbeck*	100/57	Do.	Do.	100	9

TABLE LXI—Statement showing Species tried in Rameshwaram centre—cont.

Serial number and species.	R.G. number.	Date of planting.	Method of introduction.	Survival.	Mean height.
(1)	(2)	(3)	(4)	(5)	(6)
				PER CENT.	
46 *Acacia planifrons*	101/57	25th October 1957	.. Naked seedlings	87	5"
47 *Casuarina equisetifolia*	102/57	5th November 1957	.. Do.	100	15"
48 *Acacia leucophloea*	103/57	25th October 1957	.. Do.	100	15"
49 *Acacia dealbata*	110/57	Do.	.. Do.	90	5"
50 *Pinus pinea*	114/57	7th December 1957	.. Basket plants	93	4"
51 *Ailanthus glandulosa* (Kashmir) ..	115 57	Do.	.. Root cutting	100	"

211. *General inference regarding suitability of different species f* ımeshwaram.—Combining the results of all Experimental Garde r the last three years, from the points of view of both surviv r cent and height growth, the following general inferences can l awn regarding the suitability of different species for Rames ıram :—

I. *Very good*—
- (i) *Casuarina equisetifolia.*
- (ii) *Colophyllum mophyllum.*
- (iii) *Eucalyptus hybrid.*
- (iv) *Terminalia catopa.*
- (v) *Dalbergia sissoo.*
- (vi) *Acacia planifrons.*
- (vii) *Acacia arabica.*

II. *Moderately satisfactory*—
- (i) *Tectona grandis.*
- (ii) *Adansonia digitata.*
- (iii) *Acacia leucophloca.*
- (iv) *Albizzia lebbeck.*
- (v) *Albizzia stipulata* (Orissa origin).
- (vi) *Pithecolobium dulce.*
- (vii) *Prosopis juliflora.*
- (viii) *Pongamia glabra.*
- (ix) *Eugenia jambolana.*
- (x) *Anacardium occidentals.*

III. *Very poor*—
- (i) *Acacia dealbata.*
- (ii) *Acacia mollissima.*
- (iii) *Acacia ferruginea.*
- (iv) *Cassia javanica.*
- (v) *Cassia siamea.*

212. *Direct sowing of mixture of species for sand fixation.*—Anothe experiment was tried, sowing a mixture of seeds of *Cassia siamea Dalbergia sissoo, Azadirachta indica, Dichrostachys cinerea, Eugeni jambolana, Albizzia lebbeck, Acacia ferruginea, Acacia planifrons* in furrows in triple lines one foot apart. Seeds of all the specie germinated well, but due to ensuing hot weather all plants died o drought except some seedlings of *Eugeina jambolana, Dalbergi sissoo, Azadirachta indica*. The results are not encouraging.

213. *Direct sowing of palmyra (Borassus flabellifer). Rameswaram.*—As palmyra (*Borassus flabellifer*) is an indigenous specie in the Rameshwaram Island, line sowings of palmyra nuts wer also tried in the years 1955, 1956 and 1957. The results are furnished below :—

TABLE LXII—*Statement showing results of palmyra line sowing in Rameshwaram Island.*

Serial number.	E.G. number	Date of dibbling.	March 1958.	
			Survivals.	Mean height.
1	11/55 ..	2nd August 1955.	524/1000	18"
2	47/56 ..	14th September 1956.	1197/1500	10"
3	80/57 ..	30th September 1957.	1500/1500	Just germinating.

214. *Planting sets of Spinifix squarrosus and Ipomea biloba.*—Sets of *Spinifix squarrosus* and *Ipomea biloba* were planted with view to study their rooting capacity and their ability to fix shifting sand. There was 100 per cent survivals of *Spinifix squarrosus* and 64 per cent survivals of *Ipomea biloba*. The growth is generally rapid in low-lying areas whereas in higher areas the growth is poor. Further observations are being made :—

215. *Vegetative propagation through stem cuttings in Rameshwaram Island.*—Experiments were conducted during 1955, 1956 and 1957 to study whether vegetative propagation by planting cuttings of the following species with a view to cover the ground and ensure conservation of soil against wind action:—

TABLE LXIII—*Results of introduction of vegetative propagation through stem cuttings.*

Species.	E.G. number.	Date of planting.	Survival.
1 *Thespiesia populnea* ..	4/55	22nd June 1955.	Nil 70
Do. ..	34/56	10th July 1956	19 120
Do. ..	90/57	6th October 1957.	Nil 120
2 *Hibiscustiliaceous*	6/55	26th July 1955.	Nil 70
3 *Prythrine indica*	8/55	17th August 1955.	Nil 64
Do.	46/56	3rd September 1956	Nil 50
4 *Poinciana elata*	5/55	28th July 1955.	Nil 50
Do. ..	117/57	5th January 1958.	[illegible]
5 *Lannea grandis*	45/56	24th August 1956.	Nil 100
Do.	119/57	5th January 1958.	10 25

It is clear that vegetative propagation through cuttings is a success in Rameshwaram as the cuttings sprout during rains and dry back in summer.

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

216. *Pruning in Teak Plantations.*—The conclusion was reached that pruning has no beneficial effect on the height or diameter increment of the plants (please see paragraphs 189 to 192 of the Annual Report for 1955–56).

217. *Thinning in Teak Plantations.*—In the composite Madras State, previous to re-organization there were extensive sample plots to investigate various problems of thinning in teak plantations. All these plots have since been transferred to the Kerala State. The results of measurements of these plots have been given in detail in paragraphs 193 to 201 of the Annual Report for the year 1955–56. As the conclusions drawn are of some interest to Forest Officers in the present Madras State who have to deal with Teak Plantations, an article compiled by the Silviculturist on "Thinning Research in Teak Plantations" is attached as Appendix 'K'.

218. *Eradication of Lantana through* Bambusa arundinecea.—*E.P. No.* 67 of 1936—*Coimbatore South.*—In E.P. No. 67 of 1936 of South Coimbatore Division, an attempt was made to suppress Lantana by the introduction of *Bambusa arundinecea* 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 eleven years, the bamboos had reached a height of only 9.1' to 9·5', against 13' 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 clumps 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.

219. *Eradication of Lantana by clearfelling and burning and planting forest crops with kumri crops.*—The invasion of dense growth of Lantana in the sandalwood areas of Salem North Division and elsewhere in teak plantations has become a menace to the growth and development of useful forest crops. Hence experiments were started during 1954–55 to ascertain whether it is possible to eradicate Lantana and reafforest the area with valuable timber and fuel species, after clear-felling and burning the existing Lantana growth.

220. ***E.P. No. 31/54—Denkanikota.***—The E.P. No. 31/54 in Noganur R.F., 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)—Clear-felling the entire growth, burning the debris and planting *Dalbergia sissoo, Cedrella toona, Eucalyptus citriodora* and *Eucalyptus hybrid*, in lines 22′ apart, at an espacement of 9′ along the lines with a kumri crop of ragi (*Eleusine coracana*) in the beginning of the north-east monsoon.

(B)—Clearing strips 3′ to 4′ wide in the Lantana growth at intervals of 22′ and planting seedlings of 5 species in the centre of the cleared strip at an espacement of 9′, in the beginning of the north-east monsoon. There was no kumri crop in the treatment.

At the end of 1½ years in January 1956 measurements show that cuttings and burning Lantana though costly is significantly better than planting in strips without cuttings and burning the Lantana. As the kumridar does not work of clear-felling and burning, there is no expenditure involved in this operation. Hence the indications are that clear-felling and burning Lantana infested areas and planting in lines 22′ apart with a kumri crop of ragi is distinctly successful. In March 1958, at the age of 4 years, the plants in the area clear-felled and burnt, with a kumri crop of ragi were as below :—

TABLE LXIV—*Height growth in a clear-felled Lantana area with kumri.*

E.P. No. 31/54, Noganur Reserve Forest	*Species.*	*Date of planting.*	*Number put.*	*Number surviving.*	*Mean height.*
	Eucalyptus rostrata ..	21st July 1954.	135	35	11·6′
	E. citriodora ..	21st July 1954.	135	18	15·0′
	E. hybrid	21st July 1954.	135	13	14·2′
	Cedrella tonna ..	21st July 1954.	135	26	5·6′
	Dalbergia sissoo ..	21st July 1954.	135	10	4·6′

The height growth of the three species of Eucalyptus is very encouraging.

221. ***Eradication of Lantana through weedicides.***—Experiments on the eradication of *Lantana camara* through weedicides such as 2-4-D, 2-4-5-D, Pentachlorophenol were initiated during the year in Javalagiri Reserve 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 :—

(i) 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 four 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 ophenol using 3 oz., 4 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 clear-felled and the cut surfaces were painted with shell weed killer 10 per cent (10 oz. added to 90 oz. of water) and shell weed killer 20 per cent (20 oz., dissolved in 80 oz. of water) on 21st December 1955. Repainting was one three more times at intervals of about three weeks.

By the 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 Pentachlorophenol (P.C.P.).

During the north-east monsoon rains in September-October 1957, it was found that fresh shoots appeared from below ground level from live roots. New seedlings also appeared from dormant seeds lying in the ground. Hence the eradication of Lantana is not an unqualified success. While application of weedicides checks the growth of Lantana, further experiments are necessary to devise methods of eradicating it.

222. ***Eradication of Lantana through Biological methods.***—In and around Denkanikota, Lantana is subject to the attack of the scale insect *Orthezia insignis* Browne, the Lantana scale insect (Family-Coccides, 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 Salem North Division with a rainfall of 40 inches and not in Wynaad or in Nilambur with a higher rainfall.

223. *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 1957 when the plot was last measured, there were 55 trees in the pruned plots with an average girth of 17·5" and 32 trees in the unpruned plot with an average girth of 17.3". Thus there is no difference in girth between the pruned and unpruned plots. Despite pruning epicormic branches sprouted ; it is too early to draw any conclusions.

(viii) MIXTURE.

224. *Nil.*

(ix) UNDER-PLANTING.

225. *Under-planting in teak plantations.*—Inspection of teak plantations in the Madras State (and also Kerala State) shows that ordinarily there is an appreciable amount of under-growth in teak plantations and that this is generally adequate to protect the soil from the adverse effects of exposure, desiccation, and erosion.

Under planting may be considered from the point of view of producing a valuable subsidiary crop of timber such as *Swietenia macrophylla* or *Sterculia companulata* or other products such as *Rauwolfia serpentina*, *Ocimum kilimandscharicum* or *Cinnamomum zeylanicum*. Under-planting does not seem to be necessary solely from the point of view of soil protection. Attention is invited to paragraph 49-A where in 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 under-planting of teak with *Cephalostachyum pergracile* have indicated that there is a slight decrease in the volume production of teak as a result of under-planting. The loss of increment of teak due to under-planting may well outweigh the money value of the subsidiary crop. Hence looked at from this point of view also, under-planting of pure teak plantations does not appear to be desirable.

226. *Origin of under-planting 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 clear felling of mixed deciduous forests, the continued cultivation of pure teak plantation 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.

227. *Teak plantation-Under—planting experiment* 1930–1940.—Since 1930, right up to 1956–57 extensive experiments were carried out on this interesting subject in the Research Centres Nilambur, Wynaad, Dhoni. The results of these experiments were furnished in detail in paragraphs 213 to 218 of the Annual Report of Silvi cultural Research for the year 1955–56. An article on 'Under planting in Teak Plantations' was also written by the State Silviculturist, Madras and the same was published in the Indian Forester for May 1956 (pages 225 to 236).

228. An experiment was started at Topslip Research Centre, to find out whether Piper nigurm (Pepper vine) can be successfully established, in a teak plantation after final thinning at the age of about 45 years, using the teak stems as standards, with a view to secure a subsidiary income from the pepper during the 25 years up to rotation age of 80 years when the teak will be clear felled and replanted. For this purpose an area of one acre was selected in the 1900 Teak Plantation of Mount Stuart series between furlongs 0/3 to 0/6 in the Topslip-Sungam Road. 80 teak trees were selected and pits 2' long 1½' board and 1½' deep were dug at the foot of the trees on the northern side ' the pits were filled in with pulverised earth and rooted pepper cuttings obtained from the Pepper Development Officer, Taliparamba were planted at 5 cuttings per tree on 16th September 1956. In December 1956 there were 295 survivals out of 400 and these had given new shoots 9" to 13" long. By end of March 1957, there were only 34 survivals under 18 trees, the casualties having occured mainly in February, March 1957 due to drought.

Again replanting was done on 26th December 1957; the survivals by March 1958 were only 268/400. The poor survival was due to late planting which was due to difficulty in getting the rooted plants from the Kerala State.

229. The preliminary indication is that the rainfall of the locality is too meagre for successful establishment of the pepper vine. However the experiment will be repeated during the coming year and results observed.

230. *Lac cultivation in Denkanikota.*—During the year 1957, lac cultivation was carried on at Denkanikota, on a very small scale. Three *Schleichera trijuga* trees were inoculated with 12 lb. of brood lac on 15th July 1957, in pot culture garden. The settlement was not satisfactory and the crop was a failure due to adverse weather.

231. *Manufacture of Lac products in Denkanikota.*—Attention is invited to paragraphs 195 of the Annual report on Silvicultural Research for the year 1956–57. The lac factory is now functioning at Cumbum in Madurai district under the supervision of the Forest Utilization Officer, Madras. The results of working of the Lac Factory will be dealt with by the Forest Utilisation Officer in his report on forest utilization which forms 'Appendix I' of this report.

x) Silvicultural Systems.

232. *Nil.*

(xi) Miscellaneous.

233. *Nil.*

PART III.

WORKING PLANS AND STATISTICS.

(i) Working Plans.

234. 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 proposed prescriptions on Silvicultural matters and statistical work. In particular, the Working Plan Chapter on the management of Hulicaldrug irrigated Teak Plantations in the Mettupalayam Range of Coimbatore South division was revised by the State Silviculturist. Also advice was given on the thinning cycle and Intensity of thinning on Teak plantations in the Tirunelveli North division.

235. The following statement shows the Working Plans under preparation, at the beginning of the year, new working plans taken up for revision during the year and those completed during the year.

Table LXV—*Statement showing the Working Plan under preparation*

	Working plans in progress at commencement of the year.	*Working plans taken up for revision during the year.*	*Working plans completed during the year.*	*Working plans in progress at the end of the year.*	*Remarks.*
1	Salem South	..	Salem South.	..	Not yet sanctioned.
2	Tirunelveli South.	..	..	Tirunelveli South.	....
3	Madurai North.	..	..	Madurai North ..	..
4	..	Madurai South.	..	Madurai South ..	....

236. No working plans were sanctioned by the Chief Conservator of Forests during the year. The Working Plan for Salem South Division was under scrutiny and will be sanctioned shortly. The working plans for Tiruchirappalli and Coimbatore North divisions which were under scrutiny were sanctioned during 1958–59.

(ii) Yield, volume and Form factor tables—Sample plots.

237. No new sample plots were opened during the year. The 32 sample plots, representing 9 species at the close of the year 1956–57, were maintained during the year. An abstract is furnished in paragraph 6 giving the distribution of the sample plots by Forest Division and species. Appendix 'B' furnished a detailed list of all sample plots at the close of the year.

238. *Permanent Preservation Plots.*—No permanent preservation plots existed in Madras State, on 31st March 1957. During the year, S.P. No. 1 of South Coimbatore division was converted into a permanent preservation plot. This is the oldest teak plantation in the present Madras State, being now 85 years old. Please see paragraph 7 above. Hence there was one permanent preservation plot at the end of the year.

239. *Tree increment plots.*—The 9 trees increment plots which existed at the close of the year 1956–57 were maintained during the year. No new tree increment plots were opened during the year. Appendix 'B' furnishes a detailed list of all these plots. These are situated in five Forest Divisions and cover five species (Two plots comprise miscellaneous evergreen species).

240. *Multiple yield tables for teak.*—The yield tables for teak complied by Mr. M. V. Laurie and published as Indian Forest Records —No. I, Volume IV-A have been in use for a very long time. During the year 1955–56, new Multiple yield tables for teak complied by the Statistical Branch of the Central Silviculturist have been issued in a typed form and these are now in use.

(iii) BARK MEASUREMENTS—HEARTWOOD MEASUREMENTS, ETC.

241. *Nil.*

(iv) MISCELLANEOUS FORMULAE, ETC. DISTRICT EXPERIMENTS.

242. In addition to Research conducted by the State Silviculturist, Madras State, Madras, 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.

243. *Fungus disease of Casuarina equisetifolia.*—In the Padugais 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 parastic fungus (*Trichosporeum vesciculosum*). Further investigations on the nature of the disease have to be made and suitable control measures devised.

B. FOREST ENTOMOLOGY.

(*a*) ***Systematic Entomology.***

244. *Nil.*

(*b*) ***Economic Entomology.***

(i) Specific investigations.

245. *Teak defoliator attack in Madras State—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 qeustion 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 were not taken up during 1956–57 as no suitable area could be selected and also becuase the defoliator attack was very mild. In topslip, in the 1930 teak plantation of Mount Stuart eighty trees were selected and after recording their diameters, the trees were grouped into four groups of twenty trees each. It is proposed to carry out the experiment with the following four treatments, with the idea of determining the loss of increment of teak due to attack of defoliators :—

A : Complete hand defoliation in March-April after new flush of leaves has appeared ;

B : Complete immunity from defoliation by intense spraying of chemicals such as Hexidol or Gammaxene once in March-April and again in September ;

C : Complete hand defoliation once in September ;.

D : Control—Nothing to be done.

This experiment could not be carried out in Topslip centre during 1957–58 due to the fact that the defoliator attack was very mild. The experiment will be carried out in the coming year and results reported.

(ii) Miscellaneous investigations.

246. *Ailanthus excelsa and A. malabarica.*—In Madras State large areas are being taken up for artificial regeneration with soft wood suitable for the Match Industry, such as *Bombax malabaricum*, *Ailanthus excelsa* and *Ailanthus malabarica*. The latter two plants are subject to the attack of a defoliator "*Eligna narcissus*" (No C. tuidae). Investigations have been undertaken by the Forest Entomologist in February 1955, to study the life history of this insect.

Hexidol spraying experiment—Ayirangal softwood plantations of 1955—C. II.—An experiment on the sprayings of Hexidol in the crown of the *Ailanthus excelsa* plants was started with a view to observe whether the defoliator attack can be controlled or eradicated. Five sub-plots each of one chain square were selected at random and sprayed with a solution of Hexidol (2 gallons of water and 1 lb. of Hexidol) on both the crown and the main trunk, in the months of October to December 1956 (three sprayings monthly). Observations in 1957 showed that there was no difference in the intensity of defoliation between the sprayed sub-plots and the unsprayed plants in the rest of the plantation.

E.G. No. 555/57—*Ailanthus excelsa—Topslip.*—This was started during the year to ascertain whether dusting of the crown of Ailanthus excelsa trees in the 1955 Sethumadai plantation can effectively prevent defoliator attack by Eligna narcissus. The defoliator attack during the current year was very mild. Plants in both the control and treated plots suffered from mild defoliation. No appreciable difference was noticed. This experiment will be repeated.

247. *Bombax malabaricum—Shoot-borer.*—*Bombax malabaricum* is subject to the attacks of the shoot-borer 'Tonica neviferana'. No remedical 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.

(iii) Unclassified or unidentified damage.

248. *Nil.*

(c) *Forest Zoology.*

249. *Nil.*

(d) *Utilization.*

250. In the Madras State there is a whole-time Forest Utilization Officer, with headquarters at Madras working directly under the control of the Chief Conservator of Forests, Madras. A copy of the seport prepared by him on Forest Utilization for the year 1957–58 is furnished as Appendix 'I'.

MADRAS
26th August 1958.

P. VENKATARAMANY,
State Silviculturist, Madras State.

APPENDIX A.

Rainfall Statement of the Research Centres.

Statement Showing the average monthly rain fall in the charts for Research Stations for 1957—Calender year for certain stations and for 1957–58 for other Stations referred to in paragraphs.

Months.	Evergreen Forest. Topslip.		Delicious Forests. Denkanikotta.		Dry deciders. Markanam.		Coastal dry area. Rameswaram.	
	Rainfall.	Number of days.	Rainfall.	Number of days.	Rainfall.	Number of days.	Rainfall.	Number of days.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
January	Nil.	..	Nil.	..	Nil.	..	0·27	2
February	Nil.	..	Nil.	..	0·36	2	0·10	1
March	Nil.	..	Nil.	..	Nil.	..	Nil.	..
April	0·06	3	Nil.	..	Nil.	..	0·69	3
May	7·70	7	3·60	2	0·05	1	0·95	3
June	11·60	17	1·60	3	5·58	13	Nil.	..
July	14·90	22	0·04	1	7·72	10	0·99	3
August	4·10	4	2·00	2	4·07	9	0·03	1
September	Nil.	..	2·90	3	4·30	4	1·13	2
October	8·80	9	14·06	9	11·17	14	6·03	11
November	9·20	11	3·08	3	13·11	15	29·69	22
December	1·80	2	Nil.	..	1·61	5	17·76	15
Total rainfall	58·20	75	27·30	23	47·97	73	57·64	63
Total rainfall for number of years	1,991·98	2,973	1,138·81	2,263	129·67	218	120·08	121
	32		33		3		3	
Average rainfall days per year	62·25	93	34·50	68	43·22	73	40·02	40

Months.	Dry deciduous. Vemburuli.		High elevation forests. Ootacamund.		Deciduous. Tanjore.		Dry deciduous. Ulundurpet.	
	Rainfall.	Number of days.	Rainfall.	Number of days.	Rainfall.	Number of days.	Rainfall.	Number of days.
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
January	Nil.	..	Nil.	Nil.	Nil.	Nil.	..	..
February	..	..	Nil.	..	Nil.	Nil.	..	..
March	Nil.	..	Nil.	..	Nil.	Nil.	..	..
April	..	..	2·17	8	0·04	1	0·20	1
May	3·38	5	8·15	14	0·67	2	0·83	2
June	Nil.	..	1·37	21	Nil.	..	0·85	2
July	1·28	2	1·70	12	2·04	2	0·95	3
August	3·94	6	1·00	4	0·99	3	2·34	4
September	6·13	6	0·90	3	2·23	5	1·85	7
October	10·47	11	6·55	19	5·62	12	7·75	12
November	6·49	5	7·43	10	6·24	16	4·78	11
December	1·77	5	0·90	4	6·83	11	5·30	6
Total rainfall	33·46	41	30·17	95	24·66	52	24·85	48
Total rainfall for number of years	195·26	147	923·06	2,080	66·96	108	24·85	48
	3		18		2		1	
Average rainfall days per year	35·09	49	51·28	115	33·48	54	24·85	48

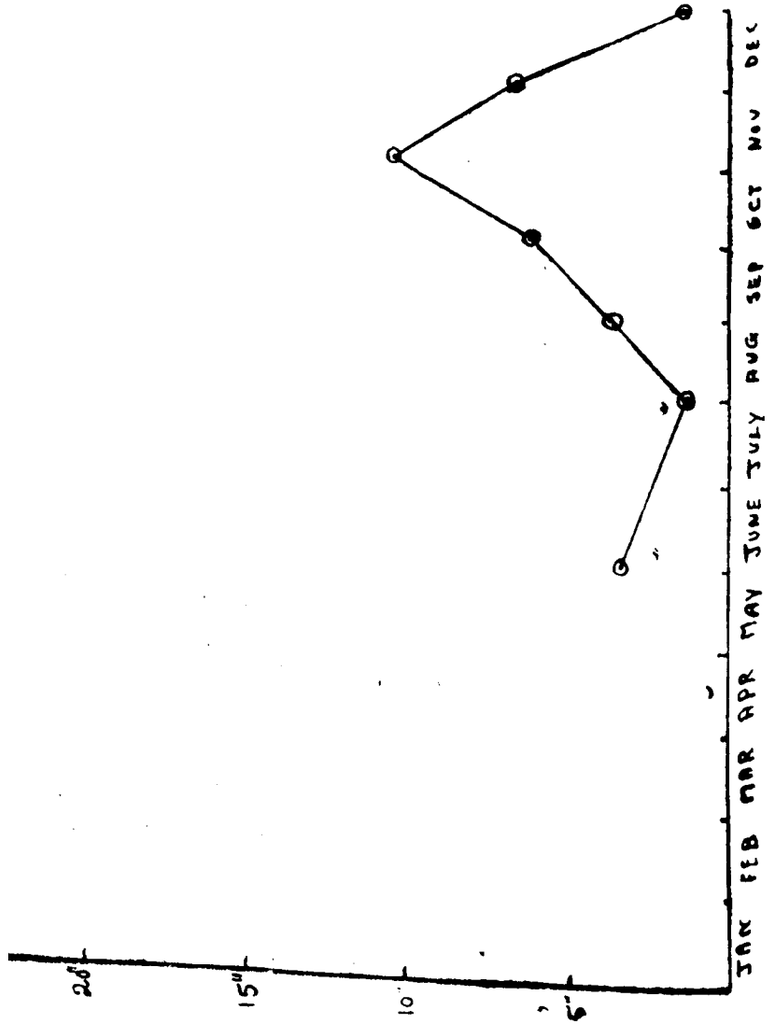
Climate factors :

Months averages :

Altidude : 2880′

Longitude : 177—3°—78—7°

Latidute : 12—4° N—12—44° N.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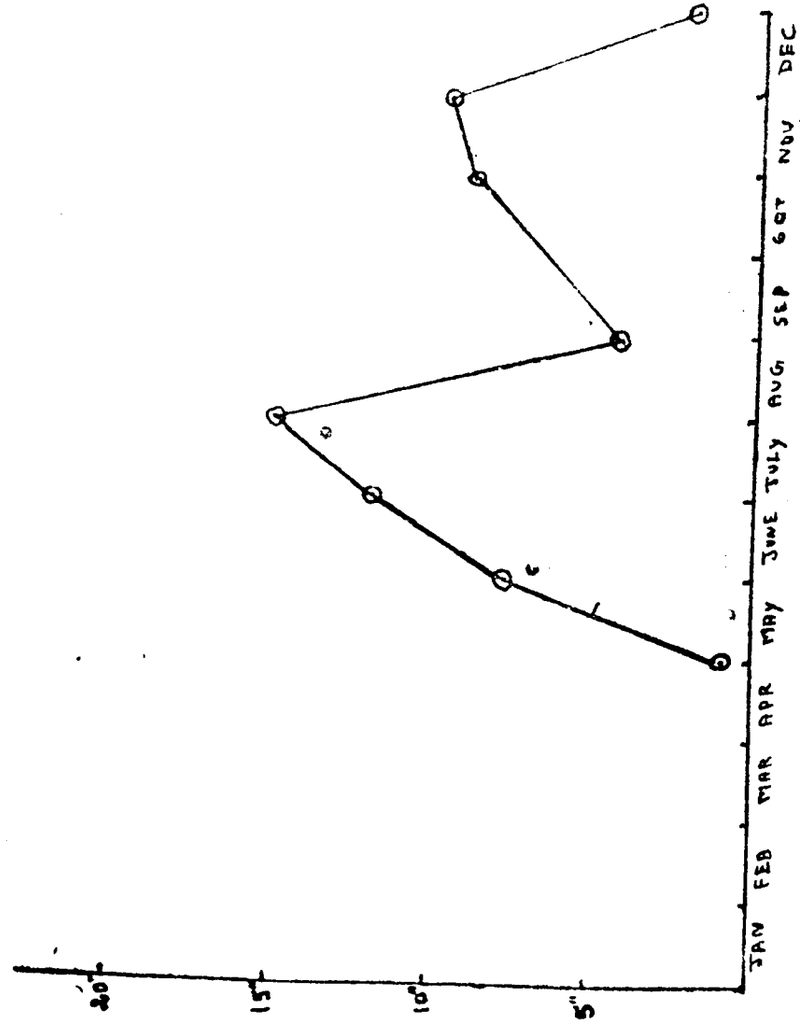
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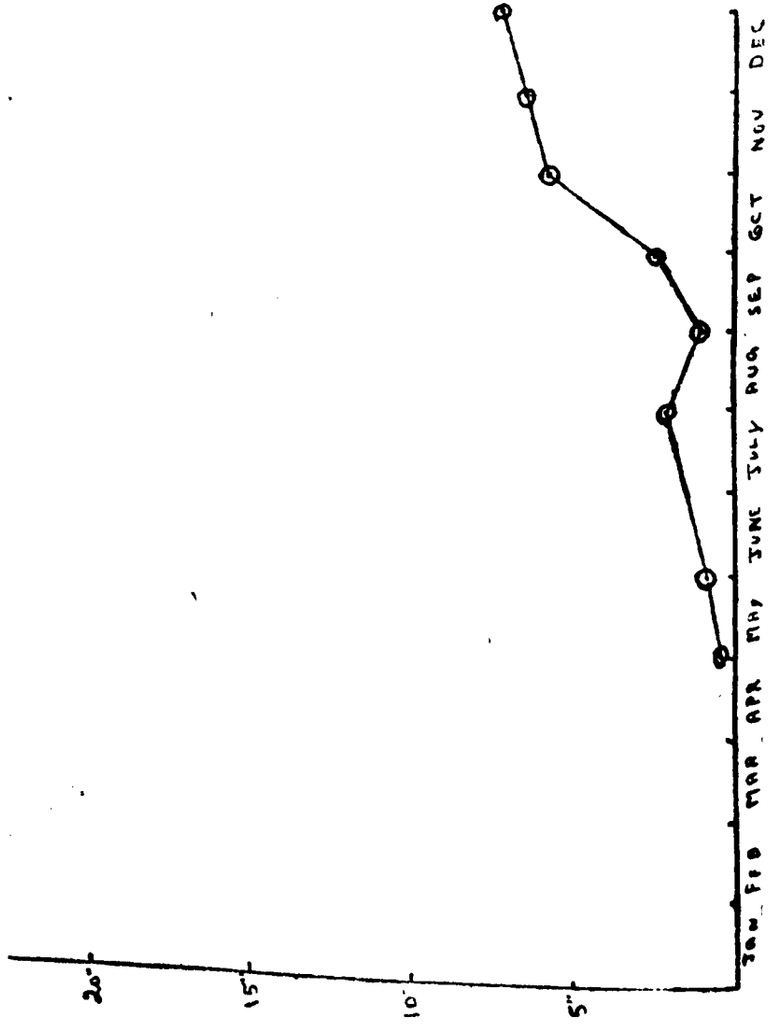
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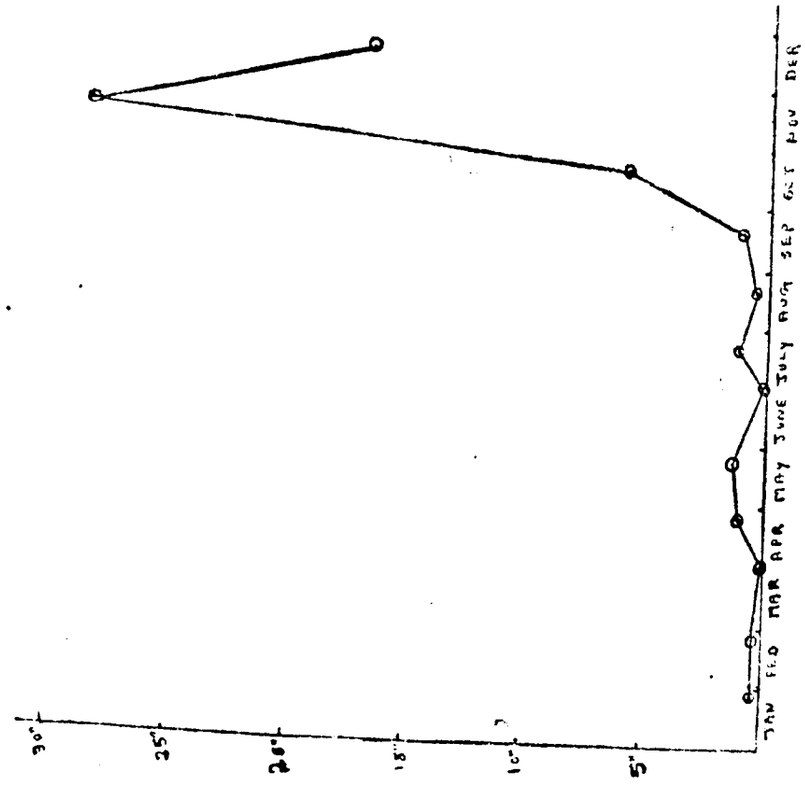
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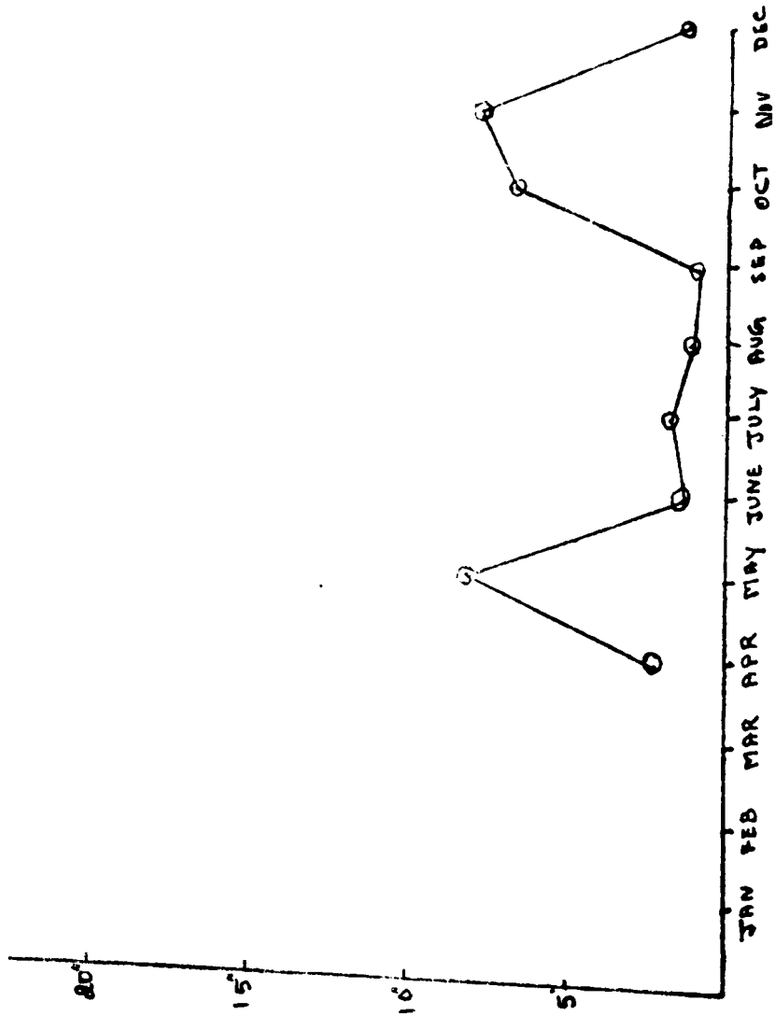
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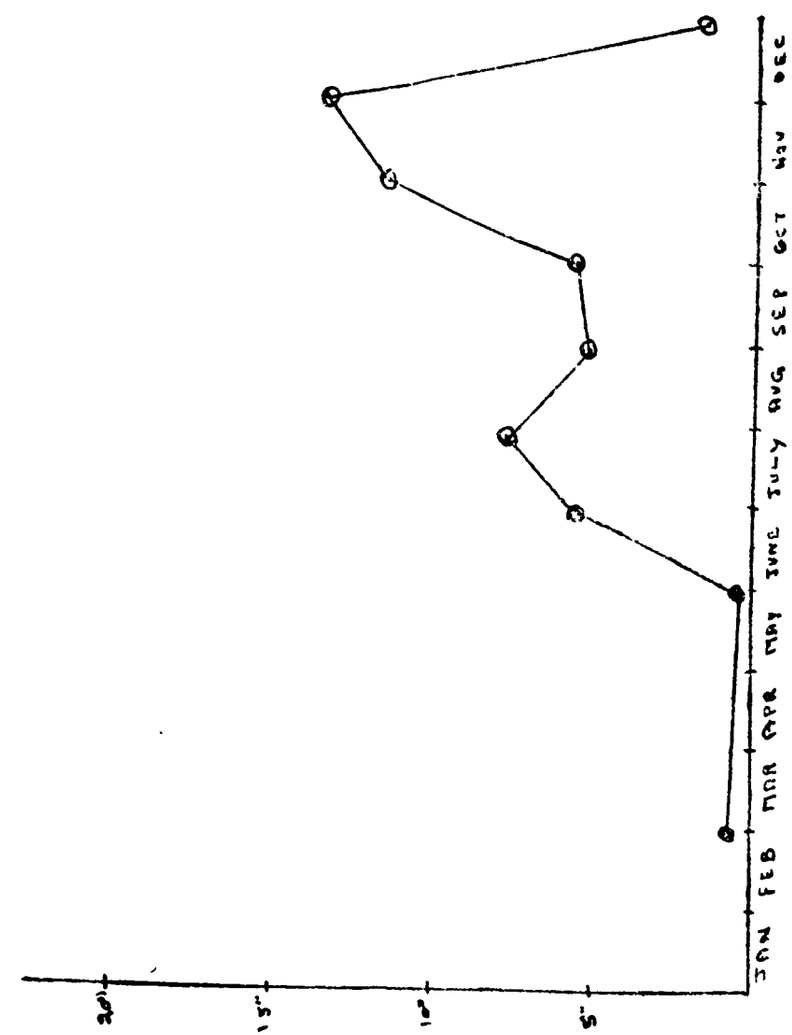
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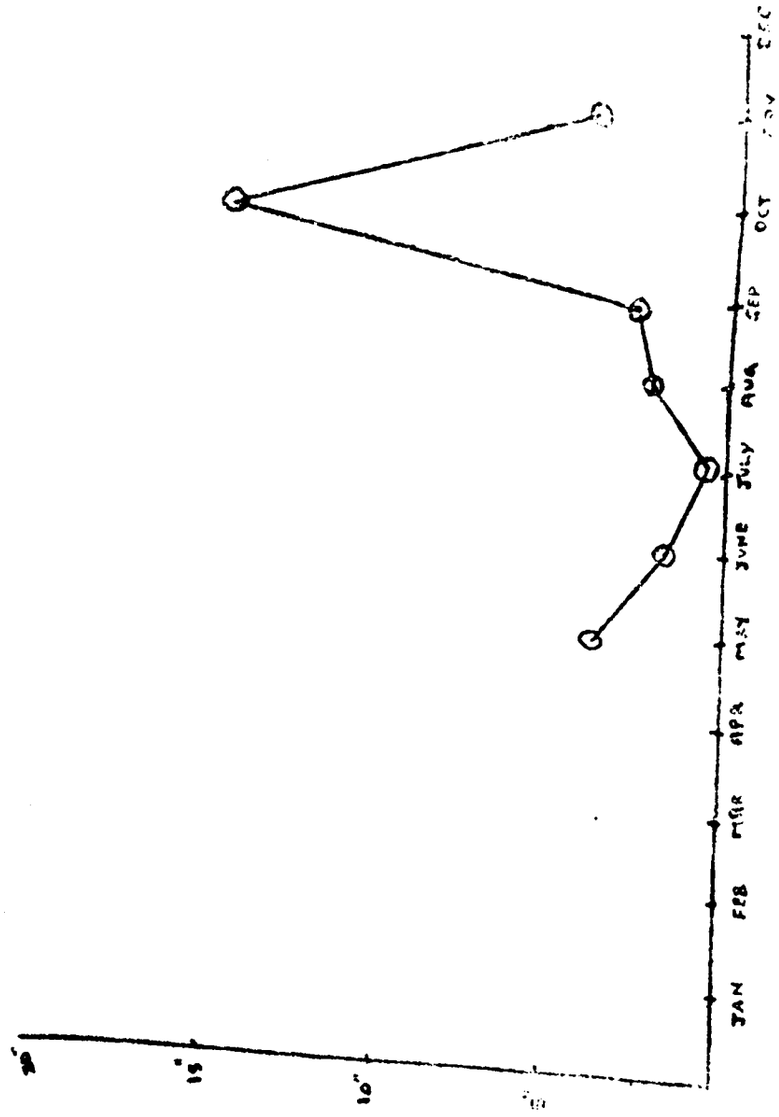
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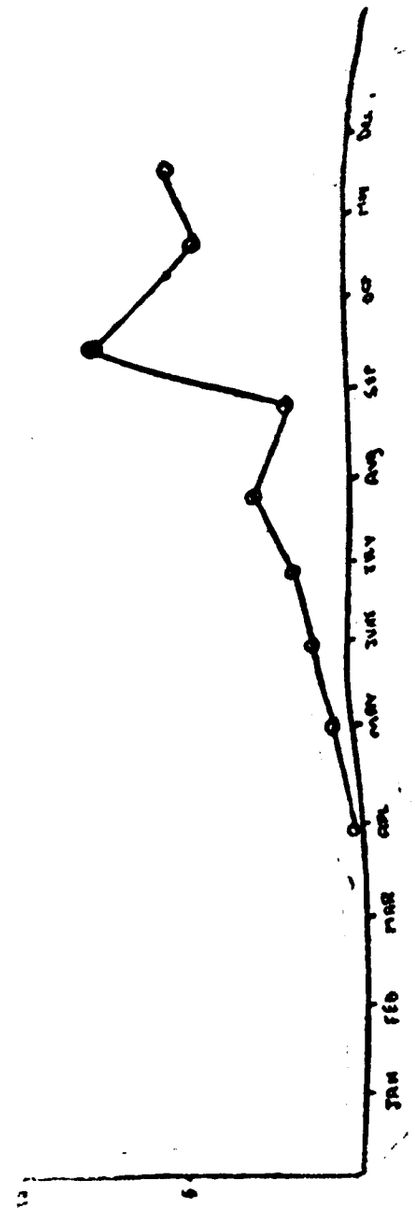


APPENDIX B.

(Referred to in paragraphs 6 and 7).

Statement showing sample plots, tree increment plots and permanent preservation plots in Madras State.

I. *Sample Plots.*

Division.	*S.P. number.*	*Species.*	*Particulars.*
Nilgiris	1	*Eucalyptus pillularis*	To study volume increment.
	2	*Eucalyptus euginoides*	Do.
	3	*Eucalyptus propinqa*	Do.
	4	*Eucalyptus acmonoides*	Do.
	5	*Eucalyptus paniculata*	Do.
	8	*Acacia mollissima*	Do.
	9	*Acacia decurrens*	Do.
	10	*Acacia mollissima*	To find out the yield of bark at different ages.
Coimbatore, South	2 to 17	*Tectona grandis*	To compare the height diameter and volume increment of teak of different origins.
	22	*Do.*	To study height diameter and volume increments.
	23	*Do.*	Do.
	24	*Do.*	Do.
	25	*Ailanthus excelsa*	To study the growth development and girth increment.
	26	*Do.*	Do.
Coimbatore, Nilgiris, ...	1	*Tectona grandis*	To study the diameter volume increment of irrigation teak.
	3	*Do.*	To compare the effect irrigated of a teak plantation raised in an area of poor thorny scrub forest after the 4th, 5th and 6th monsoons after planting teak.

II. *Tree Increment Plots.*

Division.	*T.I.P. number.*	*Species.*
Nilgiris	1	*Eucalyptus globulus.*
	2	*Shola species.*
Salem, North	1	*Santalum album.*
Salem, South	2	*Do.*
Vellore, East	1	*Do.*

Division.	*T.I.P. number.*	*Species.*	*Part in Madras State.*	*Part in Kerala State.*
		Mesua ferrea		
Coimbatore, South	1	This lies along reservoir path.	1. Reservoir path from 0 to 74.	1. Reservoir path from 74 to 105.
	2	Tekkadipath	2. Tekkadipath from 0 to 6.	2. Tekkadipath from 6 to.
	3	Pandaravadai	3. Pandaravadai path (entirely) in Madras.	3. Olakkanurpath chain 51 to 74.
	4	Olakkanurpath total number of trees 1 to 222 Number in items (i) to (3) above 1 to 145. Nos. in items 4 above 146 to 222. Total number of trees 1 to 73 numbers in items (1) to (3)–1 to 17 number in items (4) 18 to 73.	4. Olakkanurpath 0 to 51 chains.	
	2	*Hoopea parviflora*	Do.	Do.
	3	*Calophyllum elatum* Total number of trees 1 to 159. No. I items (i) to 184 above 1 to 134 above 1 to 134 number in items 4 above 135–159.		

APPENDIX B—*cont.*

Statement showing Sample Plots tree increment Plots and permanent preservation Plots in Madras States—cont.

III. *Permanent Preservation Plots.*

Division.	*P.P. number.*	*Species.*	*Particulars.*
Coimbatore, South-Pollachi Topalip	1	*Tectona grandis*	To ascertain data for yield table for teak at Mount Stuart hill in Topalip.

APPENDIX C.

APPENDIX C.

Statement showing seeds and seedlings collected and supplied to various indentors during 1957–58.

(referred to in paragraphs 25.)

Serial number and species. (1)	Supplied to whom. (2)	Seed origin. (3)	Supplied by (4)	Quantity. (5) LB.	OZ.
1 *Acacia arabica*	District Forest Officer, Fodder and Pasture division.	Andhiyur	Range Officer, Andhiyur	80	0
2 *Do.*	Research Forester, Vemburuli	Natham	Range Officer, Natham	5	0
3 *Do.*	District Forest Officer, Tirunelveli, North.	Thanjavur	Research Forester, Thanjavur	10	0
4 *Do.*	Range Officer, Rameswaram	Pollachi	Range Officer, Pollachi	25	0
				120	0
1 *Acacia fernesiana*	Curator, Indian Museum, Calcutta.	Denkanikotta	Research Range Officer, Denkanikotta.	10	0
2 *Do.*	Research Ranger, Nellore	Do.	Do.	5	0
				15	0
1 *Acacia ferruginea*	Research Range Officer, Nellore	Do.	Do.	5	0
				5	0
1 *Acacia concinna*	Research Ranger, Nellore	Do.	Do.	10	0
				10	0
1 *Acacia decurrens*	Divisional Forest Officer, North Garhwal.	Ootacamund	Research Forester, Ootacamund	5	0
2 *Do.*	Divisional Forest Officer, Simla	Do.	Do.	20	0
3 *Do.*	Divisional Forest Officer, Solan	Do.	Do.	0	1
4 *Do.*	District Forest Officer, Bhadravathi.	Do.	Do.	2	0
5 *Do.*	Research Forester, Rameswaram	Do.	Do.	0	2
6 *Do.*	State Silviculturist, Orissa	Do.	Do.	2	0
				29	3
1 *Acacia dealbata*	State Silviculturist, Madhya Pradesh.	Do.	Do.	10	0
2 *Do.*	Divisional Forest Officer, Solan	Do.	Do.	0	1
3 *Do.*	Divisional Forest Officer, South Almora.	Do.	Do.	0	8
				10	9
1 *Acacia mollissima*	Divisional Forest Officer, North Garhwal.	Do.	Do.	5	0
2 *Do.*	Divisional Forest Officer, Simla	Do.	Do.	20	0
3 *Do.*	Divisional Forest Officer, Solan	Do.	Do.	0	1
4 *Do.*	District Forest Officer, Vizagapatnam North.	Do.	Do.	2	0
5 *Do.*	Director of Forests, North East Frontier Agency, Tirap.	Do.	Do.	25	0
6 *Do.*	Divisional Forest Officer, Theri	Do.	Do.	40	0
7 *Do.*	Divisional Forest Offier, South Almora.	Do.	Do.	0	8
8 *Do.*	Divisional Forest Officer, North Garhwal.	Do.	Do.	2	8
9 *Do.*					

APPENDIX C—*cont.*

Statement showing seeds and seedlings collected and supplied to various indentors during 1957–58—cont.

Serial number and species.	*Supplied to whom.*	*Seed origin.*	*Supplied by*	*Quantity.*
(1)	(2)	(3)	(4)	(5)
10 *Acacia mollissima.*	Resin Depot Officer, Rishikesh ..	Ootacamund. ..	Research Forest Officer, Ootacamund. ..	100
11 *Do.*	District Forest Officer, Kollegal ..	Do. ..	Do. ..	10 0
12 *Do.*	Director of Forests, North East Frontier Agency, Tirap.	Do. ..	Do. ..	160 0
13 *Do.*	Forest Research Officer, Himoo ..	Do. ..	Do. ..	1 0
14 *Do.*	State Silviculturist, Assam	Do. ..	Do. ..	375 0
15 *Do.*	Research Forester, Rameswaram ..	Do. ..	Do. ..	0 2
16 *Do.*	District Agricultural Officer, United K.J. Hills, Shillong.	Do. ..	Do. ..	80 0
17 *Do.*	District Forest Officer, Vizagapatnam South.	Do. ..	Do. ..	1 0
18 *Do.*	Divisional Forest Officer, Ghumsur South division.	Do. ..	Do. ..	4 0
19 *Do.*	Divisional Forest Officer, Simla ..	Do. ..	Do. ..	2 0
20 *Do.*	State Silviculturist, Assam	Do. ..	Do. ..	160 0
21 *Do.*	Managing Director, The Cochin Plantations, Punalur.	Do. ..	Do. ..	10 0
22 *Do.*	Soil Conservation Officer, Domodar Valley Corporation, Hasaribagh.	Do. ..	Do. ..	5 0
23 *Do.*	District Forest Officer, Vizagapatnam South.	Do. ..	Do. ..	1 0
				953 3
1 *Acacia monoliformis*	Research Forestor, Ootacamund ..	Do. ..	Do. ..	1 0
				1 0
1 *Acacia leucophloea*	Research Forester, Rameswaram ..	Markanam ..	Research Forester, Markanam ..	3 8
2 *Do.*	District Forest Officer, Vellore West.	Anthiyur ..	Range Officer, Anthiyur	30 0
				33 8
1 *Acacia planifrons*	State Silviculturist, Andhra Pradesh, Kurnool.	Madurai	Range Officer, Ayyalur	5 0
2 *Do.*	Research Forester, Ulundurpet ..	Madurai	Do.	5 0
3 *Do.*	State Silviculturist, Andhra Pradesh, Kurnool.	Tirunelveli ..	Range Officer, Tirunelveli	5 0
				19
1 *Albizzia amara*	Research Forester, Ulundurpet ..	Ramanathapuram.	Range Officer, Tiruppattur ..	25 6
2 *Do.*	District Forest Officer, Fodder and Pasture, Madras.	Udumalpet ..	Range Officer, Udumalpet	10 0
3 *Do.*	Do.	Polur	Range Officer, Polur	14 0
				49 0
1 *Albizzia lebbeck*	Research Forester, Ulundurpet ..	Ramanathapuram.	Range Officer, Tiruppattur ..	25 0
2 *Do.*	District Forest Officer, Fodder and Pasture Division, Madras.	Udumalpet ..	Range Officer, Udumalpet	225 0
3 *Do.*	Do.	Tirunelveli ..	Range Officer, Sankarankoil ..	117 0
4 *Do.*	Do.	Andhiyur ..	Range Officer, Andhiyur	250 0
				677 0

APPENDIX C—*cont.*

Statement showing seeds and seedlings collected and supplied to various indentors during 1957–58—*cont.*

Serial number and species. (1)	*Supplied to whom.* (2)	*Seed origin.* (3)	*Supplied by* (4)	*Quantity.* (5) LB.	OZ.
1 *Albizzia stipulata*	District Forest Officer, Vellore West.	Visakhapatnam ..	Range Officer, Shenkotta	0	8
				0	8
1 *Arjuna myrabalam*	Director, Highways, Research Institute, Madras-25.	Denkanikotta ..	Range Officer, Denkanikotta ..	1	0
				1	0
1 *Areca catechu*	Divisional Forest Officer, Banda ..	Mettupalayam ..	Range Officer, Mettupalayam ..	40	0
				40	0
1 *Azadirachta indica*	District Forest Officer, Fodder and Pasture Division, Madras.	Satiyavedu ..	Range Officer, Satiyavedu	550	0
2 *Do.*	Do.	Mettupalayam ..	Range Officer, Mettupalayam ..		
				550	0
1 *Adenanthera pavonina* ..	Horticultural Officer, Hindustan Steel (Private), Limited, Rourkela.	Denkanikotta ..	Research Range Officer, Denkanikotta.	10	0
				10	0
1 *Anacardium occidentale* ..	Divisional Forest Officer, Shadol	Markanam ..	Research Forester, Markanam ..	10	0
2 *Do.* ..	Divisional Forest Officer, Baran ..	Do. ..	Do. ..	50	0
3 *Do.* ..	State Silviculturist, Rajasthan ..	Tanjore	Research Forester, Tanjore ..	10	0
4 *Do.* ..	Research Forester, Rameswaram ..	Markanam ..	Research Forester, Markanam ..	8	0
5 *Anacardium occidentale* ..	Research Forester, Ulundurpet ..	Tanjore	Research Forester, Tanjore ..	10	0
6 *Do.* ..	Do. ..	Panruti	Range Officer, Panruti	40	0
7 *Do.* ..	Forest Officer, Damodar Valley Corporation.	Do. ..	Do.	20	0
8 *Do.* ..	Divisional Forest Officer, Hazaribagh.	Tanjore	Research Forester, Tanjore ..	20	0
9 *Do.* ..	Divisional Forest Officer, North Ranpur Division.	Do.	Do. ..	2	0
10 *Do.* ..	Officer-in-charge, Botany Branch, Forest Research Institute, Dehra Dun.	Panruti	Range Officer, Panruti	0	8
11 *Do.* ..	Research Forester, Tanjore ..	Do.	Do.	30	0
12 *Do.* ..	Research Forester, Vemburuli ..	Ulundurpet ..	Research Forester, Ulundurpet ..	5	0
				205	8
1 *Ailanthus excelsa*	Research Forester, Tanjore ..	Bodinaickanur ..	Range Officer, Bodinaickanur ..	2	0
2 *Do.*	Central Silviculturist, Dehra Dun ..	Do. ..	Do. ..	0	8
3 *Do.*	District Forest Officer, Cuddalore ..	Ghumsur ..	District Forest Officer, Ghumsur South.	10	0
4 *Do.*	District Forest Officer, Salem North.	Lucknow ..	Research Forester, Ootacamund ..	130	0
5 *Do.*	District Forest Officer, Gudalur ..	Do. ..	Do. ..	20	0
6 *Do.*	Do. ..	Nagpur	State Silviculturist, Bombay State, Nagpur.	4	0
7 *Do.*	District Forest Officer, Salem North.	Kodaikanal ..	Range Officer, Bodinaickanur ..	70	0
8 *Do.*	District Forest Officer, Gudalur ..	Do. ..	Do. ..	56	0
9 *Do.*	District Forest Officer, Salem North.	Andhra	Range Officer, Giddalur	10	0
				302	8
1 *Ailanthus grandis*	Research Forester, Ootacamund, Tanjore, Topslip and Marakanam.	Assam — ..	Deputy Range Officer, Batasipur ..	3	0
				3	0

APPENDIX C—*cont.*

Statement showing seeds and seedlings collected and supplied to various indentors during 19 7 58—cont.

Serial number and species. (1)	*Supplied to whom.* (2)	*Seed origin.* (3)	*Supplied by* (4)	*Quantity.* (5) Lb.	oz.
1 *Ailanthus Malabarica* ..	Director, Science Techniques, Pondicherry.	Wynaad	State Silviculturist, Madras ..	0	2
2 *Do.* ..	Research Foresters, Tanjore, Markanam, Topslip and Vemburuli.	Do.	Do. ..	0	14
3 *Do.* ..	Research Range Officer, Denkanikotta.	Do.	Do. ..	4	0
4 *Do.* ..	District Forest Officer, Ootacamund.	Do.	Research Ranger, Wynaad	20	0
				25	0
1 *Bombax malabaricum*	Director, Sciences, and Techniques, Pondicherry.	Tanjore	Research Forester, Tanjore ..	1	0
2 *Do.*	District Forest Officer, Coimbatore North Division.	Calcutta	Messrs. Biswanath a d Co., Calcutta.	90	0
3 *Do.*	Research Forester, Rameswaram ..	Tanjore	Research Forester, Tanjore ..	1	0
4 *Do.*	District Forest Officer, Salem South.	Begur	Forester, Begur	25	0
5 *Do.*	District Forest Officer, Salem ..	Orissa	Divisional Forest Officer, Raisangpur.	25	0
6 *Do.*	District Forest Officer, Madurai South, Madurai.	Dhenkanal ..	Divisional Forest Officer, Dhenkanal.	20	0
7 *Do.*	District Forest Officer, Chingleput.	Ootacamund ..	District Forest Officer, Gudalur ..	1	0
8 *Do.*	Range Officer, Bodinaickanur ..	Haldwani ..	Assistant Conservator of Forests, Haldwani.	100	0
9 *Do.*	District Forest Officer, Tirunelveli North.	Baripada ..	Divisional Forest Officer, Baripada.	20	0
10 *Do.*	Range Officer, Government Timber Depot, Pollachi.	Tanjore	Research Forester, Tanjore ..	44	0
11 *Do.*	District Forest Officer, Coimbatore North Coimbatore.	Ghumsur ..	Divisional Forest Officer, Ghumsur South.	20	0
12 *Do.*	Range Officer, Thunacadur ..	Topslip	Research Forester, Topslip	8	0
				355	0
1 *Butea frondosa*	District Forest Officer, Fodder and Pasture Division, Madras.	Hyderabad ..	State Silviculturist, Hyderabad ..	25	0
				25	0
1 *Broussonetia papyrifera* ..	District Forest Officer, Godavari Upper Division, Rajahmundry.	Denkanikotta ..	Research Ranger, Denkanikotta ..	0	8
				0	8
1 *Bauhinia variegata* ..	District Forest Officer, Coimbatore. South.	Denkanikotta ..	Research Ranger, Denkanikotta ..	10	0
				10	0
1 *Cassia angustifolia* ..	Officer-in-charge, Botany Branch, Forest Research Institute.	Tirunelveli ..	Range Officer, Ambasamudram ..	2	0
				2	0
1 *Cassia auriculata*	Divisional Forest Officer, Kotdwara.	Denkanikota ..	Research Ranger, Denkanikotta ..	2	0
2 *Do.*	Divisional Forest Officer, Gwalior ..	Do. ..	Do. ..	5	0
3 *Do.*	Divisional Forest Officer, Bharmara.	Do. ..	Do. ..	15	0
				22	0
1 *Cassia fistula*	Research Forester, Rameswaram ..	Denkanikotta ..	Research Forester, Ootacamund ..	1	0
				1	0

APPENDIX C—*cont.*

Statement showing seeds and seedlings collected and supplied to various indentors during 1957–58—cont.

Serial number and species. (1)	Supplied to whom. (2)	Seed origin. (3)	Supplied by (4)	Quantity. (5) LB.	OZ.
1 *Cassia siamea*	District Forest Officer, Vellore West.	Denkanikotta	Research Forester, Ulundurpet	19	0
2 *Do.*	District Forest Officer, Cuddalore	Do.	Research Ranger, Denkanikotta	15	0
3 *Do.*	Research Forester, Ulundurpet	Do.	Do.	20	0
				54	0
1 *Casuarina equisetifolia*	Divisional Forest Officer, Afforestation Division, Gaya.	Markanam	Research Forester, Markanam	36	0
2 *Do.*	Divisional Forest Officer, Afforestation Division, Muzafferpur.	Do.	Do.	7	0
3 *Do.*	Divisional Forest Officer, Razanibagh.	Do.	Do.	4	0
4 *Do.*	Divisional Forest Officer, Ujaipur.	Do.	Do.	1	0
5 *Do.*	Forest Research Officer, Bihar	Do.	Do.	171	0
6 *Do.*	Shri John M. Murray, Madhya Pradesh.	Do.	Do.	0	4
7 *Do.*	Divisional Forest Officer, North Bihar, Afforestation Division.	Do.	Do.	100	0
8 *Do.*	Divisional Forest Officer, Rajasthan.	Do.	Do.	0	1
				319	5
1 *Casuarina cunninghamii*	Research Ranger, Denkanikotta	Dehra Dun	Central Silviculturist, Forest Research Institute, Dehra Dun.	0	2
				0	2
1 *Chloroxylon swietenia*	State Silviculturist, West Bengal, Darjeeling.	Denkanikotta	Research Ranger, Denkanikotta	2	0
				2	0
1 *Cedrela toona*	District Forest Officer, Vellore East.	Denkanikotta	Research Ranger, Denkanikotta	2	0
2 *Do.*	Do.	Do.	Research Forester, Ootacamund	5	0
3 *Do.*	Do.	Kodaikanal	Range Officer, Kodaikanal	4	0
4 *Do.*	Range Officer, Kuttalam	Denkanikotta	Research Ranger, Denkanikotta	1	0
				12	0
1 *Dalbergia latifolia*	Forest Officer, Damodar Valley Corporation, Hazaribagh.	Topslip	Research Forester, Topslip	40	0
2 *Do.*	Director of Forestry, North-East Frontier Agency, Tirap.	Do.	Do.	0	8
				40	8
1 *Dodonea viscosa*	Research Forester, Rameswaram	Ootacamund	Research Forester, Ootacamund	2	0
				2	0
1 *Eucalyptus acmeneioides*	Research Forester, Cotacamund	Ootacamund	Research Forester Ootacamund	0	8
				0	8
1 *Eucalyptus globulus*	Forest Officer, Manipur	Ootacamunde	Research Forester, Ootacamund	41	0
2 *Do.*	Director of Forests, North East Frontier Agency, Tirap.	Do.	Do.	1	0
3 *Do.*	Divisional Forest Officer, Nainital.	Do.	Do.	4	0
4 *Do.*	Divisional Forest Officer, Bhadravathi.	Do.	Do.	1	8
5 *Do.*	Divisional Forest Officer, Janjira Mahad Din.	Do.	Do.	0	8
6 *Do.*	Divisional Forest Officer, Udaipur.	Do.	Do.	0	8
7 *Do.*	State Silviculturist, Orissa	Do.	Do.	0	8
8 *Do.*	Deputy Conservatory of Forests, Mercara.	Do.	Do.	2	0
9 *Do.*	District Forest Officer, North Coorg, Mercara.	Do.	Do.	0	5
10 *Do.*	Forest Research Officer, Hinoo	Do.	Do.	5	0

APPENDIX C—*cont.*

Statement showing seeds and seedling collected and supplied to various indentors during 1957-58—cont.

Serial number and species. (1)	*Supplied to whom.* (2)	*Seed origin.* (3)	*Supplied by* (4)	*Quantity.* (5) LB.	OZ.
11 *Eucalyptus globulus*	Divisional Forest Officer, Sirohi ..	Ootacamund ..	Research Forester, Ootacamund ..	0	8
12 *Do.*	Range Officer, Silvicultural Division, Haldwani (Uttar Pradesh).	Do. ..	Do. ..	0	8
13 *Do.*	Divisional Forest Officer, Dehra Dun.	Do. ..	Do. ..	0	4
14 *Do.*	Divisional Forest Officer, Almora ..	Do. ..	Do. ..	1	0
15 *Do.*	Divisional Forest Officer, Upper Bushahr Forest Division.	Do. ..	Do. ..	0	8
16 *Do.* ..	Divisional Forest Officer, Jubbal Forest Division, Chopal.	Do. ..	Do. ..	0	10
17 *Do.*	Shri John M. Murray, Madhya Pradesh.	Do. ..	Do. ..	0	1
18 *Do.*	District Forest Officer, Vishakapatnam South.	Do. ..	Do. ..	2	0
19 *Do.*	District Forest Officer, Cuddapah North.	Do. ..	Do. ..	1	0
20 *Do.*	Chief Conservator of Forests, Himachal Pradesh, Simla.	Do. ..	Do. ..	2	0
21 *Do.*	Divisional Forest Officer, Nainital.	Do. ..	Do. ..	5	0
22 *Do.*	Chief Forest Officer, North East Frontier Agency, Tirap.	Do. ..	Do. ..	4	0
23 *Do.*	Forest Officer, Manipur	Do. ..	Do. ..	41	0
24 *Do.*	State Silviculturist, Orissa	Do. ..	Do. ..	2	0
25 *Do.*	State Silviculturist, Kerala State ..	Do. ..	Do. ..	0	4
				116	1

1	*Eucalyptus citriodora*	Divisional Forest Officer, West Melur.	Ootacamund ..	Research Forester, Ootacamund ..	2	0
2	*Do.*	Subdivisional Forest Officer, Sabarkantha.	Do. ..	Do. ..	3	0
3	*Do.*	Range Officer, Daharn district ..	Do. ..	Do. ..	0	8
4	*Do.*	Divisional Forest Officer, Palanpur.	Do. ..	Do. ..	0	8
5	*Do.*	Range Officer, Sanjan	Do. ..	Do. ..	0	8
6	*Do.*	Divisional Forest Officer, Kalala ..	Do. ..	Do. ..	0	4
7	*Do.*	Divisional Forest Officer, Chota Udepur.	Do. ..	Do. ..	0	8
8	*Do.*	Divisional Forest Officer, West Khandesh.	Do. ..	Do. ..	0	12
9	*Do.*	Subdivisional Forest Officer, Janjira.	Do. ..	Do. ..	0	3
10	*Do.*	Range Officer, Palghar	Do. ..	Do. ..	0	14
11	*Do.*	Divisional Forest Officer, Bilaspur.	Do. ..	Do. ..	0	10
12	*Do.*	Divisional Forest Officer, West Bhopal.	Do. ..	Do. ..	0	2
13	*Do.*	Divisional Forest Officer, Chindwara.	Do. ..	Do. ..	0	4
14	*Do.*	Divisional Forest Officer, Korea Division.	Do. ..	Do. ..	0	1
15	*Do.*	Divisional Forest Officer, Jabalpur.	Do. ..	Do. ..	1	0
16	*Do.*	Divisional Forest Officer, Raipur ..	Do. ..	Do. ..	0	2
17	*Do.*	Divisional Forest Officer, Sholapur.	Do.	Do. ..	3	0
18	*Do.*	Divisional Forest Officer, Gwalior ..	Do. ..	Do. ..	3	0
19	*Do.*	Forest Store-keeper, Kotdwara ..	Do. ..	Do. ..	4	0
	.. ..	....	Do. ..	Do. ..		
20	.. ..	District Forest Officer, Godawari Lower Division.	Do. ..	Do. ..	1	0
21	*Do.*	Divisional Forest Officer, Udaipur.	Do. ..	Do. ..	0	6
22	*Do.*	State Silviculturist, Orissa	Do. ..	Do. ..	0	3

APPENDIX C— *cont.*

Statement showing seeds and seedlings collected and supplied to various indentors during 1957–58—cont.

Serial number and species. (1)	*Supplied to whom.* (2)	*Seed origin.* (3)	*Supplied by* (4)	*Quantity.* (5) LB.	OZ.
23 *Eucalyptus citriodora.*	.. Research Ranger, Denkanikotta ..	Ootacamund ..	Research Forester, Ootacamund ..	0	8
24 *Do.*	.. Divisional Forest Officer, Sawantwadi.	Do. ..	Do. ..	0	8
25 *Do.* ..	.. District Forest Officer, Godavari Upper Division.	Do. ..	Do. ..	1	0
26 *Do.* ..	.. Divisional Forest Officer, Sirohi ..	Do. ..	Do. ..	0	8
27 *Do.* ..	.. Research Forest Officer, Ulundurpet.	Do. ..	Do. ..	0	2
28 *Do.* ..	.. District Forest Officer, Godawari Lower Division.	Do. ..	Do. ..	0	1
29 *Do.* ..	.. Soil Conservation Officer, Machkund.	Do. ..	Do. ..	1	0
30 *Do.* ..	.. Research Forester, Vemburuli ..	Do. ..	Do. ..	0	4
31 *Do.* ..	.. State Silviculturist, Madhya Pradesh, Rewa.	Do. ..	Do. ..	0	4
32 *Do.* ..	.. Range Officer, Alangayam	Do. ..	Do. ..	0	4
33 *Do.* ..	.. Range Officer, Sathanur	Do. ..	Do. ..	0	4
34 *Do.* ..	.. Range Officer, Tiruvannamalai ..	Do. ..	Do. ..	0	4
35 *Do.* ..	.. Range Officer, Chengam	Do. ..	Do. ..	0	4
36 *Do.* ..	.. District Forest Officer, Godavar Lower Division.	Do. ..	Do. ..	0	4
37 *Do.* ..	.. District Forest Officer, Rajasthan ..	Do. ..	Do. ..	0	4
38 *Do.*	.. District Forest Officer, Vellore East.	Do. ..	Do. ..	0	8
39 *Do.* ..	.. Research Forester, Topslip	Do. ..	Do. ..	5	0
				0	8
				34	9

Eucalyptus eugenoides ..	Soil Conservation Officer, Vasad ..	Ootacamund ..	Research Forester, Ootacamund ..	0	8
				0	8
1 *Eucalyptus robusta*	Divisional Forest Officer, Shadol, Madhya Pradesh.	Ootacamund ..	Research Forester, Ootacamund ..	0	8
2 *Do.*	Soil Conservation Officer, Vasad ..	Do. ..	Do.	0	8
3 *Do.*	Do. Bellary ..	Denkanikotta ..	Research Ranger, Denkanikotta ..	11	0
4 *Do.*	Do. Do. ..	Ootacamund ..	Research Forester, Ootacamund ..	1	0
5 *Do.*	Divisional Forest Officer, East Almora Division.	Do. ..	Do. ..	0	8
				2	12
1 *Eucalyptus rostrata*	Research Forester, Tanjore ..	Ootacamund ..	Research Forester, Ootacamund ..	0	1
2 *Do.*	District Forest Officer, Nellore South.	Do. ..	Do.	0	5
3 *Do.*	* Divisional Forest Officer, Surendranagar.	Do. ..	Do. ..	0	8
4 *Do.*	Rev. F. R. Conservator, Mission Hospital, Miraj.	Do. ..	Do. ..	1	0
5 *Do.*	Divisional Forest Officer, Jodhpur.	Do. ..	Do. ..	2	0
6 *Do.*	Divisional Forest Officer, Udaipur.	Do. ..	Do. ..	0	6
7 *Do.*	Research Ranger, Denkanikotta ..	Do. ..	Do. ..	0	8
8 *Do.*	Forest Research Officer, Hinoo ..	Do. ..	Do. ..	5	0
9 *Do.*	Divisional Forest Officer, Sirohi ..	Do. ..	Do. ..	0	8
10 *Do.*	Forest Ranger, Silvicultural Division, Haldwani (Uttar Pradesh).	Do. ..	Do. ..	0	8
11 *Do.*	District Forest Officer, Vizagapatnam South.	Do. ..	Do. ..	2	0
12 *Do.*	Do.	Do. ..	Do. ..	2	0

APPENDIX C—cont.

Statement showing seeds and seedlings collected and supplied to various indentors during 1957-58—cont.

Serial number and species. (1)	*Supplied to whom.* (2)	*Seed origin.* (3)	*Supplied by* (4)	*Quantity.* (5) LB.	OZ.
13 *Eucalyptus rostrata*	Research Forester, Markanam ..	Ootacamund ..	Research Forester, Ootacamund ..	0	4
14 *Do.*	District Forest Officer, Saidapet ..	Do. ..	Do. ..	0	12
15 *Do.*	Research Forester, Topsl p	Do. ..	Do. ..	1	0
16 *Do.*	Soil Conservation Officer, Machkund.	Do. ..	Do. ..	1	0
17 *Do.*	Research Forester, Vemburuli ..	Do. ..	Do. ..	0	4
18 *Do.*	District Forest Officer, Tirunelveli North.	Do. ..	The Nilgiris Seed Depot	2	0
19 *Do.*	Divisional Forest Officer, Hazanibagh.	Do. ..	Research Forester, Ootacamund ..	9	0
20 *Do.*	District Forest Officer, Godavari Lower.	Do. ..	Do. ..	1	0
21 *Do.*	District Forest Officer, Janjira ..	Do. ..		2	0
				32	0
1 *Eucalyptus crebra* ..	Forest Research Officer, Bihar ..	Ootacamund ..	Research Forester, Ootacamund ..	20	0
				20	0
1 *Eucalyptus propinqua* ..	Do. ..	Do. ..	Do.	20	0
				20	0
1 *Eucalyptus teraticornis* ..	Propagation Superintendent, Cinchona (Department) Plantation, Anamalais.	Ootacamund ..	Research Forester, Ootacamund ..	2	0
				2	0
1 *Eucalyptus pilularis* ..	Research Forester, Ootacamund ..	Ootacamund ..	Research Forester, Ootacamund ..	1	8
				1	8
1 *Eucalyptus paniculata* ..	Divisional Forest Officer, Sawantwadi.	Ootacamund ..	Research Forester, Ootacamund ..	0	8
				0	8
1 *Enterolobium saman* ..	Divisional Forest Officer, Northern Doab.	Markanam ..	Research Forester, Markanam	20	0
2 *Do.* ..	Divisional Forest Officer, Avadh Forest Division.	Do. ..	Do. ..	10	0
3 *Do.* ..	Divisional Forest Officer, Urajbhumi Forest Division.	Do. ..	Do. ..	10	0
4 *Do.* ..	Soil Conservation Officer, Pellary ..	Do. ..	Do.	5	0
5 *Do.* ..	Superintendent, Hosur Cattle Farm.	Do. ..	Do. ..	7	0
6 *Do.* ..	Superintendent, Sheep and Goat Development Farm.	Do. ..	Do. ..	7	0
				59	0
1 *Omelina arborea*	District Forest Officer, Vizagapatnam South.	Denkanikotta ..	Research Ranger, Denkanikotta ..	10	0
				10	0
1 *Glyricidia maculata*	District Forest Officer, Vellore West.	Denkanikotta	Research Ranger, Denkanikotta ..	21	0
				21	0
1 *Grevellia robusta*	Municipal Forest Officer, Gardwara Road.	Ootacamund ..	Research Forester, Ootacamund ..	0	8
2 *Do.*	Divisional Forest Officer, Pibih Division.	Do. ..	Do. ..	1	8

APPENDIX C—*cont.*

Statement showing seeds and seedlings collected and supplied to various indentors during 1957-58—cont.

Serial number and species. (1)	*Supplied to whom.* (2)	*Seed origin.* (3)	*Supplied by* (5)	*Quantity.* (6) lb.	oz.
3 *Grevillea robusta*	Divisional Forest Officer, Binjor ..	Ootacamund ..	Research Forester, Ootacamund. ..	2	0
4 *Do.*	Divisional Forest Officer, Kotdwara.	Do. ..	Do. ..	2	0
5 *Do.*	Divisional Forest Officer, Meerut ..	Do. ..	Do. ..	4	8
6 *Do.*	Forest Officer, Simla	Do. ..	Do. ..	0	
				10	8
1 *Jardwickia binata* — —	Divisional Forest Officer, Birkhum Division, West Bengal.	Coimbatore ..	Range Officer, Ulundurpet .. —	55	0
				55	0
1 *Do.* — —	Hill Cotton Research Forester, Topslip	Ootacamund ..	Research Forester,	0	12
				0	12
1 *Leucaena glauca*	Range Officer, Kuttalam ..	Denkanikotta ..	Research Ranger, Denkanikotta ..	1	0
2 *Do.*	District Forest Officer, Salem South.	Do. ..	Do. ..	38	0
				39	0
1 *Melia dubia*	District Forest Officer, Vellore West Division.	Denkanikotta ..	Research Ranger, Denkanikotta ..	20	0
2 *Do.*	District Forest Officer, Chingleput.	Do. ..	Do. ..	12	0
3 *Do.*	Range Officer, Kuttalam ..	Do. ..	Do. ..	1	0
				33	0

1	*Morus alba*	Research Ranger, Denkanikotta ..	Dehra Dun ..	Central Silviculturist, Forest Research Institute, Dehra Dun.		0	4
2	Do.	District Forest Officer, Vellore West.	Do. ..	Do.		1	0
3	*Do.*	Do.	Do. ..	Research Forester, Ootacamund ..		0	4
4	*Do.*	District Forest Officer, Vellore East.	Hosur ..	Sericultural Expert, Hosur ..		2	0
						3	8
1	*Ochroma lagopus*	District Forest Officer, Guntur ..	Topslip ..	Research Forester, Topslip ..		1	10
2	*Do.*	Shri S. V. Pandit, North Kanara ..	Do. ..	Do. ..		0	½
3	*Do.* ..	State Silviculturist, West Bengal ..	Denkanikotta ..	Research Ranger, Denkanikotta ..		0	4
4	*Do.*	State Silviculturist, Bombay ..	Do. ..	Do. ..		0	½
5	*Do.*	District Forest Officer, Nellore South.	Do. ..	Do.		0	5
6	*Do.* ..	State Silviculturist, Orissa ..	Do. ..	Do. ..		0	4
7	*Do.*	District Forest Officer, Cuddapah North.	Do. ..	Do. ..		0	10
8	*Do.*	State Silviculturist, Andhra Pradesh, Hyderabad.	Do. ..	Do. ..		0	2
9	*Do.*	Research Ranger, Nellore ..	Do. ..	Do. ..		0	2
10	*Do.*	Research Ranger, Tirupathi	Do. ..	Do. ..		0	2
11	*Do.*	State Silviculturist, Assam ..	Do. ..	Do. ..		1	0
12	*Do.*	State Silviculturist, Rajasthan ..	Do. ..	Do. ..		1	0
13	*Do.* ..	District Forest Officer, Godavari Lower Division.	Do. ..	Do. ..		0	2
						5	9½
1	*Ocimum camphora*	Divisional Forest Officer, Gomati Rapti Division.	Topslip ..	Research Forester, Topslip ..		5	0
						5	0

APPENDIX C—*cont.*

Statement showings seeds and seedling collected and supplied to various indentors during 1957–58—cont.

Serial number and species. (1)	*Supplied to whom.* (2)	*Seed origin.* (3)	*Supplied by* (4)	*Quantity.* (5) LB.	OZ.
1 *Pithecolobium dulce*	District Forest Officer, Cuddalore ..	Hyderabad ..	State Silviculturist, Hyderabad ..	100	0
2 *Do.*	Research Forester, Ulundurpet ..	Tanjore ..	Research Forester, Tanjore ..	5	0
3 *Do.*	District Forest Officer, Vellore West.	Do. ..	Do. ..	37	0
				142	0
1 *Pterocarpus santalinus* ..	District Forest Officer, Fodder and Pasture Division, Madras.	Satiyavedu ..	Range Officer, Satiyavedu ..	161	0
2 *Do.* ..	Do.	Ranipet ..	Range Officer, Ranipet ..		
				161	0
1 *Santalum album*	Horticultural Officer, Hindustan (Private) Limited, Rourkela.	Denkanikotta ..	Research Ranger, Denkanikotta ..	1	0
2 *Do.*	Divisional Forest Officer, Kotdwara.	Do. ..	Do. ..	2	0
3 *Do.*	Divisional Forest Officer, Ramnagar Forest Division.	Do. ..	Do. ..	5	0
4 *Do.*	Divisional Forest Officer, Banda ..	Do. ..	Do. ..	40	0
5 *Do.*	Divisional Forest Officer, Bahraich Division.	Do. ..	Do. ..	40	0
6 *Do.*	Divisional Forest Officer, Gorakhpur.	Do. ..	Do. ..	2	0
7 *Do.*	Pratap Chand, Bafna Harada ..	Do. ..	Do. ..	1	0
8 *Do.*	State Silviculturist, West Bengal, Darjeeling.	Do. ..	Do. ..	2	0
9 *Do.*	Divisional Forest Officer, Bijnor Forest Division.	Do. ..	Do. ..	2	0
10 *Do.*	Divisional Forest Officer, Gorakhpur Forest Division.	Do. ..	Do. ..	1	0
11 *Do.*	Divisional Forest Officer, Gonda Forest Division	Do. ..	Do. ..	5	0
12 *Santalum album*	Divisional Forest Officer, Haldwani Forest Division, Lucknow.	Denkanikotta ..	Research Ranger, Denkanikotta ..	10	0
13 *Do.*	*Do.*	Do. ..	Do. ..	1	0
14 *Do.*	State Silviculturist, West Bengal	Do. ..	Do. ..	2	0
15 *Do.*	Soil Conservation Officer, Ootacamund.	Do. ..	Do. ..	1	0
16 *Do.*	Divisional Forest Officer, Burdwan.	Do. ..	Do. ..	5	0
17 *Do.*	Divisional Forest Officer, Malda Division.	Do. ..	Do. ..	1	0
18 *Do.*	Conservator of Forests, West Bengal.	Do. ..	Do. ..	0	8
				121	8
1 *Strychnos nux vomica*	Officer-in-charge, Botany Branch, Forest Research Institute, Dehra Dun.	Denkanikotta ..	Research Ranger, Denkanikotta ..	1	0
				1	0
1 *Tamarindus indica*	Research Forester, Ulundurpet ..	Ramanathapuram.	Range Officer, Tiruppattur ..	50	0
				50	0
1 *Terminalia catappa*	Research Forester, Rameswaram ..	Tiruchirappalli ..	Sri Ramakrishna Tapovanam, Tiruchirappalli.	6	0
				6	0
1 *Terminalia arjuna*	Junior Engineer, Highways, Madras.	Denkanikotta ..	Research Ranger, Denkanikotta ..	3	0
				3	0

APPENDIX C—*cont.*

Statement showing seeds and seedings collected and supplied to various indentors during 1957–58—cont.

Serial number and species.	Supplied to whom.	Seed origin.	Supplied by.	Quantity.	
(1)	(2)	(3)	(4)	(5)	
				LB.	OZ.
1 *Terminalia tomentosa*	District Forest Officer, Tanjore ..	Topslip ..	Research Forester, Ootacamund ..	50	0
2 *Do.*	Do. ..	Kerala ..	State Silviculturist, Kerala ..	19	0
3 *Do.*	Do. ..	Mudumalai ..	Range Officer, Mudumalai ..	80	0
4 *Do.*	Do. ..	Thunacadavu ..	Range Officer, Thunacadavu ..	100	0
				249	0
1 *Tectona grandis*	District Forest Officer, Vellore West.	Mudumalai ..	District Forest Officer, Gudalur ..	750	0
2 *Do.*	District Forest Officer, Tanjore ..	Do. ..	Do. ..	8,000	0
3 *Do.*	District Forest Officer, Salem South.	Do.	Do. ..	200	0
4 *Do.*	Divisional Forest Officer, Satara ..	Do. ..	Do. ..	100	0
5 *Do.*	District Forest Officer, Cuddalore ..	Do. ..	Do. ..	170	0
6 *Do.*	Block Development Officer, Gudalur.	Do. ..	Do. ..	150	0
7 *Do.*	District Forest Officer, Salem North.	Do. ..	Do. ..	2,500	0
8 *Do.*	District Forest Officer, Madurai South.	Do. ..	Do. ..	3,000	0
9 *Do.*	District Forest Officer, Madurai North.	Do. ..	Do. ..	1,250	0
10 *Do.*	District Forest Officer, Vellore East.	Do. ..	Do. ..	1,000	0
11 *Do.*	District Forest Officer, Saidapet ..	Do. ..	Do. ..	400	0
12 *Do.*	District Forest Officer, Chingleput.	Do. ..	Do. ..	100	0
13 *Do.*	District Forest Officer, Viza apatnam.	Do. ..	Do. ..	200	0
14 *Do.*	Divisional Forest Officer, Avadh ..	Do. ..	Do. ..	160	0
15 *Do.*	Divisional Forest Officer, Bahraich.	Do. ..	Do. ..	400	0
16 *Do.*	Divisional Forest Officer, Vundlekhaud.	Do. ..	Do. ..	320	0
17 *Do.*	Divisional Forest Officer, Kotdwara.	Do. ..	Do. ..	480	0
18 *Do.*	Divisional Forest Officer, Dehra Dun.	Do. ..	Do. ..	80	0
19 *Do.*	Resin Depot Officer, Kotdwara ..	Do. ..	Do. ..	80	0
20 *Do.*	Divisional Forest Officer, Southern Doab, Forest Division.	Do. ..	Do. ..	40	0
21 *Do.*	District Forest Officer, Kalagarh ..	Do. ..	Do. ..	120	0
22 *Do.*	Divisional Forest Officer, Urajbhumi.	Do. ..	Do. ..	40	0
23 *Do.* ..	Divisional Forest Officer, North Kheri.	Do. ..	Do. ..	3,500	0
24 *Do.*	Divisional Forest Officer, Philibhit Forest Division.	Do. ..	Do. ..	800	0
25 *Do.*	Range Officer, Kalyan ..	Anamalais ..	Research Forester, Topslip ..	80	0
26 *Do.*	Superintendent, Assam Forest School, Pandu.	Do. ..	Do. ..	15	0
27 *Do.*	Officer-in-charge, Botany Branch, Forest Research Institute, Dehra Dun.	Do. ..	Do. ..	2	0
28 *Do.*	District Forest Officer, Tirunelveli South.	Do. ..	Do.	2,933	0
29 *Do.*	District Forest Officer, Vellore West.	Do. ..	Do. ..	300	0
30 *Do.*	District Forest Officer, Tanjore ..	Do. ..	Do. ..	2,000	0
31 *Do.*	Central Silviculturist, Forest Research Institute.	Do. ..	Do. ..	20	0
32 *Do.* ..	Research Forester, Rameswaram ..	Do. ..	Do. ..	10	0
				29,260	0

APPENDIX 'C'

Total quantities of various seeds supplied.

Serial number and name of species.	Quantity supplied. LB.	OZ.
1 *Acacia arabica*	120	0
2 *Acacia Farnesiana*	15	0
3 *Acacia ferruginea*	15	0
4 *Acacia decurrens*	29	3
5 *Acacia concinna*	10	0
6 *Acacia dealbata*	10	9
7 *Acacia mollissima*	955	3
8 *Acacia moniliformis*	1	0
9 *Acacia leucophloea*	33	8
10 *Acacia planifrons*	15	0
11 *Albizzia amara*	49	9
12 *Albizzia lebbeck*	677	0
13 *Albizzia stipulata*	0	8
14 *Arjuna myrobalans*	1	0
15 *Areca catechu*	40	0
16 *Azadirachta indica*	500	0
17 *Adenanthera pavonina*	10	0
18 *Anacardium occidentale*	205	0
19 *Ailanthus excelsa*	302	8
20 *Ailanthus grandis*	3	0
21 *Ailanthus malabarica*	25	0
22 *Bombax malabaricum*	355	0
23 *Butea frondosa*	25	0
24 *Broussonetia papyrifera*	0	8
25 *Bauhinia variegata*	10	0
26 *Cassia angustifolia*	2	0
27 *Cassia auriculta*	2	0
28 *Cassia fistula*	1	0
29 *Cassia siamea*	64	0
30 *Casuarina equisetifolia*	819	5
31 *Casuarina cunninghamii*	0	2
32 *Chloroxylon swietenia*	2	0
33 *Cedrela toona*	12	0
34 *Dalbergia latifolia*	40	8
35 *Dodonaea viscosa*	2	0
36 *Eucalyptus acmenoides*	0	8
37 *Eucalyptus globulus*	116	1
38 *Eucalyptus citriodora*	34	9
39 *Eucalyptuseugenoides*	0	8
40 *Eucalyptus robusta*	2	12
41 *Eucalyptus rostrata*	32	0
42 *Eucalyptus crebra*	20	0
43 *Eucalyptus propinqua*	20	0
44 *Eucalyptus pilularis*	1	8
45 *Eucalyptus paniculata*	0	8

Total quantities of various seeds supplied—cont.

Serial number and name of species.	Quantity supplied. LB.	OZ.
46 *Eucalyptus tereticornis*	2	0
47 *Enterolobium saman*	59	0
48 *Gmelina arborea*	10	0
49 *Gliricidia maculata*	21	0
50 *Grevillea robusta*	10	8
51 *Hardwickia binata*	65	0
52 *Hill cotton*	0	12
53 *Leucaena glauca*	39	0
54 *Melia dubia*	33	0
55 *Morus alba*	3	8
56 *Ochroma lagopus*	5	9¼
57 *Ocimum camphora*	5	0
58 *Pithecolobium dulce*	142	0
59 *Pterocarpus santalinus*	161	0
60 *Santalum album*	121	8
61 *Strychnos nux vomica*	1	0
62 *Tamarindus indica*	50	0
63 *Terminalia catappa*	6	0
64 *Terminalia arjuna*	2	0
65 *Terminalia tomentosa*	249	0
66 *Tectona gr*	29,200	0
	34,260	3¼

APPENDIX 'C'—*cont.*

Details of various seedlings supplied.

Serial number and species.	*Supplied to whom.*	*Origin.*	*Supplied by.*	*Quantity numbers.*
1 *Acacia mollissima*	Research Forester, Topslip	Ootacamund	Research Forester, Ootacamund	198
2 *Acacia decurrens*	Do.	Do.	Do.	96
3 *Kudzu vine* (cuttings)	District Forest Officer, Fodder and Pasture Division, Madras.	Coonoor	Assistant-in-charge, Kallar and Berliar Fruit Stores, Mettupalayam	50
4 *Morus alba* cuttings	District Forest Officer, Salem North.	Hosur	Sericultural Expert, Hosur	500
5 *Terminalia arjuna* (seedlings).	Junior Engineer, Highways, Madras.	Denkanikotta	Research Ranger, Denkanikotta.	300
6 *Tectona grandis stump*	Research Forester, Thanjavur	Thanjavur	District Forest Officer, Thanjavur	3,000
7 *Do.*	District Forest Officer, Vellore West.	Coimbatore	District Forest Officer, Coimbatore South, Pollachi	25,000
8 *Do.*	District Forest Officer, Salem North.	Do.	Do.	25,000
9 *Do.*	Divisional Forest Officer, Ambala	Mettupalayam	Range Officer, Mettupalayam	200
10 *Do.*	Research Forester, Rameswaram	Do.	Do.	135
				54,379

APPENDIX D

Statement showing the details of seeds of exotic species received and despatched to various centres for trial during 1957—58 (Referred to in para 25).

Species	*Seeds received from whom and Country of origin.*	*Quantity received.*	*Despatched to*
(1)	(2)	(3)	(4)
		LB.	
1 *Calamus gurubu*	State Silviculturist, Assam.	1½	Research forestor, Thanjavur Topslip.
2 Do.	Do.	5	District Forest Officer, Vellore East.
3 *Diospyros Lotus.*	Chief Conservator of Forests, Madras (Australia).	3	District Forest Officers, Salem North, Vellore East and West, Tirunelveli North and South, Madurai North, Coimbatore North and all Research Foresters and Research Ranger and Forester, Guindy Park, except Research Forester, Ootacamund.
4 *Dalbergia sissoo*	Special Forest Officer, Tarai and Babar Haldwani.	1,500	District Forest Officer, Fodder and Pasture and District Forest Officer, Saidapet.
5 *Do.*	Superintendent, Livestock Research Station, Hosur Cattle Farm.	777—0	District Forest Officer, Fodder and Pasture Division, Madras.
6 *Do.*	Range Officer, Asansol.	1 maund.	District Forest Officer, Tanjore.
7 *Do.*	Range Officer, Rudrapur, Ramanathapuram.	50 bags.	District Forest Officers, Vellore West and East, Cuddalore, Salem South, Madurai North.
8 *Do.*	Research Ranger, Denkanikotta.	50—0	Research Foresters, Rameswaram and Ulundurpet.
9 *Do.*	Superintendent, Livestock Research Station.	1,075—0	District Forest Officers, Salem North and Fodder and Pasture Division and Vellore west.
10 *Do.*	Range Officer, Rydax.	4 maunds	District Forest Officer, Tiruchirappalli.
11 *Do.*	Range Officer, Madarihat.	6 bags.	District Forest Officer, Vellore East.
12 *Prosopis juliflora.*	Research Ranger, Denkanikotta.	253—0	District Forest Officer, Tanjavur.
13 *Do.*	Bellary merchants ..	2,600—0	District Forest Officer, Fodder and Pasture Division.
14 *Do.*	Do.	35—0	Range Officer, Rameswaram.
15 *Do.*	Do.	15—0	Research Forester, Rameswaram.
16 *Do.*	Research Forester, Thanjavur.	395—0	Forester, Guindy Park.

APPENDIX 'D'—*cont.*

ement showing the details of seeds of exotic species received and despatche: rious centres for trial during 1957-58 (*Referred to in paragraph* 25)— *cont.*

pecies.	*Seeds received from whom and country of origin.*	*Quantity received.*	*Despatched to*
(1)	(2)	(3)	(4)
..			
ziezia alcata	Forest Research Institute.	6—0	Conservator of Forests, Kozhikode circle and all Research Foresters and Forester, Guindy Park, except Research Forester, Ootacamund.
18 *Grewia populifolia.*	Chief Conservator of forests, Madras.	Small	Research Foresters, Thanjavur, Vemburuli, Markanam and Ulundurpet.
19 *Eucalyptus hybrid.*	State Silviculturist, Mysore.	96—0	All the District Forest Officers.
20 *Sterculia companulata.*	Chief Conservator of Forests, Andamans.	248 —0	District Forest Officers, Chingleput, Vellore East, Tirunelveli South, Ootacamund, Madurai South, Tiruchirapalli, Gudalur Saidapet, Madurai North, Tirunelveli North, Tanjavur and Research Ranger Denkanikotta and Research Foresters, Thanjavur, Rameswaram, Marakanam, Vemburuli, Ulundurpet and Ootacamund.
21 *Cassia siamea* (Cassia florida).	State Silviculturist, Tanganyika.	Small quantity.	Research Ranger, Denkanikotta and all Research Foresters Except Research Forester, Ootacamund, District, Forest Officers, Salem North, South, Chingleput, Saidapet, Vellore East and West, Cuddalore, Coimbatore North, Ootacamund, Gudalur Madurai North and Coimbatore South.
22 *Cinnamomum camphora.*	State Silviculturist Tanganyika.	7 Ozs.	Research Foresters, Ootacamund and Topslip.
23 *Eucalyptus striodora.*	Do.	..	District Forest Officers, Gudalur, Vellore East, Vellore West, Chingleput, Tiruchirappalli, Saidapet, Coimbatore South and all Research Foresters and Research Ranger, Denkankotta.
24 *Eucalyptus maculata.*	Do.	Small quantity.	Curator, Botanic Gardens, Ootacamund and Research Forester, Ootacamund.
25 *Eucalyptus maidinii.*	Do.	..	Do.

APPENDIX E.

APPENDIX 'D'—*cont.*

Statement showing the details of seeds of exotic species received and despatched to various centres for trial during 1957-58 (*Referred to in paragraph* 25,— *ante.*

Species.	*Seeds received from whom and country of origin.*	*Quantity received.*	*Despatched to*
(1)	(2)	(3)	(4)
17 *Albizzia falcata*	Forest Research Institute.	6—0	Conservator of Forests, Kozhikode circle and all Research Foresters and Forester, Guindy Park, except Research Forester, Ootacamund.
18 *Grewia populifolia.*	Chief Conservator of forests, Madras.	Small	Research Foresters, Thanjavur, Vemburuli, Markanam and Ulundurpet.
19 *Eucalyptus hybrid.*	State Silviculturist, Mysore.	96—0	All the District Forest Officers.
20 *Sterculia companulata.*	Chief Conservator of Forests, Andamans.	248 —0	District Forest Officers, Chingleput, Vellore East, Tirunelveli South, Ootacamund, Madurai South, Tiruchirapalli, Cudalur Saidapet, Madurai North, Tirunelveli North, Tanjavur and Research Ranger Denkanikotta and Research Foresters, Thanjavur, Rameswaram, Marakanam, Vemburuli, Ulundurpet and Ootacamund.
21 *Cassia siamea* (Cassia florida).	State Silviculturist, Tanganyika.	Small quantity.	Research Ranger, Denkanikotta and all Research Foresters Except Research Forester, Ootacamund, District, Forest Officers, Salem North, South, Chingleput, Saidapet, Vellore East and West, Cuddalore, Coimbatore North, Ootacamund, Gudalur Madurai North and Coimbatore South.
22 *Cinnamomum camphora.*	State Silviculturist Tanganyika.	7 Ozs.	Research Foresters, Ootacamund and Top-slip
23 *Eucalyptus citriodora.*	Do.	..	District Forest Officers, Gudalur, Vellore East, Vellore West, Chingleput, Tiruchirappalli, Saidapet, Coimbatore South and all Research Foresters and Research Ranger, Denkanikotta.
24 *Eucalyptus maculata.*	Do.	Small quantity.	Curator, Botanic Gardens, Ootacamund and Research Forester, Ootacamund.
25 *Eucalyptus maidinii.*	Do.	..	Do.

APPENDIX E.

APPENDIX 'E'

Statement showing seed weight with germinative capacity plantnt per cent and best method of raising (Referred to in paragraph 26).

Species.	Number. Seeds. Per oz.	Number. Seeds. Per lb.	Number. Fruits. Per oz.	Number. Fruits. Per lb.	Germinative capacity.	Plants per cent.	Plants per lb.	Best method of raising. Artificially. Direct sowing.	Entire transplanting.	Vegetative propagation. Stump planting.	Stump 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
Acacia aureuliformis	1,213	19,408	..	..	80	65	12,615	..	1	..	..	..	III—IV
Acacia baileyana	966	15,456	..	..	33	14	2,164	..	1	..	..	..	VIII.
Acacia cyanophylla	2,010	32,160	..	..	94	93	29,909	..	1	2	..	..	IV
Acacia cyclopsis	7,351	1,760	..	..	47	46	5,410	..	..	..	..	..	XII—IV
Acacia dealbata	2,340	37,440	..	..	45	33	12,335	..	1	2	..	..	XII—IV
Acacia decurrens	1,740	27,840	..	..	53	19	5,290	..	1	..	..	..	XII—I
Acacia fernesiana	290	4,640	..	..	22	7	305	..	..	..	..	..	..
Acacia ferruginea	167	2,647	..	..	99	30	2,138	1	..	..	..	..	XII—IV
Acacia leucophloea	1,076	17,216	..	..	42	30	5,165	1	..	..	..	..	XII—IV
Acacia melanoxylon	2,043	32,544	..	..	83	78	25,384	..	1	1	..	..	IV
Acacia mollissima	1,795	28,560	..	..	57	15	4,284	..	1	..	..	..	XII—II
Acacia Planifrons	722	11,552	..	..	42	25	4,043	..	..	..	..	..	VI—VIII
Acacia saligna	1,346	21,824	..	..	9	8	1,746	..	..	..	..	..	XII—I
Acacia sundra	750	12,000	..	..	90	90	10,809	1	..	..	..	..	XI—V
Acrocarpus fraxinifolius	876	14,016	..	..	49	33	5,326	2	1	..	..	..	III—IV
Adansonia digitata	44	704	..	..	54	50	..	..	..	..	..	..	Seed collected from Rameswaram.
Adenanthera pavonina	99	1,584	..	..	83	83	1,249	..	1	..	..	..	VII
Aglaia roxburghiana	51	816	..	..	57	56	457	..	1	..	..	..	I
Ailanthus excelsa	291	4,656	..	..	6	4	186	..	..	..	..	..	I—III
Ailanthus grandis	40	..	..	..	51	34	215	..	..	..	..	..	..
Ailanthus malaberica (Bezur)	266	..	..	..	14	5	221	..	..	..	..	..	..
					18	18	601	..	..	..	..	..	..
Alangium lamarckii	49	784	..	..	47	47	363	..	..	..	..	..	V and VII
Albizzia amara	400	6,400	..	..	83	74	4,736	..	..	..	..	..	XII—II and V
Albizzia lebbeck	314	5,024	..	..	65	39	2,462	2	..	..	..	..	..
Albizzia falcata	389	6,224	..	..	39	49	2,000	..	..	..	1	..	XII—II and VI
Albizzia stipulata	1,997	31,952	..	..	8	1	320	..	1	..	1	..	II—IV
Alourites fordii	16	256	..	..	25	..	..	..	..	..	..	..	..
Alourites montana	12	192	..	..	..	..	..	..	..	..	..	..	..
Alnus nepalensis	66,308	1,060,928	..	..	24	1	10,609	..	..	..	..	..	I and II
Alstonia scholaris	3,501	56,061	..	..	30	28	15,634	..	..	..	..	..	I and IV
Anacarium occidentale	5·3	85	..	..	98	98	83	1	2	..	..	..	III—V
Anogeissus latifolia	2,265	36,240	..	..	..	1	362	..	..	..	..	..	..
Antiaris toxicaria	18	288	..	..	39	25	101	..	..	..	..	..	..
Averaria excelsa	16	256	..	..	..	..	..	..	..	..	..	..	..
Artocarpus hirsuta	61	976	..	..	97	81	781	2	1	..	..	..	IV—V
Artocarpus integrifolia	5	82	..	..	59	59	48	..	..	..	..	..	VI—VII
Azadirachta indica	130	2,080	..	..	90	89	1,851	2	1	..	..	..	V—X
Balanocarpus utilis	7	110	..	..	72	69	76	..	1	..	..	..	X
Bambusa arundinacea	2,277	36,432	..	..	38	37	13,480	..	..	..	..	..	II—IV
Bambusa gigantea	3,475	..	..	..	2	1	555	..	..	..	..	..	..
Bambusa polymorpha	1,396	22,336	..	..	40	32	7,148	..	..	..	..	..	III
Bambusa tulda	485	7,280	..	..	2	1	73	..	..	..	..	..	..
Bauhinia purpurea	55	880	..	..	98	95	836	2	..	1	..	..	II—III
Bauhinia racemosa	224	3,584	..	..	27	23	825	2	..	1	..	..	..
Bauhinia variegata	44	704	..	..	50	45	317	..	..	..	..	..	V
Berberis tinctoria	2,880	46,080	..	..	56	23	10,598	..	..	..	..	..	V
Bischofia javanica	1,694	27,104	..	..	79	75	20,326	..	1	..	..	..	X—II
Bombax insigne	332	5,312	..	..	0·4	0·4	21	..	..	..	..	..	IV
Bombax malabaricum	778	12,448	..	..	22	16	1,922	..	1	2	..	..	III—V
Broussonetia papyrifera	17,465	297,280	..	..	47	28	78,198	..	1	2	..	..	VI
Calamus caesius	25	400	..	..	Seed lost viability.			..	..	..	..	..	..
Calamus pseudotenuis	70	1,120	..	..	6	6	..	..	..	..	..	..	..
Calamus rheedii (Topslip)	170	2,720	..	..	..	..	..	..	..	..	..	..	..
Calamus scipionum	96	1,536	..	..	..	..	....	..	..	..	..	..	..
Calamus rotang	27	592	..	..	50	50	..	..	..	..	..	..	..

APPENDIX 'E'—*cont.*

Statement showing seed weight with germinative capacity plant per cent and best method of raising (Referred to in paragraph 26)—cont.

Species.	Number.				Germinative capacity.	Plants per cent.	Plants per lb.	Best method of raising.					Month sown.
	Seeds.		Fruits					Artificially.			Vegetative propagation.		
	Per oz.	Per lb.	Per oz.	Per lb.				Direct sowing.	Entire transplanting.	Stump planting.	Stump cutting.	Air layering.	seeds.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Callitris rhomboides	4,855	77,680	..	..	45	18	13,982	..	..	..	..	..	IV—VI
Calophyllum elatum	4	64	..	..	89	67	3	..	1	..	..	..	V—IX
Canarium euphyllum	14	224	..	..	176	1·6	..	..	1	..	..		Germination period 46-72 days.
Canthium didymum	303	4,848	..	..	42	12	582	..	..	..	..	..	III—VII
Cassia auriculata	908	14,528	..	..	68	53	7,700	1	..	..	..	..	I—III
Cassia fistula	177	2,832	..	..	55	47	1,331	1	..	..	..	..	II—IV
Cassia Javanica	182	2,912	..	..	13	13	..	..	..	..	..	..	..
Cassia marginata	128	2,048	..	..	65	47	1,331	1	..	..	..	..	II—IV
Cassia siamea	1,033	16,528	..	..	98	87	14,379	1	..	..	..	..	II—IV
Cassia siamea (Tanganyika)	860	13,760	..	..	36	36	4,864	..	..	..	..	..	..
Cassia tomentosa	1,083	16,328	..	..	13	8	1,322	1	..	..	..	..	II—IV
Castanospermum australe	1	16	..	..	56	53	8	1	..	..	..	..	IV
Casuarina cunninghamiana	1,220	19,520	..	..	70	70	17,152	..	..	..	..	..	..
Casuarina decaisneana	2,240	35,840	..	..	50	41	15,360	..	..	..	..	..	..
Casuarina equisetifolia	9,600	..		..	27	27	..	..	1	..	..	..	IX—I
Casuarina montana	32,778	524,448	..	..	15	5	26,222	..	1	..	..	..	I
Casuarina torulosa	2,320	37,120	..	..	13	13	..	..	..	..	..	..	..
Cedrela odorata	3,192	51,072	..	..	27	15	7,661	..	1	..	..	..	III
Cedrela odorata (Jamaica)	1,626	..	..	..	..	..	..	..	..	..	..	..	..
Cedrela toona	4,466	71,456	..	..	82	62	44,303	..	2	1	1	..	IV—VIII
Celtis tetrandra	420	6,720	..	..	5	5	336	..	..	..	..	..	VI
Conchrus ciliaris	15,232	243,712	..	..	29	29	850	..	..	..	..	..	..
Ceratonia siliqua (Cyprus)	155	..	..	..	24·5	19·7	488	..	..	..	..		Germination period 1 to 40 days.
Chukrasia tabularis	2,206	35,786	..	..	36	34	12,490	2	2	..	..	..	XII
Chlorozylon swietenia	2,288	35,648	..	..	85	69	24,597	..	1	..	..	..	III—VIII.
Chlorophora excelsa	1,283	196,528	..	..	33	29	56,993	..	2	1	..	..	
Chloroxylon swietenia (Ceylon)	1,406	22,496	..	..	78	58	13,048	..	..	..	..	..	III—X
Cinnamomum camphora	249	3,884	..	..	69	47	1,812	..	1	2	..	..	
Cinnamomum zeylanicum	1·5	1,680	..	..	1	1	17	..	1	..	..	..	..
Cinnamomum zeylanicum (Begur 1955)	116	..	..	..	0·4 to 6	0·4 to 5	..	..	..	1	..	..	
Cytisus scoparius	3,188	51,008	..	..	30	24	12,232	..	..	..	..	..	III—IV
Commiphora caudata	386	6,176	..	..	13	11	679	..	..	..	..	..	I
Cryptomeria japonica	2,691	15,506	..	..	0·2	..	..	..	..	..	..	..	IV
Compressus macrocarpa	4,384	70114	..	..	13	12	81417	..	(1 Pots)	..	..	..	IV-VI
Eupressus torulosa	4,693	75,088	..	..	9	5	3,754	..	..	..	..	..	V—VI
Dalbergia latifolia	..	..	525	8,400	65	55	4,520	..	2	1	..	..	V—VI
Dalbergia sissoo	560	89,690	..	..	14	5	4,480	1	1	1	..	..	I—XI
Dalbergia sissoides	..	..	454	7,264	70	51	3,705	..	..	..	..	..	XII—II
Daphniphyllum glaucescens	137	2,192	..	..	10	5	110	..	..	..	..	..	V—VI
Dendrocalamus brandisii	3,475	55,600	..	..	2	1	556	..	1	..	..	..	II
Dendrocalamus longispathus	2,367	37,872	..	..	2	1	379	..	..	..	..	..	III—IV
Dendrocalamus strictus	1,245	19,920	..	..	48	64	12,749	..	1	..	..	..	III—IV
Dispetrocarpus lotus	250	4,000	..	..	55	2	32	..	..	..	..	..	..
Dipterocarpus bourdillonii	..	..	..	8	41	20	16	..	1	..	2	..	V
Dipterocarpus indicus	..	..	5	78	41	26	20	..	1 (basket)	..	..	..	III—VIII
Dodonaea viscosa	3,220	51,520	..	..	12	12	6,182	..	..	..	..	..	I—IV
Dolichandrone crispa	852	13,632	..	..	54	48	6,543	1	..	..	..	..	I—IV
Dolichandrarone falcata	725	116,000	..	..	13	1	116	..	..	..	..	..	II—VI
Dysoxylum malabaricum	6	65	..	..	85	85	84	..	1	..	..	..	VII—VIII
Elaeocarpus oblongus	10	160	..	..	7	6	10	..	..	..	..	..	II—V
Eriodendron enfractuosum	180	2,880	..	..	24	23	..	..	..	..	..	..	..
Erythroxylon monogynum	922	14,752	..	..	59	46	6,786	..	..	..	..	..	IX—III
Eucalyptus astringens	80,240	..	..	..	40·4	..	..	..	..	..	..	..	X. Germination period 12 to 16 days.
Eucaliptus citriodora (Nillagiris seed)	4,670	..	..	..	6·9	6.2	4,530	..	..	..	..	..	
Eucalyptus eugeniodes	76,800	21,28,800	..	..	..	..	..	..	..	..	..	..	VI
Eucalyptus ficifolia	2,170	34,720	..		53	4	1,389	..	..	..	..	..	V
Eucalyptus globulus	8,675	138,816	..	..	32	20	27,765	..	1 (Mossed)	..	..	..	III
Eucalyptus grandis	800,	..	..	..	10	8.3	..	..	..	..	..	..	

APPENDIX 'E'—*cont.*

*Statement showing seed weight with germinative capacity plant per cent and best method of raising (Referred to in paragraph 26)*cont—.

Species.	Number.				Germinative capacity,	Plants per.	Plants per.	Best method of raising.					
	Seeds.		Fruits.					Artifically.		Vegetative propagation.			Month to collect Seeds,
	Per Oz.	Per lb.	Per Oz.	Per lb.				Direct showing.	Entire trans plant-ing.	Stump plant ing.	Stump cutting	Air layering,	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Eucalyptus leucoxylon	1,474	23,584	..	..	14	4	64	..	..	..	..	..	..
Eucalyptus maculata	6,112	97,792	..	..	13	12	11,735	..	1 (mossed).	..	..	..	..
Eucalyptus marginata	12,760	..	..	..	0·6	0·2	..	..	..	..	..	..	..
Eucalyptus melanophloia (Queensland)	1,474	23,584	..	..	Nil.	Germination due to bed seeds.							
Eucalyptus pillularis	35,200	563,200	..	..	0·1	0·1	563	..	..	..	..	..	..
Eucalyptus propinqua	26,176	413,816	..	..	0·07	0·6	2,513	..	..	..	..	..	..
Eucalyptus rostrata	22,500	..	..	..	13·5	13·5	..	..	..	..	..	..	..
Eucalyptus umbellata (New South Wales origin).	3,264	51,224	..	..	12	12	..	..	..	..	..	..	..
Eugenia arnottiana	105	1,680	..	..	73	71	1,193	..	..	..	..	..	V–VII
ex*Eugenia lophullifolia*	146	2,336	..	..	20	16	374	..	..	..	..	..	V
Eurya japonica	25,600	409,600	..	..	..	..	..	..	..	..	..	..	IV
Evodia roxburghiana	3,670	57,120	..	..	66	21	11,995	..	1	2	..	..	IV, V, XI–XII
Feronia elephantum	1,395	23,320	..	..	66	63	14,062	..	1	..	..	..	X–IV
Girotia rottlerhormis	11	176	..	..	43	40	70	..	2	..	..	..	X–V
Glochidion neilgherrense	1,299	20,768	..	..	29	4	831	..	..	..	..	..	III–IV
Gluta travancorcia	2	32	..	..	96	90	20	..	1	2	..	..	IV–VIII
Gluta travancorica (Wynaed' 1954)	4	64	..	..	70	70	45	..	..	..	..	..	..
Gossypium (Assam hill cotton)	455	7,280	..	..	23	23	1,674	..	..	..	..	..	..
Gmelina arborea	42	672	..	..	64	56	56	376	..	1	2	..	III–IV
Gmelina arborea (Wynaad 1954)	48	..	..	..	49	44	338	..	..	..	..	..	..
Grewia tiliaefolia	231	4,496	..	..	84	76	3,417	..	2	1	..	..	V–VI
Hakea saligna	2,276	36,416	..	..	78	68	24,763	..	..	..	..	..	IX–XII
Herdwickia binata	..	..	141	2,256	38	32	722	..	1	..	..	..	III–VII
Herdwickia Pinnata	7	116	..	..	85	80	93	2	1	3	..	..	V–VI
Harrisonia bennettii	269	4,304	..	..	12	8	344	..	..	..	..	..	I
Holoptellia integrifolia	1,276	20,416	..	..	17	15	3,062	..	..	1	..	..	III–IV
Hopea parviflora	..	..	82	1,312	68	54	708	2	1	..	..	..	V–VII
Hyphaenthobaica (Dun nut from Cairo)	..	5	..	..	50	50	2·5	..	..	..	..	..	Period of Germ six months.
Hymenodictyon excelsum	8,595	130,096	..	..	13	12	16,331	..	..	..	..	..	III
Indigofera teysmanii	4,671	..	..	..	56	52	39,187	..	..	..	..	..	
Indigofera endecaphylla	4,022	..	..	..	..	27	16	10,501	..	..	..	..	....
Ixchi bush clover	100	1,600	..	..	44	20	320	..	..	..	..	..	....
Jucaranda minosifolia	3,745	59,920	..	..	53	30	23,360	..	..	..	..	..	V
Juniperus procera	1,346	21,536	..	..	12	5	1,077	..	..	..	..	..	XII–I
Khaya grandifolia	..	..	..	..	35	30	..	..	..	..	..	..	....
Lagerstroemia flosreginae	3,887	62,192	..	..	60	55	34,205	..	2	1	..	..	XII–III
Khaya pencgalensis	..	..	..	..	10	10	..	..	..	..	..	..	....
L. Lanceolata	5,173	82,768	..	..	20	13	10,760	..	1	2	..	..	XII–III
Lantana camara	1,302	20,832	..	..	3	2	417	..	..	..	..	..	VIII
Leucaina glauca	873	13,968	..	..	58	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
Maba buxifolia	286	4,576	..	..	92	88	4,027	..	..	..	..	..	XI–I
Machilus macrantha	103	1,727	..	..	0·4	0·4	7	..	..	..	..	..	III
Mahonia leschenaultii	1,781	24,496	..	..	58	50	14,248	..	..	..	..	..	II–IV
Mangifera indica	3	44	..	..	82	79	24	2	1	..	..	..	V–VI
Manihot glaziovii	923	14,848	..	..	28	28	4,224	..	..	..	..	..	....
Markhamia platycalyx	1,140	18,240	..	..	1	1	182	..	1	..	..	..	....
Melia dubia	..	..	7	112	1·5	1·5	1	..	..	..	..	..	I, II, X–XI
Melioma wightii	140	2,440	..	..	14	10	224	..	..	..	..	..	III–V
Melocanna bambusoides	2	32	..	..	56	5	2	..	..	..	..	..	....
Memecylon umbellatum	216	3,456	..	..	94	90	3,110	..	..	..	..	..	XI–XII
Mesua ferrea	28	448	..	..	80	68	305	..	1	..	..	..	XI–III
Michelia nilagirica	363	5,808	..	..	24	22	1,336	..	..	..	..	..	IV–VI
Morus alba	26,015	416,240	..	..	12	5	20,812	..	..	..	1	..	....
Morus alba (Meerut)	15,100	..	..	..	0·6	5	12,080	..	..	..	..	..	Period of Germ 8–25 days.

APPENDIX E—*cont.*

Statement showing seed weight with germinative capacity plant per cent and best method of raising (Referred to in paragraph 26)—cont.

Species.	Number.						Best method of raising.						
	Seeds.		Fruits.				Artificially.			Vegetative propagation.			
	Per Oz.	Per lb.	Per Oz.	Per lb.	Germinative capacity.	Plants per.	Plants per.	Direct sowing.	Entire trans planting.	Stump planting.	Stump cutting.	Air layering.	Month to collect Seeds.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Mundulea suberosa		953	15,328	..	..	54	35	5,365	..	..	..	..	IV
Rapanea wightiana		1,296	20,736	..	..	20	20	4,147	..	..	..	..	IV–VI
Neolitsea zeylanica		190	3,040	..	..	54	53	1,671	..	..	..	..	V–VII
Ochroma lagopus		4,240	67,840	..	..	0·7	0·1	63	..	1	..	..	..
Ocimum kilimandscharicum		46,000	..	..	..	..	..	..	..	..	..	..	..
Palaquium ellipticum		7	112	..	..	60	68	76	..	1	..	..	V–VIII
Phoebe goalparensis		28	448	..	..	9	9	40	..	..	..	..	..
Plooba goalparhensis (wynaad)		28	448	..	..	15	14	60	..	..	..	..	..
Photinia notoniana		10,830	173,230		..	21	..	..	..	..	..	..	V–VIII
Pinus caribaea (Honduras Begur 1954)		1,084	..	..	..	34	23	6,269	..	..	..	..	..
Pinus Caribaea (Honduras) (Chandanathode 1954).		1,804	..	..	..	63	63	16,184	..	..	..	..	..
Pinus insignis		1,807	28,912	..	..	8	4	1,156	..	..	..	..	V–VI
Pinus insularis		3,680	58,880	..	..	2	1	589	..	..	..	..	II
Pinus longifolia		234	3,744	..	..	80	46	1,722	1	..	..	..	IV
Pinus Pinea		56	896	..	..	30	28	224	..	..	..	..	..
Pithecolobium dulce		183	2,928	..	..	79	50	1,464	1	..	..	..	II–V
Pleurostylia wightii		1,213	19,408	..	..	20	12	2,320	..	..	..	..	XI
Poecilleneuron indicum		1	15	..	..	31	29	4	..	1	..	..	..
Poinciana elata		241	3,856	..	..	65	14	540	..	..	..	1	.. XII
Poinciana regia		62	992	..	..	68	19	183	..	..	..	..	.. IV
Polyalthia fragrans		9	140	..	..	17	16	22	..	..	..	..	.. V
Polyalthia longifolia		21	336	..	..	3	2	7	..	..	..	..	.. IV–IX
Pongamia glabra		..	..	17	272	15	12	33	..	..	..	..	.. III–V & X
Premna tomentosa		1,759	28,144	..	..	1	1	281	..	..	..	..	.. IV
Prinsepia utilis		171	2,736	..	..	..	..	..	..	..	..	..	.. IV
Prosopis juliflora		924	14,784	..	..	89	78	10,792	1	..	..	..	.. V
Prosopis spicigera		753	12,045	..	..	88	88	10,502	..	..	..	..	.. II–VII
Pterocarpus dalbergioides		..	..	52	832	49	29	241	..	1	..	..	.. II–VII
Pterocarpus marsupium		..	..	60	960	97	90	864	3	2	1	..	.. I–VI
Pterocarpus santalinus		..	..	29	467	88	65	623	..	..	1	..	.. II–VII
Pueraria javanica		1,025	16,400	..	..	37	36	..	..	..	..	..	.. ....
Pterospermum rubiginosum		1,911	30,576	..	..	14	8	2,446	..	..	..	..	.. I
Pterospermum phaseroides		1,650	26,400	..	..	45	33	10,128	..	..	..	..	.. ....
Pterospermum thumbergiana		2,012	32, 192	..	..	27	25	..	..	..	..	..	.. ....
Pyrethrum		21,445	34	..	..	..	..	..	..	..	..	..	.. ....
Quercus incana		14	228	..	..	80	51	116	..	..	..	..	.. II
Rauwolfia canescens (with pulp dried)		650	..	..	..	..	..	..	..	..	..	..	.. ....
Rauwolfia canescens (within pulp dried)		350	..	..	..	..	..	..	..	..	..	..	.. ....
Rauwolfia serpentina (with pulp dried)		735	..	..	17	12	1,210	..	..	..	..	..	.. IV
Rhodomyrtus tomentosa		3,686	58,976	..	..	9	1	590	..	..	..	..	.. ....
Samadara indica		11	176	..	..	33	32	56	..	..	..	..	.. II, IV, VI, VII
Sapindus emarginatus		75	1,200	..	..	67	62	744	..	..	..	..	.. II—IV
Sapindus trifoliatus		55	880	..	..	72	60	528	..	..	..	..	.. IV—VI
Santalum album		147	2,352	..	..	85	58	1,364	..	1	2	..	.. X—XI and III—IV
Schleichera trijuga		62	992	..	..	76	72	714	..	..	1	..	.. II—VIII
Semecarpus anacardium		13	208	..	..	57	53	110	..	..	..	..	.. II—IV
Shorea talura		..	..	29	464	68	60	278	1	..	..	..	.. V
Sideroxylon tomentosum		85	1,360	..	..	18	16	218	..	..	..	..	.. VI
Soymida febrifuga		373	6,048	..	..	29	25	1,512	..	1	..	..	.. II—VII
Sterculia companulata		110	..	..	..	51	44	767	..	..	..	..	.. ....
Sterculia urens		179	2,864	..	..	32	18	515	..	2	1	..	.. V
Stipa tenesima		13,200	211,260	..	..	3	2	4,224	..	..	..	..	.. ....
Strychnos nux vomica		17	272	..	..	52	141	..	..	..	..	..	.. XII—V
Strychnos nuxpotatorum		46	736	..	..	62	62	456	..	..	..	..	.. III—VII
Strylosanthes gracillis		8,890	142,249	..	..	38	32	47,000	..	..	..	..	.. Soaking in hot water give better germination.

APPENDIX 'E'—*cont.*

Statement showing seed weight with germinative capacity plant per cent and best method of raising (Referred to in paragraph 26)—cont.

Species.	Number. Seeds. Per oz.	Seeds. Per lb.	Fruits. Per oz.	Fruits. Per lb.	Germinative capacity.	Plant per	Plants per	Best method of raising. Artificially. Direct sowing.	Entire transplanting.	Stump planting.	Vegetative propagation. Stump cutting.	Air layering.	Month to collect Seeds.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Strylosanthes gracillis (Nilambur Centre) ..	9,520	..	..	..	15·7	15·2	19,130	..	..	..	..	..	Period to germination 25 dap.
Strylosanthes gracillis (Begur)	9,520	..	..	..	6	4	6,100	..	..	..	..	..	..
Swietenia macrophylla	65	1,040	..	..	78	75	759	2	1	..	..	.	XII—III
Swietenia mahogani	95	1,520	..	..	74	73	1,110	..	..	..	..	..	XI—XII
Symplocos foliosa	80	1,280	..	..	..	..	..	..	..	..	..	..	III—VII
Tamarindus indica	41	656	..	..	95	80	525	1	..	..	..	..	II—V
Tectona grandis	..	..	50	80	68	58	464	..	..	1	..	..	XI—V
Tephrosia candida	1,300	20,800	..	..	55	45	9,360	1	..	..	..	..	XI—I
Terminalia arjuna	..	..	22	352	19	17	60	..	..	..	..	..	XI—XII and IV—VII
Terminalia bellerica	..	..	6	96	62	52	51	..	1	..	..	..	II
Terminalia catappa	..	..	5	80	25	25	20	..	..	..	..	..	..
Terminalia chebula	..	..	18	294	60	50	147	..	1	..	..	..	I—VI
Terminalia crenulata	..	..	22	352	72	58	204	..	..	1	..	..	I—VI
Terminalia myriocarpa (Dhoni)	..	..	16,000	..	10	7	17,920	..	..	..	..	..	Germination period 12—30 days.
Terminalia myriocarpa (Topslip)	..	..	16,000	..	·1	1·0	2,560	..	..	..	..	..	I—IV
Terminalia paniculata	..	..	1,014	16,224	16	9	1,460	..	..	1	..	..	XI—IV
Terminalia tomentosa	..	..	30	480	5	3	9	..	..	..	..	..	II
Ternstroemia japonica	200	3,200	..	..	4	0	0	..	..	..	..	..	II—VII
Tetrameles nudiflora	12,884	1,94,544	..	..	0·9	0·2	393	..	..	..	..	..	III—V
Thyrostachys oliveri	1,890	30,240	..	..	25	22	6,653	..	..	..	..	..	V
Trema orientalis	5,155	88,240	..	..	11	9	7,942	2	1	..	..	..	I—VI
Tsuga brunoniana	10,000	1,60,000	..	..	4	4	6,400	..	..	..	..	..	..
Valeria indica	..	..	1·6	26	80	76	20	..	1	..	..	..	VII—VIII
Viburnum coriceum	566	9,056	..	..	4	4	262	..	..	..	..	..	VII
Viburnum erubescens	1,005	16,080	..	..	7	7	1,126	..	..	..	..	..	VII
Vitex altissima	352	5,648	..	..	8	8	169	..	..	..	..	..	XI—IV
Vitex littoralis	85	1,408	..	..	30	..	..	..	..	..	..	..	V—VII
Vitex peduncularis	273	4,368	..	..	25	15	655	..	1	2	..	..	VII—VIII
Widdringtonia whytei	278	3,448	..	..	9	5	..	..	..	..	..	..	..
Wrightia tinctoria	751	12,016	..	..	66	58	6,969	1	2	..	..	..	II—V
Xylia xylocarpa	95	1,520	..	..	99	80	1,216	3	..	..	..	..	I—V
Zizyphus glabrata	207	3,312	..	..	19	13	397	..	..	2	..	..	X—II
Zanthoxylum rhetsa	383	7,728	..	..	0·2	..	..	..	..	..	..	..	I—IV
Zizyphus incurva	114	1,824	..	..	69	33	693	..	..	..	..	..	I
Zizyphus jujuba	56	896	..	..	95	82	735	..	..	..	..	..	I—VII
Zizyphus spinachristi(Cypress)	..	..	..	..	100	62·5	..	..	..	..	..	..	Germ. period 85 days
Zyzbus xylophyrus	612	9,792	..	..	62	40	3,917	..	..	..	..	..	III

APPENDIX F.

Statement showing results of seed pre treatment tests.
(referred to in paragraph 34.)

Species.	Number of tests made.	Average germinative capacity with			
		un-treated.	cold water.	hot water.	boiling water.
(1)	(2)	(3)	(4)	(5)	(6)
Acacia auriculiformis	8	14	14	16	17
Acacia baileyana	4	2	3	19	42
Acacia cyanophylla	9	11	14	17	35
Acacia cyclopsis	4	8	8	7	4
Acacia dealbata	6	45	68	60	87
Acacia decurrens	4	1	1	8	24
Acacia ferruginea	11	48	42	47	33
Acacia leucophloea	14	21	12	17	23
Acacia melanoxylon	1	83	81	91	90
Acacia mollissima	5	5	2	11	29
Acacia planifrons	6	18	16	18	18
Acacia saligna	4	6	5	5	3
Acacia sundra	10	34	28	30	25
Acrocarpus fraxinifolius	25	8	8	9	6
Adenanthera pavonana	6	31	31	13	1
Ailanthus excelsa	1	0	1	0	Not done.
Alangium lamarckii	2	8	13	11	1
Albizzia amara	22	41	35	30	34
Albizzia lebbeck	4	20	18	19	15
Alnus nepalensis	4	1	1	9	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
Bauhinia 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 clatum	7	15	14	13	0
Canthium diydmum	2	2	3	3	0
Cassia auriculata	14	12	9	11	5
Cassia fistula	17	11	11	8	7
Cassia marginata	12	17	22	13	5
Cassia siamea	16	50	37	47	5

APPENDIX F—*cont*

Statement showing results of seed pre-treatment tests.
(referred to in paragraph 34)—cont.

Species.	Number of tests made.	Average germinative capacity with			
		un-treated.	cold water.	hot water.	boiling water.
(1)	(2)	(3)	(4)	(5)	(6)
Cedrela odorata	1	1	..	..	Not done.
Ceratonia siliqua (carob tree Cyprus).	1	49	49	..	..
Chukarasia tabularies	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
Dalbergia sissoides	30	26	26	32	5
Dendrocalamus strictus	7	28	19	18	0
Dolichandrone crispa	6	12	10	10	1
Dolichandrone 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 tillaefolia	4	7	5	7	5
Hakea saligna	2	45	0	0	0
Hardwickia binata	1	38	25	27	1
Hardwickia pinnata	1	..	..	..	..
Holoptelia integrifolia	1	1	0	1	0
Hymenodictiyon excelsum	1	8	9	10	Not done.
Juniperus procera	4	2	4	5	1
Lagerstroemia flos reginae	1	5	3	3	0
Lagerstroemia lancelolata	31	5	4	4	0
Leucaena glauca	12	24	36	31	32
Ligustrum neilgherrense	2	66	21	13	2
Litsea zeylanica	2	15	9	7	0
Lophopatalum wightianum	1	1	1	0	Not done.
Machilus macrantha	1	0	0	0	Not done

APPENDIX F—*cont.*

Statement showing results of seed pre-treatment tests (referred to paragraph 34)—cont.

Species.	Number of tests made.	Average germinative capacity with			
		Untreated.	Cold water.	Hot water.	Boiling water.
(1)	(2)	(3)	(4)	(5)	(6)
Mahonia leschenaultii	4	51	6	2	0
Mangifera indica	3	34	43	42	3
Markhamica 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
Palaquium ellipticum	15	38	48	40	..
Phoeba goalparensis	1	1	1	0	0
Phoeba insignis	3	4	9	2	0
Pinus longifolia	4	34	43	27	49
Pithecolobium dulce	9	47	20	42	5
Pleurostylia wightii	1	13	20	2	0
Poinciana elata	3	17	21	19	21
Pentiana regia	1	28	28	26	68
Prlyalthia fragrans	3	5	4	2	1
Premna tomentosa	1	1	1	1	1
Prosopis Juliflora	6	61	62	53	46
Poospis specigera	1	10	12	8	9
Pterocarpus dalbergioides	6	13	16	11	5
Pterocarpus sentallium	15	21	59	29	16
Pterocarpus santalinus	3	14	18	17	4
Pterocarpus Marsupium	96	39	31	32	12
Prrtospermum rubiginosum	1	11	11	0	Not done.
Quercus incana	2	81	0	0	0
Sapindus emarginatus	5	17	7	11	10
Schleichera trijuga	22	27	25	23	0
Shorea talura	1	68	54	54	1
Soymida febrifuga	10	1	3	1	0
Sterculia urens	5	18	15	16	0
Strychnos nux vomica	5	12	19	18	3
Strychnos 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. Kernel	4	6	1	2	0

APPENDIX F—*cont.*

Statement showing results of seed pre-treatment tests (referred in to paragraph 34)—cont.

Species.	Number of tests made.	Average germinative capacity with			
		Untreated.	Cold water.	Hot water.	Boiling water.
(1)	(2)	(3)	(4)	(5)	(6)
Terminali crenulata—					
1. Fresh seed	83	28	30	24	6
2. Stored 14 months	10	9	8	7	8
Terminalia myriocarpa	1	10	..	..	..
Terminalia paniculata	29	10	8	8	..
Terminalia tomentosa	1	1	1	1	0
Tetrameles nudiflora	1	1	1	1	Not done.
Thyrostachys oliveri	1	10	11	4	2
Trema orientalis	7	3	2	2	1
Vateria indica	3	58	57	58	0
Vitex altissima	2	3	3	4	0
Vitex littoralis	2	30	38	1	0
Vitex peduncularis	3	7	8	3	0
Wrightia tinctoria	4	21	30	24	2
Xylia xylocarpa	42	20	26	25	13
Yanthoxylon rhetsa	1	0	0	0	..
Zizyphus glabrata	3	6	4	4	4
Zizyphus incurva	5	31	24	24	22
Zizyphus jujuba	14	22	26	17	19
Zizyphus xylopyrus	3	11	13	13	13

APPENDIX G.

[Notes on experiments carried out in Forest division during 1957–58 (referred to in paragraphs 193, 245)].

District Experiments—1957–58.

1. In addition to experiments carried out by State Silviculturist and by Research Officers directly under him several interesting experiments were carried on by the District Forest Officer, on matters of particulars interest to them. A brief resume of these experiments is furnished below :—

Fodder and Pasture Division, 1957–58.

2. The Fodder and Pasture Division was formed with effect from 27th August 1956 with the object of reclaiming eroded lands in the Reserved Forests of Chingleput Division by soil conservation methods and after reclamation, to protect the area by proper fencing. It is also proposed to sink wells and raise good edible perennial grass and fodder under the scheme.

3. During the four year period under the Second Five-Year Plan, it is proposed to tackle 15,000 acres at 3,750 acres per annum at a total cost of 12·19 lakhs. The cost per acre comes to about Rs. 33·00 per acre.

4. During 1956–57 only preliminary operations were carried and regular regeneration operations were started only in 1957–58.

5. In 1957–58, regeneration operations were done over at an area of 3,627 acres at a total cost of Rs. 93,298. This works out to Rs. 25·7 per acre.

6. *Method of treatment in* 1957–58.—The areas taken are mostly of the degraded scrub jungle type with little or no growth and showing signs of erosion. The area is surveyed and demarcated early in September and lines 4′ wide are out 33′ apart keeping the lines clear of all existing growth. In the north-east monsoon earth work is undertaken. If the area is flat, then the technique is to dig pits $2\frac{1}{2}' \times 2\frac{1}{2}' \times 1\frac{1}{2}'$ spaced $16\frac{1}{2}'$ apart in the lines. In sloping terrains the technique is to dig trenches $12' \times 1' \times 1'$ spaced 22′ apart, the dug out earth is made into a mound on the down hill side. The earth work is completed before 31st March. Planting is done after a good shower of rain in June-July. Entire transplants are used in planting both in the pits and trenches. After planting, the pits have saucers made (6′ diameter) round them to trap all rain water for the benefit of the plants. Casualties are replaced in the North-east monsoon using pot plants. Two weedings and soil workings are prescribed and the plot is split into blocks of 50 acres, each block having a plot mazdoor to look after protection and any tending operations which can be easily done by them. In the second year provision is made for replacement of casualties and 2 blocks of 50 acres each are kept in charge of one mazdoor. The cost involved per acre for the pit method is Rs. Twentysix and in the the case of the trench method Rs. Thirty

7. It is proposed to raise fodder grass in between the tree lines. As an experimental measure, it is proposed to raise grass over two plots of 50 acres each to start with from 1958–59. Grasses will be raised both by irrigation and under the dry technique. Two nurseries for multiplication of grass seeds have been opened for this purpose.

8. It is too early to comment on the results achieved during 1957–58 as the scheme has been in force for only one year so far. There had been no rains from the middle of November 1957 and this is adversly affecting the stocking in all the plots of 1957–58. The stocking varies from 20 to 60 per cent and the height growth varies from 6″ to 6.′

The species raised are—

1. *Dalbergia sissoo.*
2. *Albizzia lebbeck.*
3. *Albizzia=amara.*
4. *Azadirachta indica.*
5. *Acacia arabica.*

Dalbergia sissoo and *Albizzia lebbeck* have given comperatively good results in all the plots during 1957–58.

Method Proposed for 1958–59.

9. The method described in paragraph 6 will be continued during the year 1958–59 except for reducing the size of pits and trenches with a view to reduce cost. It is proposed to have pits of sizes $1' \times 1' \times 1'$ as against pits of $2\frac{1}{2}' \times 2\frac{1}{2}' \times 1\frac{1}{2}'$ during the previous year. Similarly the trenches in blocks with sloping ground will be $4' \times 1' \times 1'$ with shoulder drains instead of trenches $12' \times 1' \times 1'$ as in the previous year.

Saidapet Division.

District Experiments : 1957–58—*Saidapet Forest Division.*

10. Please see paragraphs 5 and 6 of Appendix ' G ' of the Report on Silvicultural Research for 1956–57. During the year 1957–58, in Saidapet Division, 3,212 acres were regenerated with cashew at a total cost of Rs. 1,65,485. The average rate per acre comes to Rs. 52. This amount includes the maintenance charges, in the second year of the Plantations raised during 1956–57. The entire work was done departmentally. There was no demand for undertaking the work along with kumri.

Method of Regeneration Adopted in 1957–58.

11. The method adopted was to do sowing of seeds at an espacement of $16\frac{1}{2}' \times 33'$. Re-sowing was done repeatedly to ensure full stocking. During the North-east monsoon rains, casualties were replaced. Provisions was made for replacing 25 per cent of the casualtics.

Cost.

12. The cost of the planting one acre up to Establishment in the third year comes to about Rs. 56 as follows :—

	Rs.
First year	40
Second year ..	10
Third year	6

Survivals and Height Growth.

13. In the 1957–58 plantations in spite of the adverse rainfall conditions during the year the percentage of survivals was about 60 and height growth was about 18″.

1956–57 Plantations.

14. During 1956–57, 4,327 acres were regenerated with cashew at a total cost of Rs. 1,29,920 (about Rs. 30 per acre). The planting method adopted was to sow seeds in alternate lines with planting of basket plants in alternate lines. Hence, this method of planting constitutes a comparitive experiment on a vast scale between.—

1. Direct sowing.
2. Planting Basket plants.

The results of survival and height growth at the end of one and two years show that there is no significant difference either in survival or hieght growth between the two methods of raising cashew. Attention is invited to the experiments and conclusions drawn in the main body of the report on the artificial regeneration of cashew. The results of this district experiment generally confirm the conclusions drawn in the experiments undertaken in the Research Gardens.

I. Coimbatore South Division.

Tunacadavu range.—(1) An area of one acre was selected by the State Silviculturist in 1936 Teak Plantation for under planting with *Rauwolfia serpentina*. The undergrowth in the area was cut and completely cleared. A fence around the area was put up. The area was divided into four quardrants and planting with natural seedlings of Rauwolfia at 3' espacement was done as follows :—

(i) Whole plant, (ii) root cuttings, (iii) root and shoot cuttings and (iv) shoot cuttings.

For want of planting materials only half the area (½ acre) was planted. 60 per cent survivals has been noticed in planting with (ii) root cuttings and (iii) root and shoot cuttings. Survivals in planting with (i) whole plant and (ii) Shoot cuttings are only 15 per cent.

2. Underplanting in Teak R.A. 1928 :—Over an area of 10 acres was done with *Evodia* and *Mahogony* in strips ½ chain apart and 2' wide. There is about 70 per cent survivals. *Evodia* is growing better than *Mahogony*.

Schleichera trijuga plot.—An area of one acre was planted at 11'×11' espacement with *Schleichera trijuga*. There is about 60 per cent survivals and the condition of plants is satisfactory.

Punachi range—Eucalyptus saligna.—Seedlings were planted around the Range Office and Range Officer's quarters. Out of a total of 84 seedlings, there is a survival of 56. The maximium height of the plants is 20' and the average height is 11'. In R.A. 1957 in Lower Punachi, 190 seedlings were planted and 86 are surviving. The plants are healthy.

II Tanjore Division.

Nursery work.—This teak experiment was tried at the first instance by the State Silviculturist at Vennar-Vettar Headworks. Soon after this division was formed a big nursery of about 400 beds were raised with teak seeds. One oil engine was taken on hire from Agriculture Department and the nursery was flood irrigated. One year later the stumps were uprooted and planted in the area proposed to be planted. Weeding was done to the nursery four times per year.

In the 1956 compact areas the height growth is ranging from one foot to 17 feet. Most of the areas is fully covered with natural growth of *Acacia arabica* and the areas have the appliance of a real forest. The branches of the *Acacia arabica* interfering with teak are cut and removed and the teak plants freed.

Some of the plants were badly attacked by *Hapalia machaeralis* a mixture of D.D.T. 5 per cent and Hexidol 950 to a proportion of 7 : 2 was sprayed with help of sapper lot sprayer which destroyed the insects. A few plants were washed away due to floods. This area was inspected by the Chief Conservator of Forests.

1956 *Avenue Teak Plantation.*—The growth of teak is stunted as the soil is very poor. Several seedlings have died during summer. Replacement was done with *Dalbergia sissoo* seedlings.

1956 *Plantation compact area.*—Planting was done from June to October. The height growth of the whole plantations is uneven and is ranging from 1 to 15 feet. Percentage of survival 80 per cent.

1957 *Avenue Plantations.*—The height growth is ranging from 1' to 12'. The height growth is good in some of the plantations. Particularly in Vettar left bank the height growth is ranging from 8' to 12' apart. Percentage of survival is about 75 per cent.

Watering regime.—Watering is being done to the plantations throughout the year in non-rainy days with one gallon of water per plant once in two days. The nurseries only are being flood irrigated by water.

Replacement.—From the month of August replacement of casualties is being done as and when the plants are damaged by floods, cattle and men.

Weeding.—Weeding is being done to the plantations twice a year.

The cost for the plantations is as follows :—

	Rs.
1956–57—	12,114·01.
1957–58—	89,047·32.

III. Salem South Division.

1. Mr. J. Prioris, French Perfumer, grower and distiller of Aromatics and perfumes, Yercaud; Salem district, made an offer to the Forest Department that he is in a position to inject fluids into spiked sandal trees and thereby control or eradicate the disease. The Government in their order Memo. No. 92205/CIV/56-2, dated 22nd November 1956 gave sanction for carrying out experiment on injection of fluids into spiked sandal trees. Accordingly healthy and spiked sandal trees were enumerated and numbered in the Kapputhu and Kurumbapatti Reserved Forests in Salem South Division (Forest) on either sides of the ridge path to Gundur village.

2 The serial numbers of the trees were record with their classification (spiked, healthy, half spiked, half healthy) their diameter at breast height, and the treatments allotted to several trees. A statement showing these is attached.

3. The trees were divided into three classifications as below based on spike attack :—

(1) Healthy trees, that is without any trace of spiked leaves ;

(2) Spiked trees (entire crown of spiked leaves) ;

(3) Trees with half the crown containing healthy leaves and hall the crown containing spiked leaves.

4. *Method of injection of fluid* .—Mr. Prioris has given three pounds of a chemical fluid. During his discussion with me at Salem on 25th January 1957, he indicated to me the method of treatment which is as follows :—

" Cut the affected tree with a saw at a height of three feet (2 to 4 feet from ground level ; bore augur hole with ½" or three quarter inch diameter augur, on the cuts surface to a depth of 2" to 3" in a slanting direction so that the end of the augur hole comes near the cambial layer of this stump. For trees up to 12" girth one hole will be sufficient. The whole is filled with about ½ to 1 oz. of the fluid and plugged at the top with moist clay. For trees of larger girth two holes may be put and the fluid may be one to 1½ oz. per tree. Mr. Prioris stated that spiked trees, if given this treatment, will respond with new shoots and that the new shoots will be completely healthy.

5. *Allotment of treatment.*—For research purposes, the selected trees were allotted to 3 treatments as shown below :—

A : Control— Nothing done.

B : Trees cut with a saw at a height of 3 feet from ground level;

C : Trees cut at the height of 3 feet from ground level ; augur holes bored and fluid put in.

6. The treatments given to the trees in Kapputhu and Kurumbapatti Reserved Forests are kept separately so that the results may be observed and analysed separately for each Reserved Forests.

7. *Frequency of observation.*—The local subordinates of Salem South Division, will inspect the numbered trees once a month. The Research Ranger, Denkanikotta will inspect the plot quarterly and the State Silviculturist will inspect it half-yearly. It is expected that the trees will have to be kept under observation for 15 to 25 years in order to see whether the new shoots which come up remain healthy and can form heartwood in the same way as trees in the natural sandal forest.

The results are being watched.

IV. Gudalur Division (Segur Range).

Out of 464 *Eucalyptus citriodora* and *Eucalyptus rostrata* seedlings planted in 5 acres during 1955 only 4 seedlings are surviving now. In the 3 acres 1955 Regeneration area, out of 947 *Eucalyptus rostrata* and *Eucalyptus hybrid* seedlings planted there are now only 232 seedlings struggling for their existence. These seedlings have neither put up any appreciable growth nor do they show any healthy signs of their future existence. As these plantations have failed they have been abandoned.

Eucalyptus citriodara may not come up well as an under-plant in Teak plantations. Hence no research experiment was tried regarding this.

APPENDIX H.

Statement showing rank, designation and address of Forest Officers exclusively on research work in Madras State during 1957–58 *(referred to in paragraph* 12).

I. Shri P. Venkataramany, M.A., I.F.S.,
State Silviculturist.

Throughout the year under report.

II. *Ranger.*

(1) Shri S. S. Srinivasarathnam, Research Ranger.
From 1st April 1957 to 16th February 1958. — at Denkanikottah,
From 17th February to 31st March 1958 — at Madurai (headquarters of the Research Ranger, was shifted to Madurai with effect from 17th February 1958).

III. *Foresters.*

(1) Shri P. Balakrishnan, Research Forester, State Silviculturist's office.
From 1st April to 21st April 1957. — at Ootacamund,
From 22nd April 1957 to 31st March 1958. — at Madras (transferred to Madras consequent on the shifting of Office to Madras).

(2) Shri M. Marudachalam, B.A., Research Forester.
From 1st to 21st April 1957. — at State Silviculturist's office Ootacamund.
From 22nd April to 28th September 1957. — as Research Forester, Rameswaram Centre.
From 29th September to 11th December 1957. — as Research Forester, Vemburul Centre.
From 12th December 1957 to 31st March 1958. — as Research Forestor, State Silviculturist's office, Madras.

(3) Shri A. A. Victor, Research Forester. — at Ootacamund (throughout the year).

(4) Shri O. Madhavan Nambiar, Research Forester. — at Markanam (throughout the year).

(5) Shri A. A. Nair, Research Forster.
From 1st to 21st April 1957. — as Research Forester, Rameswaram, on leave.
From 22nd April to 21st June 1957.
From 22nd June to 20th September 1957. — as Research Assistant Forester, State Silviculturist's Office Madras.
From 21st September 1957 to 31st March 1958. — as Research Forester, Rameswaram.

(6) Shri K. V. Vijayaraghavan, Research Forester. — at topslip (throughout the year).

(7) Shri K. G. Damodaran, Research Forester. — at Thanjavur (throughout the year).

(8) Shri G. Radhakrishnan, Research Forester. From 1st April to 19th August 1957.	as Research Forester, Vemburuli, on leave.
From 20th August to 10th December 1957. From 11th December 1957 to 31st March 1958.	as Research Forester, Vemburuli.
(9) (*a*) Shri K. Gopalakrishnan, Research Forester. From 1st April to 29th June 1957.	as Research Forester, Ulundurpot. Reported to undergo Ranger's Course in the Southern Forest Ranger's College, Coimbatore
(*b*) Shri O. Madhavan Nambiar, Research Forester. From 30th June to 24th July 1957.	(additional charge)
(*c*) Shri S. Kannappan, Research Forester. From 25th July 1957 to 31st March 1958.	Ulundurpet

APPENDIX I.

UTILISATION AND ECONOMIC RESEARCH REPORT FOR THE YEAR 1957-58—UTILISATION DIVISION, MADRAS—REFERRED TO IN PARAGRAPH 50.

I. *General work of Administration.*

(1) The Forest Utilisation Division, Madras, continued as a separate division during the year 1957-58 under the direct control of the Chief Conservator of Forests, Madras. Sri. K. Shanmuganathan, M.A., A.I.F.C., held charge of this division from 1st April 1957 to 24th April 1957 afternoon, Sri E. S. Thangam, B.SC. (Hons.), A.I.F.C., held charge of this division from 6th May 1957 forenoon to 4th June 1957 afternoon and 5th July 1957 forenoon to the end of the period under review. Sri T. B. Jambulingam, M.A., A.I.F.C., Personal Assistant (Development) to the Chief Conservator of Forests, Madras, was holding additional charge from 24th April 1957 afternoon to 6th May 1957 forenoon and 4th June 1957 afternoon to 5th July 1957 forenoon.

(2) The main activities of this division during the year were practically the same as those mentioned in the last year's report. They were :

(*a*) Inspection and organising supplies of timber to other State Government Departments and Public Works Department, Electricity Department and Industries Department, Government Sponsored Industrial and other Institutions and Municipalities.

(*b*) Inspection and organising supplies of timber to the Railways against purchase orders issued by the Director-General of Supplies and Disposals, New Delhi.

(*c*) Inspection and organising supply of wooden poles for transmission lines required by the State Electricity Department.

(*d*) Inspection and organising supply of Departmentally produced sleepers to Railways.

(*e*) Joint Inspection of Test length sleepers laid on the track with the Railway Officers.

(*f*) Assistance to Forest Research Institute and other Research Organisation by arranging supply of materials.

(*g*) Studying market conditions and trend of trade in Timber and Minor Forest Produce and keeping the division officers in the State informed.

(*h*) Preparation of the Timber Trend Survey Report for the Madras State in collaboration with the Government of India under the auspices of *Ecafe of Food and Agricultural Organisation.*

(*i*) Manufacture and supply of lac products to various departments and institutions.

(*j*) Conducting periodical sale, of lac and inspection of lac forms and drawing up of technical notes.

(*k*) Maintenance of Ledger Files and for important Timber and Minor Forest Produce in the State.

(*l*) Propaganda, participating in Exhibitions and answering queries regarding forest products.

II. Experimental and Commercial Activities.

(1) *Timber Trend Survey.*—In collaboration with the Government of India, The Timber Trend survey was organised by the Forest Utilisation Officer, for the Madras State under the direction of the Chief Conservator of Forests. The Government of India put up this work in order to collect the All-India data for compiling the details required by the Food and Agricultural Organisation, Rome. The work in this State was started early in this Financial Year and major portion of the work was completed by the end of the Financial Year. The field data for the report was collected with the help of 18 selected subordinates, one each for each Forest Division.

(2) Messrs. Vithaldas Makanji and Sons, Navasari, to whom samples of Anogeissus latifolia were supplied for manufacture of tex pins from Coimbatore (South) Division on experimental basis have since informed that the species has not been found suitable due to the following reasons:—

"(*a*) The pegs were put to test and the same gave way (i.e.), broke easily, the wood being brittle.

(*b*) The type of wood required for the pegs should be tough and texture wood having the quality of elasticity also so that when they are bent they should, stand the shocks and shears in working (i.e.), the wood should be most durable in strength to withstand the shock resistance". [Vide II (1) (*b*) of last year's report.]

(3) The Dean, College of Integrated Medicine, Madras, to whom one log of *Phyllanthus Emblica* (Nellikai)was supplied from Coimbatore (South) Division for carrying out experiment in curing diabetes has since informed that a female patient who was admitted on 15th August 1957 and discharged on 11th September 1957 was given a decoction of log of *Phyllanthus Emblica* for a period of 20 days she was having 2 per cent of sugar in the urine on 22nd August 1957 before the administration of drug and on 7th September 1957 urine was found to contain 1·5 per cent of sugar.

The Dean has suggested that atleast 100 cases of 'diabetes mottitas' should be treated with this drug before a definite opinion can be given. He has also recommended that the drug may be tried extensively, in the diabetic clinics of the city hospitals and the Therapeutic value of the same assessed properly. [Vide II (1) (*c*) of last year's report.]

III. Timber Seasoning.

Nil.

IV. Timber testing.

(1) The Superintendent, Explosive Project Office, Kirkee, Poona, to whom sample logs of *Salix Tetrasperma* was supplied in January 1954 in connection with the manufacture of high grade charcoal for gun powder on experimental basis has informed that it was found to have considerable heart-wood formation and its ash content was as high as 4·1 per cent. It was therefore considered to be unsuitable for manufacture of high grade charcoal for gun powder. [Vide last year's report 3 (*a*).]

(2) The Superintendent, Explosive Project Office, Kirkee to whom 1,800 lb. of wood of *Euphorbia Tirucalli* was supplied for manufacture of gun powder from charcoal has informed that the species *Euphorbia Tirucalli* was not suitable for the production of charcoal for military purposes owing to its high ash content. [Vide last year's report 3 (*b*).]

(3) The following species were supplied to the Officer-in-charge of Wood Preservation Branch, Forest Research Institute, Dehra Dun, from Coimbatore (South) Division for carrying tests on natural durability and durability after preservative treatment in the national test yards to be opened by the Government of India under Second Five Year Plan :—

(1) *Gedrelia Toona.* (2) *Dysoxlum Malabaricum.* (3) *Hopea Parviflora* (4) *Calophyllum Tomentosum.* (5) *Dalbergia Latifolia.* (6) *Grewia Tilaefolia.* (7) *Albizzia Odoratissima.*

The timbers supplied have been taken up for conversion into specimens and treatment with different preservations at different absorptions. The samples are expected to be placed after the rains (October 1958) in six different national test yards for the investigation of their durability. The results of the test are awaited in due course and thereafter each year after the annual inspection. [Vide last year's report 3 (*c*).]

(4) The President, Forest Research Institute, Dehra Dun, requested the Chief Conservator of Forests, Madras, for the supply of logs of the following species for experimental purposes : (1) *Cassia Marginata.* (2) *Terminala Chebula.* (3) *Mesua Ferrea.*

So far 8 cubic feet *Terminala Chebula* and 139 cubic feet of *Mesua Ferrea* have been supplied from Salem South and Coimbatore South divisions respectively. Supply of 8 cubic feet of *Cassia Marginata* is being arranged. The results of the experiment are awaited.

(5) The Chief Engineer, Public Works Department, Madras, requested the Chief Conservator of Forests, to arrange for the supply of samples of the following timber to get them tested in the Public Works Department Laboratory regarding strength, durability and allied factors :—

(1) *Terminalia Tomentosa.*
(2) *Lagerstroena Lanceolata.*
(3) *Ptercarpus Marsupium.*
(4) *Artocarpus Hirsuta.*
(5) *Hardwickia Species.*
(6) *Hopea Parviflora.*

(7) *Mangifera Indiga.*
(8) *Adina Cardifolia.*
(9) *Grewia Tilaefolia.*
(10) *Eucalyptus Species.*

The Timber samples have been supplied from the Coimbatore South Division, Ootacamund Division and Tirunelveli South Division. The results of the tests are awaited from the Chief Engineer, Public Works Department, Madras.

(6) The Gwalior Forest Products, Shivapurai, Madhya Pradesh, required one maund of heart wood of *Acacia sundara* for experimental purposes. The supply was arranged from the Vellore West Division and the results of the experiment are awaited.

IV-A. Wood preservation.

(1) *Test length sleepers.*—Treated and untreated sleepers laid in the track in various localities were inspected along with the concerned officers of the Railways. The results of the tests were communicated to all concerned. A statement showing the details of the inspections is appended. (Statement I).

(2) *Inspection of Ascu and creosote treated poles.*—During the year, no inspections of Ascu and creosote treated poles were under taken as such inspection were discontinued from 1956–57 in accordance with Chief Conservator of Forests's orders.

V. Minor Forest produce.

(1) During the year under report, the Government Lac Factory at Cumbum, continued to manufacture lac products according to demand. A statement showing the quantities of lac products manufactured and supplied during the year is attached. (Statement II) Bees wax produced departmentally in the Coimbatore North Division was supplied to the Jail Departments as usual.

(2) The Chief Professor of Chemistry, Presidency College, Madras, to whom a quantity of 9½ lb. of roots of *Aristolochia Indica* was supplied from Tirunelveli South Division for chemical investigation, has furnished the following results : "The material supplied from Tirunelveli South Division was correctly identified as *Arstolochia Indica* but did not contain any Ishwarone and was therefore unsuitable for their experiments. It contained Aristolochic acid, present in samples collected from other localities in India. [Vide last year's report 5 (*f*).]

(3) The Chief Professor of Chemistry, Presidency College, Madras, to whom 50 lb. of *Plumbago Zeylanica* was supplied from Coimbatore South Division for experimental purposes has not yet communicated the results. [Vide last year's report 5 (*g*).]

(4) The Director, Medical Services, New Delhi, to whom 3 lb. of *Pithacolobieum Bigenimum* was supplied from Tirunelveli North Division for experimental purposes. He has informed that the seeds of *pithcolobieum Bigenimum* did not give any positive results compared to the seeds of the same species obtained by him from Burma in 1940. He has also informed that these seeds are not so large nor so brightly brown. [Vide last year's report 5 (*i*)].

(5) Six and half railway seers of barks of *Ficus Talboti* was supplied to Messrs. United and Chemical and Allied Products, Culcutta, from Tirunelveli North Division for Research on Chemistry. The results of the experiment are awaited. [Vide last year's report 5 (*j*)].

(6) Chief Professor of Chemistry, Presidency College, Madras to whom 50 lb. of *Alangium Lamrcki* was supplied from Vellore West Division in April 1957 for experimental purposes as not yet communicated the results of the experiment. [Vide last year's report 5 (*k*)].

(7) Thirty small canes (*Calamus Rotang*) and 30 big canes (*Calamus Brandissi*) were su plied to the President, Forest Research Institute and Colleges, Dehra Dun in October 1957 for Experimental purposes. The results of test are awaited. [Vide last year's report 5 (*l*)].

(8) The Officer-in-charge, Wood Anotomy Branch, Forest Research Institute, Dehra Dun required wood specimens of *Hemicyclea Porteri* for experimental purposes. 2 pieces of *Hemicyclea Porteri* specimens were supplied to him from Madurai South Division and the results of the experiment are awaited.

(9) Officer-in-charge, Minor Forest Produce Branch, Forest Research Institute, Dehra Dun required sampl s of *Calamus Gamblei* and *Calamus Rheedi* for experimental purposes. One dozen canos of each of the canes were supplied from Coimbatore South Division and the results of the tests are awaited.

(10) The following produce have been supplied to the Dean, Madras Medical College, for experimental purposes.

(1) *Rauwolfia serpentina*—2 lb. of roots.

(2) *Strychnos nuxvomica*—5 lb. of seeds.

(3) *Strychnos nuxvomica*—5 lb. of roots.

The results of the experiments are awaited.

(11) The Director, Jiwaji, Industrial Research Laboratory, Madhya Pradesh, Gwali r required 5 lb. of each of the heart wood of wattle and B ue Gum in connection with research work that is being carried out in his laboratory regarding c llulose content in certain c llulosic materials. 5 lb. of each of the hear wood of wattle and blue gum were su plied from the Ootacamund Div sion and the results of the experiments are awaited.

(12) The Officer-in-charge of the Chemistry of Forest Products Branch, Forest Research Institute, Dehra Dun request d he Chief Conservator of Forests to arrange for the supply of 10 lb. of roots of *Coleus Aromaticus* (*Vetti Veru*) for chemical investigation. The supply was arranged from Cuddalore Division. The following are the resu'ts furnished by him. These roots yielded 0 27 per cent of an essential oil on zero moisture basis Refractive index of the oil obtained was found to be 14,967 at 2 oc. From the prelimin ry examination the oil appears to be a fine fixative for use in the cosmetic industry. The quantity of the oil obtained from the material supplied is so small that it has not been possible for to go ahead with further work.

(13) The President, Forest Research Institute and Colleges, Dehra Dun, requested the Chief Conservator of Forests to arrange for the supply of the following raw material in connection with the Annual Programme of research work of his Branch :—

(1) *Alstonia scholaris.* Barlk.

(2) *Eucalyptus critiodra.* Leaves.

100 lb. of bark of *Alstonia scholaris* were supplied from the Tinnelveli North Division. Supply of two maunds of *Eucalyptus critiodra* is in progress. The results of the experiment are awaited.

(14) The District Village Industries Officer, Vellore required 5 lb. of *Kydia calycina* bark for testing and for demonstration purposes in North Arcot district. The supply is being arranged from Gudalur Division.

(15) The Printing Store Bombay required 18 lb. of raw materials *Kittul fire* (curybota urens) for experimental purposes. The supply is being made from Tinnelveli North Division.,

VI. Paper Pulp—Nil.

VII. Tanning Materials.

(1) The Principal, Institute of Leather Technology, Madras to whom tender and mature leaves were supplied in previous years has communicated the following results : [Vide last year's report 6 (*a*).]

Tender leaves taken from 1 to 9 bags.

	PER CENT.
Moisture	6·20
Insolubles	59·71
Total solubles	34·09
Non-Tannins	18·07
Tannins	16·02
Colour—	
Yellow	3·5
Red	0·7
PH of the analytical solution	4·6

Nature leaves sampled from 10 to 29 bags.

	PER CENT.
Moisture	8·96
Insolubles	59·23
Total solubles	31·59
Non-tannins	16·80
Tannins	14·79
Colour—	
Yellow	6·0
Red	1·2
PH of the analytical solution.	4·6

(2) The Director, Central Leather Research Institute, Madras required Dhawa leaves (*Anoglissus latifolia*) AND bark for experimental purposes. The following are the supply so far :—

Dhawa leaves and bark	..	One maund each from Vellore East Division.
Dhawa leaves	.. ..	Sixty lb. from Madurai North Division.
Dhawa barks	.. ..	Fifty lb. from Madurai North Division.
Dhawa sumac	.. ..	Forty lb. from Madurai North Division.

Further supply is to be made from Madurai South Division. The results of the experiment are awaited. [Vide last year's report 6 (*c*).]

(3) The following quantities of seeds of *Terminalia chebula* and *acacia arabica* were supplied to the President, Forest Research Institute and Colleges, Dehra Dun for experimental purposes from the divisions marked against each. [Vide last year's report 6 (*d*).]

Name of the division.	*Terminalia chebula.*	*Acacia arabica.*
	LB.	LB.
Chingleput	..	2
Coimbatore South	2	2
Salem South	10	10
Madurai North	2	2
Cuddalore	..	3

Results of the experiment are awaited.

(4) The Chief Professor of Chemistry, Presidency College, Madras to whom a further supply of 180 lb. of *Feronia elephantum* was supplied for chemical analysis has since communicated the results of the analysis as follows :—

"Extraction of the root bark of *Feronia elephantum* with petroleum ether gave a colourless crystalline compound, named Feronia lactone. As a result of studies carried out on this compound it has been shown to be the geranyl ether of 7 methoxy coumarin. Further extraction of the bark with stone, alcohol gave only amorphous materials of the nature of phlobaphenes and tannins. Extraction of the stem bark of Feronia lactone gave only tannins and no crystalline material, suitable for chemical investigation."

(5) The Director, Central Leather Research Institute, Madras to whom 91 lb. of *Terminalia arjuna* fruits was supplied from Salem South Division for experimental purposes has informed that the samples of *Terminalia arjuna* fruits received from the Range Officer, Rasipuram, Salem South Division, were tested at his Institute and that the tannin content of the same was found to be negligible. [Vide last year's report 5 (*h*).]

(6) The Director, Central Leather Research Institute, Madras requested the Chief Conservator of Forests to supply some quantities of resins from *Canarium strictum* and the masses available in the forest of this State for test purposes. The following quantities of resins and mosses have been supplied and the results of the experiment are awaited.

(i) Twenty-four lb. of mosses from Ootacamund and Coimbatore North Divisions.

(ii) Twenty-six lb. of mosses from Madurai South Divisions.

(iii) Five of *Canarium strictum* sins from Tirunelveli South Division.

VIII. Wood working—Nil.

IX. Statement showing the outturn of Major and Minor Forest Produce.

Data for Statements showing the outturn of Major and Minor Forest Produce collected departmentally and through Purchasers and consumers during the year are being collected. It will be issued as separate supplement.

X. Miscellaneous—Nil.

APPENDIX.

I. Publications—Nil.

II. Statement showing designation and addresses of Forest Officers employed exclusively on research work during the year—Nil.

STATEMENT I.—*Showing the results of Joint Inspection of Test length sleepers during* 1957–58

Numbers Laid.	*Date of laying.*	*Location.*	*Description of sleepers.*	*Date of inspection.*	*Remarks.*
300	March 1943 ..	Between Tiruthuraipundi and Manali Mile 215/12 to 215/9¾.	Creosoted test length sleepers of Pillamarudu, Pali, Irul, Irumbegam, Karimarudu and vayal.	18th June 1957 ..	The results of the tests indicate that Irumbegam 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).
	De. ..	Between Omalur and Macheri Road S.MD. 214/16-215 Mettur line.	Creseted test length sleepers B.G. of pillamarudu, Pali, Karimarudu Hopea and vayal.	2nd September 1957.	The durability of the species tested is given in the descending order indicated below. Hopea, Karimarudu, Pillamarudu Pali and vayal. Pillamarudu though included in the low grade is giving better service, than Pali and vayal of the other species' (superior to low grade) Pali, an unclassified species is doing as good as vayal of other species). Hopea appears to be the most durable among the species used.

STATEMENT I.—*Statement showing quantities of various lac products sold during* 1957–58.

Serial number and name of lac products.	*Quantity manufactured and sold.*	
	LB.	OZ.
1 S. C. Polish	7,280	8
2 Shellac varnish	951	0
3 Transparent polish	8	0
4 Sealing wax, superior grade	4	0
5 Sealing wax, ordinary grade	4	0
6 Sealing wax, block cheap grade	56	0
Nil	5	0

APPENDIX J.

Results of experiments on the Artificial Regeneration Teak in the Composite Madras State from 1926 to 1956.

(Referred to in Paragraph 48).

Note:—This was submitted as an article entitled 'Progress of Research in the Artificial Regeneration of Teak (Tectona grandis) in the Madras State from 1926 to 1956', for publication in the Indian Forester; but this has so far been not published.

Summary.

Early beginings of Research on the Artificial Regeneration of Teak in 1926 are described. Experiments with teak stumps in 1928 to 1930 are given. Other experiments regarding the optimum date of planting, planting in pits as compared with planting in crowbar holes are referred to in paragraph 8 is conducted during the last 30 years from 1926 to 1936; these are dealt with briefly in the following paragraphs giving the conclusion drawn from each of the experiments.

Most of the items of Research were conducted by the State Silviculturist, Madras State, but some experiments were designed by the Central Silviculturist of Forest Research Institute on all an India basis. These are referred to, as also the part played by the Forest Research Institute in the matter of computation of sample plots on teak.

Though the Research Division of the Madras Forest Department was started in the year 1919, investigation of problems on the articial regeneration of teak was started only several years later. In those early years the direct sowing of seeds and transplanting of seedlings in prepared patches was considered so successful that no thought was given to the problem of improvement and development of the technique of artificial regeneration of teak. On the other hand, the first problem tackled with reference to teak plantations which was a very valuable asset, was the question of underplanting teak plantations with a view to soil protection and prevention of deterioration of site quality.

2. It was in 1926, that the problem of artificial regeneration of teak was taken up for Research. In that year a comparison experiment was done between notching germination seeds and transplanting seedlings 8" to 18" in height in prepared pits. It was concluded that notching germinating seeds give a good height growth, was much cheaper and also much speedier than palnting in pits. This experiment was continued in the following year also with the same results.

3. Experiments with teak stumps was started for the first time in the year 1928. At that time there was a notion that plants raised artificially from stumps would show unsoundness in the timber obtained from the plants. Hence, this experiment was designed to test whether the plants showed unsoundness. This experiment, was done in four centres, namely, Nilambur, Palghat, Kurnool West and Nilgiris, and the conclusion was firmly established in 1932-33 that there was nothing to be feared as regards unsoundness in the plants. During the following year, experiments with stump plants proved that stumps can give greater success than direct sowing of seeds.

4. In 1929-30 it was firmly established that stump planting of teak gave a crop which was much superior to that obtained by direct dibbling of teak seeds. It is worthy of mention that though the superiority of stump planting as a method of artificial regeneration

was established as early as 1929-30, stump planting as a district practice was started on a small scale in Nilambur only in 1934-35, i.e. five years later and extensive plantations were raised by the stump planting method only in 1936. This lag of four to six years is probably due to the scepticism of Forest Officers in those days on the efficacy of stump planting as compared with entire transplanting.

5. Having established that stump planting is the best method of artificial regeneration of teak, attention was directed towards the optimum date for planting teak in 1931-32. Also the question of comparison of planting teak stumps in crow-bar holes as against planting in pits was taken up. The preliminary indications were that early, planting of stumps was beneficial as regards both increased height growth and survival percentage. It was also found that though there was a slightly increased height growth with planting in pits, the difference in height growth was so little as not to justify the greater cost of pits planting. The experiment on the optimum period of planting was continued every year till 1932-33, when it was established that pre-monsoon stump planting was best in regions having the West Coast type of climate as it gave more than double the height growth in the first year and nearly 100 per cent survivals.

6. In 1932-33, further experiments were started on the following :—

(1) Effect of age of plant from which the stumps are prepared;

(2) Effect of diameter of the stump on survival and height grow; and

(3) Stump planting in pits or in crow-bar holes.

These experiments were continued during 1933-34, 1934-35 and valuable conclusions were drawn.

7. As a result of stump planting becoming the approved method for raising plantations in 1936, research on the problem was intensified in the following years and very valuable conclusions were drawn on the various aspects of the artificial regeneration of teak.

8. The various experiments on the artificial regeneration of teak conducted during the last 30 years from 1926 to 1956, are reviewed in the following paragraphs. For facility of reference on index is furnished below showing paragraph numbers in which they are dealt with :—

9. *Teak—Natural regeneration by seed.*—An experiment on the method of inducing natural regeneration of teak in a teak plantation after penultimate thinning was initiated during the year 1954–55. The experiment is still in progress and no conclusions are possible at this stage.

10. *Teak coppice—Mortality of stools.*—An experiment was started in 1937 in Palghat Division to determine the mortality of stools in teak coppice. The treatment were :—

(*a*) Low cutting (as near the ground as possible) with trimming;

(*b*) Low cutting without trimming ;

(*c*) High cutting (stumps 9" to 12") with trimming ;

(*d*) High cutting without trimming.

The experiment is still in progress. Analysis of the latest measurements shows that there is no difference so far between high cutting and cutting or between trimming stools and not trimming stools. This is indeed a happy result as forest extraction work is done mainly with illiterate mazdoors through a contractor and it is practically impossible to make the mazdoors cut the stumps low or to trim the stools.

11. *Teak—Regeneration by coppice—Reduction of coppice shoots to* 4, 2, 1, *per stool.*—An experiment was initiated in 1935 in Palghat Division with a view to determine whether it as advisable to thin out the teak coppice shoots for the purposes of producing teak poles. There were four treatments, namely, reduction of coppice shoots to 4, 2, 1 shoots and control with no reduction of shoots. The experiment is still under observation. Analysis of the latest measurements shows that the best height and diameter growth are exhibited by the treatment in the following order :—

(i) Reduction to one shoot ;

(ii) Reduction to two shoots ;

(iii) Reduction to four shoots ;

(iv) Control.

But we are interested in total volume production per acre and not in the size of the individual coppice shoots. We will have to wait till the the rotation to ascertain which treatment gives the maximum volume production.

12. *Weathering of teak seeds.*—In 1936–37, various methods of weathering teak seeds , such as :—

(i) Exposure to sun and rain for six weeks ;

(ii) Exposure to sun and rain for six weeks with watering once a week in dry weather ;

(iii) Seeds buried in pits with wet starw ;

were dried. The treatments produced no appreciable difference in germination percentage. The experiments were repeated for four years up to 1939–40 and the above conclusion was confirmed.

13. *Plantation seed versus natural forest seed for artificial regeneration work.*—Experiments were started in 1939–40.

Teak seed was collectd from trees of comparable size and condition in the natural forest and in plantations and tested in the nursery beds. Germination tests revealed no appreciable difference between them.

To study the effect of planting teak stumps raised from the two different origins of seeds (viz., plantation seed and natural forest seed), long term experiments were started and are being continued. So far there has been no significant difference in the mean heights of trees raised from the two origins (except in the case of experimental plot 85/42 of Wynaad where plantation seed gave better mean height growth). It is not however known whether any desirable or undesirable timber qualities are transmitted by such selection of trees. In view of the fact that the seed from which these plantations were raised, have been obtained from natural forests, there is reason to believe that such is not the case. Besides in Nilambur, Wynaad and South Coimbatore, plantations have been formed on a large scale, cutting natural forests containing teak trees. Seed for local use and for supply to forest officers outside

the State is being collected chiefly from Teak plantations. Hence the result of this experiment will only be of theoretical interest and will not be of any practical application.

14. *Teak plantations—Sorting of seeds according to size.*—Experiments were started during 1936–37 to find out whether sorting of seeds by size was necessary and whether only bigger sized seeds should be used in the artificial regeneration work. The experiments were concluded at the end of five years in 1939–40 and the result was published as 'Indian Forest Record Vol. IV, No. 2, Sorting of seeds by size, so far as the germination was concerned, was not economically justified. Selection big seeds gave only 46 per cent germination against 44 per cent germination in respect of seeds from district sample containing a random collection of big and small seeds.

15. *The effect of size, age and condition of seed bearer.*—Experiments were started in 1934–35 and concluded in 1938–39. The experiments, conducted over a period of five years on seeds of *Balbergia latifolia*, *Pterocarpus marsupium* and *Terminalia crenulata* besides those of teak, gave conclusive proof that as far as germination is concerned seed from both over-mature and under-mature trees was as good as that from mature trees. In order to test whether this hold good in the later development of the plant, large scale long term experiments were started in 1937 after a period of 18 years, show that is general, seeds from trees below 3' 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.

16. *Seed origin experiments.*—In 1934–35 long-term experiments were started in Nilambur and in topslip to test different origins, viz., Nilambur, Anamalais, South Bombay, South Burma and North Burma. In topslip, there were four origins, viz., South Burma, Anamalais, Mysore and Nilambur. This is a long-term experiment to compare the growth of plants raised from seeds of different origion. Latest measurements show that in Nilambur experiments, South Burma and South Bombay origins were leading as regards volume production; but in the topslip experiment the local Mount Stuart origin occupied the first place as regards the volume production, with Nilambur origin following closely behind, with the South Bombay in the last place. The indications afforded by these two sets of experiments are, therefore, contradictory for the present and hence further observations are necessary before any definite conclusions can be drawn.

17. *Effect of repeatedly using the same nursery beds for production on teak stumps.*—The experiments were started in 1936–37 and concluded in 1940–41. It was proved that using the same nursery beds year after year caused considerable failing off in production of stumps both in size and number for the same quantity of seeds even if expensive manuring is resorted to. Also the average diameter of usable stumps produced had fallen. The standard practice now is, therefore, to use nursery beds only once. The nursery beds for producing teak stumps for planting in the following year are generally located in the areas taken up for planting in the current year. The utopian idea of raising teak stumps in the State as a whole in large central teak nursery is not likely to be practical for the above reasons.

18. *Teak stumps—Nursery methods.*—Experiments were started in 1937–38 and concluded in 1940–41. The experiment showed that the optimium quantity of teak seeds to sow in a standard nursery bed of size 40' to 40' was 20 lb. to 30 lb. with no pricking out of seedlings subsequently. This was most economical in both cost and quantity of seed. Such a bed produced enough good stumps of usable size to plant one acre at 6'×6' espacement with sufficient stumps to spare for casuality replacement. Undersized plants could be stumped and replanted in the nursery or left over for the second year when they could produce a further quantity of utilisable stumps.

To see whether further economy of seed is possible without the reduce tion in the number of utilisable stumps per standard bed, experiments, were started in 1940 with sowing 10 lb. 20 lb. 30 lb. of seeds per bed. The results showed that 10 lb. was too small and that there was no difference between 20 lb. and 30 lb.

19. *Teak nursery methods—Production of usuals stumps in the second year from the undersized plants of the first year.*—These experiments were started in 1937–38. It was concluded that putting undersized seedlings back in the nursery for a second year produced plants at the end of the second year which when stumped and planted out were in no way inferior to fresh one year old stumps. This method of putting back for a second year into the nursery, undersized plants, will help us to tide over years of shortage of stumps.

20. *Pre-monsoon stump planting of teak.*—This experiment was started in 1933–34 and concluded in 1937–38. The conclusions were that, in a locality having a West Coast type of climate, pre-monsoon stump planting was the best, This early stump planting give sufficiently good stocking and great gain in height growth as compared with planting in June which was the previous district practice. Success was not dependent on what was generally considered good planting whether. The advantage of increase in height growth more than put weights the risk of poor stocking due to an exceptionally dry hot season. The best dates for planting teak were found to be middle of April in Begur, middle of April in Dhoni, late April in Kennoth, early May in topslip, middle of April in Walayar and middle of April in Nilambur.

21. *Teak stump planting—Effect of age and diameter of stumps.*—The experiments were started in the year 1933–34 and concluded in the year 1938–39 with the following results :—

Considering both survival percentage and mean height growth the work done shows that stumps do best if within the diameter range of 0·4 inch to 0·8 inch. Three-year old stumps have not done well but within the diameter range mentioned it does not appear to matter whether the stumps are one or two years old. The falling off of survival percentage and mean height growth of stumps below this range of size is much more marked than that of stumps above this range, except in the case of three-year old stumps.

22. *Teak stumps planting—Effect of length of root.*—Experiments were started in 1932–33 and concluded in 1935–36 after four years after repetitions in several centres. Root lengths of 4 inches, 6 inches, 8 inches, 10 inches were tried. It was established that there is no appreciable difference in survival percentage and no significant difference

in mean height growth between the different root lengths. The standard practice has always been to have root lengths of 8 inches, but the experiments show that root lengths upto 4 inches are equally successful.

23. *Shaving of teak stumps.*—Experiments were started in 1941–42 and were concluded in 1943–44. It was proved that careful shaving of the side roots of the teak plant at the time of preparation of the stumps was not necessary.

24. *Stump planting—Storage of teak stumps.*—Experiments were started in 1933–34 and concluded in 1939–40.

The investigation has conclusively shown that :—

(i) Teak stumps keep much longer without deterioration if they are dug up after sprouting in the nursery ;

(ii) There is no appreciable deterioration in mean height growth due to storage ;

(iii) Even in bad years climatically they will keep for two to three weeks without deterioration.

This indicates that even under exceptionally adverse weather conditions they will keep long enough to be sent from any one part of the State to any other without fear of serious deterioration.

25. *Stump planting—Transport of teak stumps.*—In 1934 teak stumps were sent from Nilambur to several districts at distances ranging upto 1,000 miles involving transport by rail and road for periods upto a fortnight. The object of the experiment was to determine whether teak stumps would travel long distance without deterioration and also whether teak stumps raised in one locality would thrive in a distant locality under very different climatic conditions. The conclusion was drawn that teak stumps could be transported over long distances without deterioration and thrive in climates very different from those where they were raised.

26. *Effect of longitudinally splitting teak stumps.*—These experiments were started in 1940–41 and have been continued. The annual area under teak planting had expanded during the thirities and the problem of getting sufficient seed was becoming acute due to clear felling of teak areas and artificial regeneration with teak and these plantations were generally too young to yield seed. To overcome this difficulty experiments were started to compare the full stumps with halved and quartered teak stumps, the spliting being done longitudinally. Observations showed that there was no significant difference in height growth or further development between halved and entire stumps. Quartered stumps gave very low survivals. Latest observations on another experiment started in 1949 confirmed the above results.

Entire stumps are safer ; but in times of scarcity, halved stumps can be used with considerable success. If the matter is considered from the point of view of regeneration of maximum number of plants from the same number of stumps halved stumps are better than entire stumps as they yield 164 plants against 100 plants for 100 stumps. Hence halved stumps can be recommended with confidence in times of scarcity of stumps.

27. *Teak—Comparison of good and malformed stumps.*—Experiments were started in the year 1949 and are in progress. Latest measurements show that malformed stumps have given even better survival per cent and height growth and good stumps even though the difference is not significent. Hence, malformed stumps can be used as freely as good stumps.

28. *Effect of depth of planting of teak stumps.*—Experiments were commenced in 1936–37 and concluded in 1943–44. It was concluded that judged by both survival percentage and mean height growth it was decidedly beneficial to plant the stumps with the top of the 1" shoot flush with the ground when doing early stump planting. There is of course the practical difficulty that this kind of ' buried ' planting makes inspection difficult and consequently a portion of the plantation may be inadvertently missed during planting.

29. *Stump planting of teak—Pit* versus *Crow-bar planting.*—Experiments were started in 1933–34 and concluded in 1934–35.

Pits gave a slight but not significant increase in height growth (average 9 per cent). There was no difference as regards percentage of survivals. It was therefore concluded that for stump planting, the preparation of pits is not worth the extra expense and that planting could be done in crow-bar holes. The latter continues to be the standard practice up to the present time.

30. *Teaks—Stump planting—Fate of casualty replacement in the second year.*—It was the practice in the district plantation work to replace casualties in teak plantations in the second year also. The investigations on the fate of casualty replacement in the second year in localities having the west coast type of climate was started during the year 1933–34 and concluded during 1939–40. The conclusions were that such replacement do not take their place in the crop and are therefore not financially worth while. Statistics show that only 42 per cent of the replacements survive and that those survivals are not taking their place in the crop at the time of the first thinning which was usually about the fifth year. This conclusions could apply of course only to cases where casualties were few and not to wholesale replacement of a felled plantation.

31. *Effect of kumri crop in teak plantation.*—These experiments were started in 1933–34 and were concluded in 1937–38. The ragi crop grown in conjunction with teak had a retarding effect on the growth of the teak. But there was no difference in survivals. In localities where labour is available for this Kumri cultivation, it is necessary to carry on this cultivation for various administrative reasons. The chief of this is the cheapness of the plantations raised by this method. Also labour engaged in forest works, will have to be given this advantage of Kumri cultivation so as to be given this advantage of Kumri cultivation so as to secure their services for the forest regeneration works. Hence in the Wynaad and Nilambur Divisions where hill labour is available for this Kumri cultivations, plantations in conjunctions with Kumri crops are the general rule. In the South Coimbatore Division where hill labour is not available for this Kumri cultivation, teak planting is done without Kumri crops.

The general conclusion of the experiment was that all the crops used were bad for the teak ; but of all the crops used, the retardation of growth was greatest with a crop of ragi. It is a dense crop and causes intense competition with the teak in the first year.

32. *Teak—Experiment on espacement.*—In the past in Nilambur, teak planting originally started in 1843 on an espasement of 5′ × 5′ and this was changed into 6′ × 6′ shortly afterwards. In the midde about 1896–1912 there was 8′ × 8′ espacement but 6′ × 6′ espacement was continued generally until recent times. In 1838, a well designed experiment was to compare the effect of 6′ × 6′ espacement with 8½′ × 8½′ espacement. This was done in one locality of the first quality and another similar experiment was started in another locality of the second locality. Another set of experiments was started in 1940 on the same subject. The conclusions are identical for both the sets of experiments. Judged by the mean height growth 8½′ × 8½′ espacement was significantly better than the 6′ × 6′ espacement. The cost of weeding with the wider espacement was also less.

Apart from cutting down nursery and planting costs, as only half the original number of stumps are now required per acre of planting, the wider espacement allows for a longer period of Ponam cultivation, resulting in better acration of the soil, greater control over weeds and consequently an accelerated start for the young teak. There is moreover the added advantage of the complete elimination of the first mechanical thinning—an essential operation in teak plantations with 6′ × 6′ espacement. Hence for Nilambur Division and Kannoth Range of Wynaad Division the wider espacement of 8½′ × 8½′ has been adopted from the year 1951.

33. *Teak—Manurial experiment.*—Experiments were started in 1953 to ascertain whether the application of fertilizers will increase the height growth of plants and thereby reduce weeding cost. Latest observations in 1956 lead to the conclusion that there is a slight increase in height growth with the application of 2 oz. to 4 oz. of fertilizers (Super phosphate or N.P.K. Mixture); but the increase in height growth is only a few feet. It is doubtful whether this limited increase in height growth will lead to any saving in weeding costs. The conclusion can, therefore, be drawn that manuring with artificial fertilizers is not beneficial.

34. *Teak—Cutting back one-year old plantation.*—The object was to compare the effect of cutting back a one year old teak plantation and non-cutting of the teak plants. The experiment was statred in 1953 and is in progress. Measurements after one year showed that the cut back plants had a mean height of 63·2″ while the mean height of the non-cut plants was 50·5″. The diff rence is significant; however further observations are necessary. If however a one year old teak plantation is accidentally burnt or severely damaged by wild elephants, one need not be sorry and the damaged plants can be cut back.

35. *Teak—Introduction of teak in the sandy localities of the East Coast and in the Canal Banks Padugais in Thanjavur district.*—With a view to augment the supplies of teak timber in the Residuary State of Madras after separation of the West Coast districts of Malabar and South Kanara in October 1956, experiments were started on the introduction of teak in South Arcot and in Thanjavur districts in 1955–56. From the existance of well-formed teak trees in parts of the Tanjore district along irrigation canals, there is reason to believe that teak can come up well in Tanjavur district. Results are waited.

36. *Teak plantations in the second rotation—Is there deterioration of site quality.*—Obs rvations in Sample Plots No. 17-A, 18-A of Nilambur which are located in the identical sites occupied by first rotation sample plots Nos. 17, 18 and 19 show that there is no deterioration in general

in higher site quality soils such as All-India Quality II and III. There is, therefore, no need for any fear that the quality of teak plantations in the second rotation will fall off due to adverse condition created by the continued cultivation of pure crops of light demanding species such as teak.

37. *Weeding Technique in the first year.*—Experiments were started in 1934–35. In 1935–36 large scale experiments were started and the conclusion was that though weeding by forking was significantly better than mamooty scraping, in mean height growth at the end of two years, to the extent of 14 per cent the cost was twice as much and it was therefore not justified.

38. *Weeding practice in Teak Plantations—Second year.*—The conclusion was drawn in 1935–36 that forking though superior to scraping is not justified on account of the increased cost. Comparison of clean scraping throughout the area with scraping to a width of 4′ only in the second year showed that clean scraping was also not justified due to increased cost. The conclusion was therefore drawn that in the second year of the teak plantation no weeding method more costly than strip scraping was necessary.

39. *Loranthus infestation on teak.*—Experiments were started in 1930–40 to test the efficiency of the current district practice of cutting the loranthus bushes at the time of thinning. The loranthus which was identified to be *loranthus longiflourus Desp. Var. falcata* was found to flower and fruit in May to December. The affected branches were cut one foot above the pest in March-April, i.e., before flowering and fruiting and laid near the nearest fire line. They were completely dead in 10 days. The post did not re-appear on the out ends of the branches. Hence this method of dealing with the pest is apparently satisfactory.

But in practice, owing to the difficulty in reaching the affected branches, near the point of infection, whole branches are cut down and thus eradication of Lantana has been almost synonymous with reducing the crown of the tree to about half to one-third of its size.

Hence experiments were initiated in 1955–56 to determine—

(i) Whether the infestation of Loranthus on teak is adversely affecting the volume increment or teak;

(ii) Whether the Loranthus can be eradicated from the teak by methods other than manual removal of the affected branches. In one set of experiments, Fernoxone and Copper Sulphate were introduced in augur holes made in the trunk of the teak trees, separately and together.

The results of the above experiments will be available only after several years.

40. *Teak Plantations—Thinning Research.*—A large number of sample plots were laid out in the year 1934–35 in accordance with a scheme drawn up by the Central Silviculturist for the initiation of the research into the best age, grades and cycles of thinning, teak plantations.

The objects of the experiments were to determine—

(*a*) the best date of first thinning;

(*b*) the best intensity of thinning;

(*c*) the best periodicity of thinning;

In teak plantations of different site qualities another set of sample plots was established to test whether Dr. Craib's theory of thinning is applicable to teak plantations.

These valuable experiments were continued right up to present time and the conclusions drawn, are given in detail in the Annual Report on Silvicultural Research for the Madras State during 1954–55. The main conclusion are furnished briefly below :—

The best time for first thinning.—Experiments showed that the 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.

Teak—Best intensity of thinning.—The conclusions drawn after 25 years of research are as follows—

(1) The difference intensities of thinning have no appreciable effect on height growth.

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

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

(4) The yield of total volume (stem timber and stem small wood) produced up to date is the highest for the 'C' Grade thinning : lowest for the 'X' Grade thinning.

Hence, the conclusion can be drawn that heavier thinning like 'E' Grade or 'X' Grade yield progressively more rapiddiameter increments; but the total volume production is reatest with an ordinary 'C' Grade thinning, and lowest with a heavy thinning of the type of 'X' Grade.

The heavy and early thinnings to anticipate and not to follow likely suppression in teak plantations.

On the lines of work done by Dr. Craib in South Africa, experiments were initiated in 1934 in Nilambur Teak Plantations. Analysis of the latest measurements shows that—

(1) the advance thinning (Dr. Craib's theory of thinning) has no appreciable effect on the height growth ;

(2) 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.

41. *Teak Plantations—Pruning in Young Plantations.*—In Nilambur, there was a practice of pruning in young plantations each year up to first thinning. The pruning was done along with weeding or climber cutting, usually at the end of the hot weather, and consists in the removal of all side branches up to the height that a man can reach with a sharp bill-hook.

To determine whether pruning is beneficial, experiments were initiated in 1932 and they are still in progress. After 24 years of intenaive research, the conclusions drawn are as below :—

The number of epi ormic branches which appeared in the pruned plot is less than the number of branches in the untreated control plot without pruning. The preliminary indication is that pruning keeps down

branches in teak plants, at least for a period of 1½ years after pruning. Fur her observations are required to see whether this diff rence in favour o pruning will continue.

As regards diameter and height increment, pruning does not appear to have any effect on the plants.

The tentative conclusion is there fore that pruning is not on the whole beneficial to teak plantation crops in their early y ars up to fir-t thinning.

42. *Teak plantations—Underplanting.*—The Research Division in Madras Forest Department was creat d in the year 1919. One of the earliest subjects take n up for research, was the possibility of introducing an underwood in the teak plantations in Nilambur, intensive research on this subject was a gain started in 1930 and many of these experiments are still in progress. Attention is invited to an article on the subject, by the present writer, published in the 'Indian Forester' for May 1956, which gives an account of the experiments up-to-date. The general conclusion was drawn that underplanting in teak plantations was heighter necessary for desirable.

43. *Teak Defoliator attack—Investig tions.*—The teak plantations in Madras State as also teak trees in natural deciduous forest are liable to the attack of the teak defoliator (Hyblaea puera) and the teak skeletonizer (Hapalia machaeralis). In the past very little research was done to find out whether there is decrease in the volume production of teak as a result of the attack of these insect pests ; and if so, whether it is desirable to undertake measures for the eradication of the pest with a view to increased volume production. In February 1955 a conference was convened in Nilambur in which the Entomologist of the Forest Research Institute participated along with the officers of the Madras Forest Department. A note was prepar d embodying up to date information on the subject and suggesting various experiments for execution. The experiments have just been initiat d and it will take several years to reach even tentative conclusions.

APPENDIX K.

TEAK PLANTATIONS—THINNING RESEARCH.

(Referred to in Paragraphs 217).

As per the Annual Administration Report for the Madras Forest Department for the year ending 31st March 1954 the total area of teak plantations in Madras State as on 1st April 1954 was 30,260·26 acres raised at a total cost of Rs. 18,62,592.

2. The inportance of teak plantations in the economy of the State is therefore great. It is therefore the settled policy of the Madras Forest Department to increase the area under teak as much as possible and to introduce teak artificially in all suitable places.

3. No problem in the management of teak plantations is of greater interest or importance than thinning.

4. Attention is invited to a paper on ' A Note on, Elite Thinning in Teak Plantations in the Madras State ' which has been contributed by the writer already.

5. In this paper, I shall attempt to describe the several experiments in progress on the different intensities of thinnings in Teak plantations in Madras State.

6. *Teak plantations—Best intensity of thinning—Wynad.*—An experiment was started in 1931 Regeneration Area of Begur in Wynad 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 readjusted 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 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 thinnings 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 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 forwarded to Forest Research Institute for computation and they have not yet been received back).

TABLE I—*Measurements of 1945 for S. P. Nos. 10 to 25 of Wynaad Experiment on different intensities of thinning.*

Intensity of thinning.	*Sp. No.*	*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 inches.*			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
C Grage ..	12	275	57	1·2	78·41	215	2,407
	18	244	52	6·5	55·64	53	2,201
	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	249·41	306	8,465
Average ..	..	316·5	51·5	5·6	54·90	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 ..	..	1,000	210	27·6	257·28	490	7,169
Average ..	..	250	52·5	6·9	64·32	122·5	1,792·7
E Grade ..	11	155	54	7·9	52·74	177	1,575
	16	179	50	7·4	52·93	120	1,427
	21	176	52	7·3	50·85	111	1,505
	22	192	49	7·1	53·28	101	1,499
Total ..	..	702	205	29·7	209·80	509	5,805
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	42·94	199	1,382
Total ..	..	496	213	31·9	171·39	666	5,055
Average ..	..	124	53·2	7·97	42·85	166·5	1,263·7
		Comparative Statement.					
C Grade ..	..	316·5	51·5	5·6	64·90	76·5	2,116·2
D Grade ..	..	250·0	52·5	6·9	64·32	122·5	1,792·7
E Grade ..	..	175·5	51·2	7·4	52·45	127·2	1,449·0
X Grade ..	..	124·0	53·2	7·9	42·85	166·5	1,263·7

7. *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 gives progresssively higher diameter increments as noted below :—

C grade	..	5·6"	diameter in 16 years.
D grade	..	6·9"	Do.
E grade	..	7·4"	Do.
X grade	..	7·9"	Do.

(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 :—

C grade	..	64·9	Square feet.
D grade	..	64·32	Do.
E grade	..	52·45	Do.
X grade	..	42·86	Do.

(iv) At the end of 16 years 1in 1947, the yield of total volume (stem timber and stem small wood volume) produced to-date, is highest for the 'C' grade thinning and lowest for 'X' grade thinning :

C grade	..	2,166	cubic feet per acre.
D grade	..	1,792·7	Do.
E grade	..	1,499·0	Do.
X grade	..	1,263·7	Do.

This indication is confirmed by similar results obtained in Sample Plots 120 to 125, referred to in para 10 below :—

Hence the conclusion can be drawn that heavier thinning 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.

8. *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 S. Ps. 10 to 25 of Wynaad referred to in paragragh 6 above.

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

C grade thinning	..	S.Ps. 77, 80, 81 and 76.
D grade thinning	..	S.Ps. 86, 82, 75 and 71.
E grade thining	..	S.Ps. 74, 83, 73 and 69.
X gade thining	..	S.Ps. 85, 84, 72 and 80.

The definitions of the different grades are as for S.Ps. 10 to 25. Wynaad (vide paragraph 6 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 II—*Measurements of* 1950 *of S.P. Nos.* 69 *to* 86 *of Nilambur Experiment on different intensity of thinnings.*

Intensity of thinning.	*S.P. No.*	*Main crop.*			*Basal area per acre after thinning square feet.*	*Stem timber volume standing.*	*Stem timber and small wood standing and thinning.*
		Number of stems.	*Top height.*	*Average diameter inches.*			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
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	29	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	66·7	7.3	51·8	195·5	1,584·7
D grade		137·2	67·2	8·2	50·4	310·7	1,315·0
E grade		100·5	67·7	8·6	39·6	282·2	1·262.2
X grade		99·5	66·5	8·9	42·7	368·5	1,205·0

9. *Analysis of the* 1950 *measurements shows that*—(i) the different intensities of thinning have no appreciable effect on height growth as the top height are as below :—

C grade	..	65·7 feet
D grade	..	67·2 feet
E grade	..	67·7 feet
X grade	..	66·5 feet

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

C grade	..	7·3" 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 Square feet per acre.
D grade	..	51·4 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 grade	..	1,584·7 Cubic feet.
D grape	..	1,315·0 Do.
E grade	..	1,262·2 Do.
X grade	..	1,205·0 Do.

These indications are identical to the conclusions drawn already from S. Ps. 10 to 25 of Wynaad, which have been detailed in paragraph 7 above and similar to results obtained from S.Ps. 120 to 125 of Nilambur described in paragraph 10 below :—

10. *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 thinning to anticipate suppression and not to follow suppression and the three S.Ps. 123, 124 and 125 are treated as control i.e. thinnings 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

tan be reduced by inducing rapid diameter increment by heavy (Craib's) thinning. On examination the results obtained in both the control and created plots during 1954–55 are given below :—

TABLE III—*Abstract of measurements recorded during* 1954–55.

Stems.	*Sample plot number.* 120	*Sample plot number.* 121	*Sample plot number.* 122	*Average for all three plots taken together.*
(1)	(2)	(3)	(4)	(5)
	Treated plots.			
Number per acre	49	49	52	50
Maximum diameter	15·3"	17·05"	19·85	19·85
Minimum diameter	9·5	9·8	9·1	9·1
Average diameter	12·6	14·3	15·02	14·0
	Control plots.			
	Sample plot number. 123	*Sample plot number.* 124	*Sample plot number.* 125	
	(6)	(7)	(8)	
Number per acre	137	161	124	141
Maximum diameter	13·9	11·0	18·5	18·5
Minimum diameter	7·5	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" while in the treated plot there are only 50 stems per acre with an average diameter of 14". The age of the plots is 21 years at the time of measurements in 1955.

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

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

12. *Analysis of the measurements recorded in* 1949 *at age* 15 *years which 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" in the treated plots as against annual diameter increment of only 0·67" in the control plots ;

(iii) at the end of 15 years, in 1949, the yield of useful basal area for the treated plot in 56 square feet as against 75 square feet for control ;

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

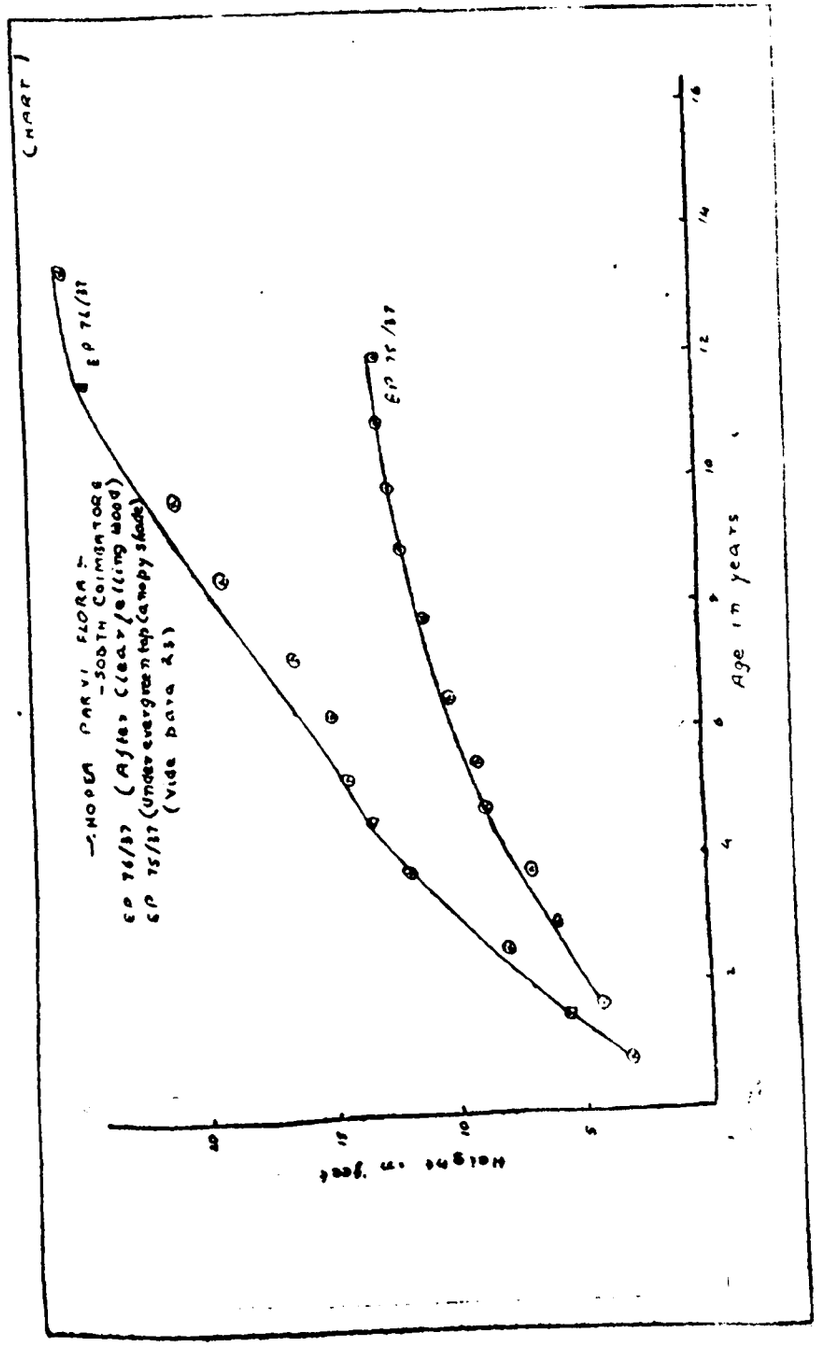
Hence Craib's thinning (i.e. heavy thinning to anticipate suppression and not to follow suppression), yields rapid diameter increment ; but the total volume production is greater with an ordinary 'D' grade thinning as adopted in the district. The indication is confirmed by similar results obtained in Sample Plots 10 to 25 of Wynaad Division and S.Ps. 69 to 86 of Nilambur Division referred to in paragraphs 7 to 9 supra.

The S.Ps. 120 to 125 were measured during 1954–55 and the measurements are under computation by the Central Silviculturists, Forest Research Institute, Dehra Dun. After computation, further date will be available regarding the effect of Craib's thinning on useful basal area and total volume production, as furnished above in Table IV.

13. *Rate of growth of diameter of teak in ordinary and in advance thinning—Compared.*—A graph showing the diameter increment with age of All-India Qualities I, II, and III of teak, as per latest Multiple Yield Tables, is attached. In the same graph, the figures furnished in Table III above for Advance Thinning in Sample Plots 120 to 122 of Nilambur are also plotted. It is found that the diameter increment in S. Ps. 120 to 122 is much higher even than in All-India Quality I as per yield tables.

14. *Possibility of reducing rotation of Teak to* 45 *years with advance thinning.*—If the same accelerated rate of diameter increment is assumed to continue, till the rotation age—which assumption is reasonable—we can expect that at therotation age of 80 years teak plants treated under Advance (or Craib's) Thinning will reach a diameter of 36" against 28" inches as per Yield Tables for All-India Quality I under 'C' grade thinning. In the alternative, if the object of management is the production of exploitable trees, of a mean diameter of 24", instead of having a rotation of 80 years, as at present, we may reduce the rotation to 45 years, on account of the rapid diameter under Advance thinning.

15. *Conclusions.*—Advance thinning has therefore produced encouraging results when applied to young teak plantations in the Madras State. Further data have to be collected before it can be applied widely to teak plantations in South India.



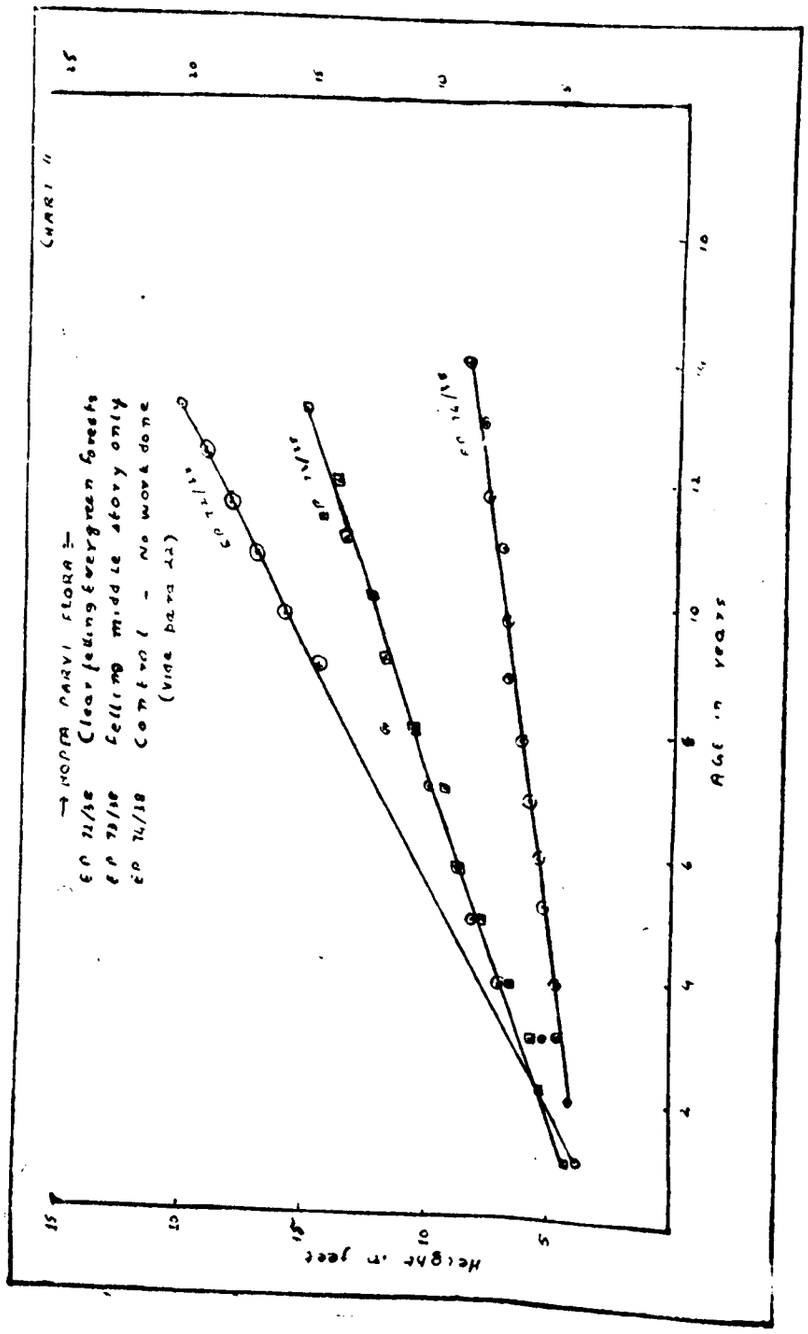


CHART II
→ NOOFA PARVI FLORA ←
EP 71/56 Clear felling evergreen forests
EP 73/58 Felling middle storey only
EP 74/58 Control - No work done
(Vide para 22)
Height in feet
Age in years

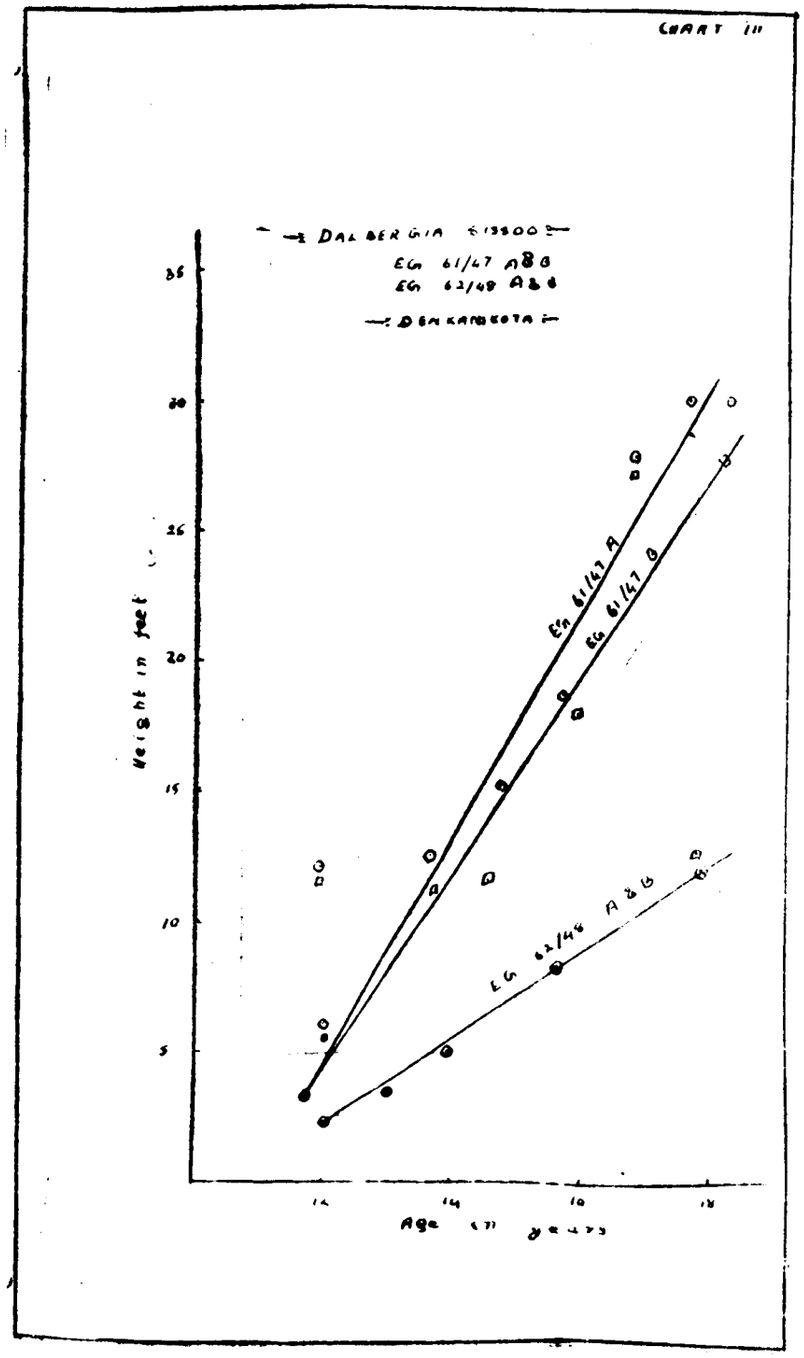


CHART III
→ DALBERGIA SISSOO ←
EG 61/47 A&B
EG 63/48 A&B
→ DENDROCALAMUS ←
EG 61/47 A
EG 61/47 B
EG 63/48 A&B
Height in feet
Age in years

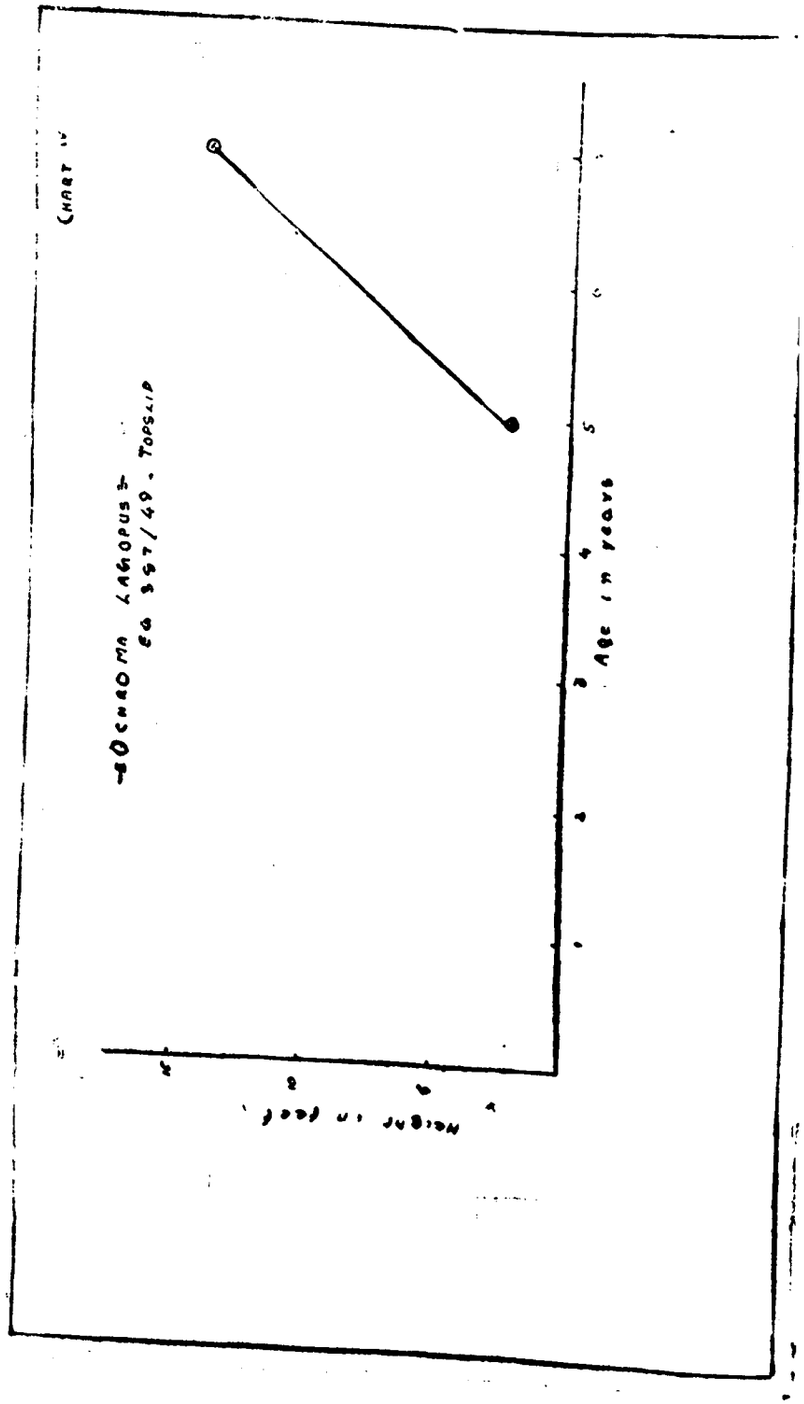


CHART IV
OCHROMA LAGOPUS
Eg 397/49 - TOPSOIL
Age in years

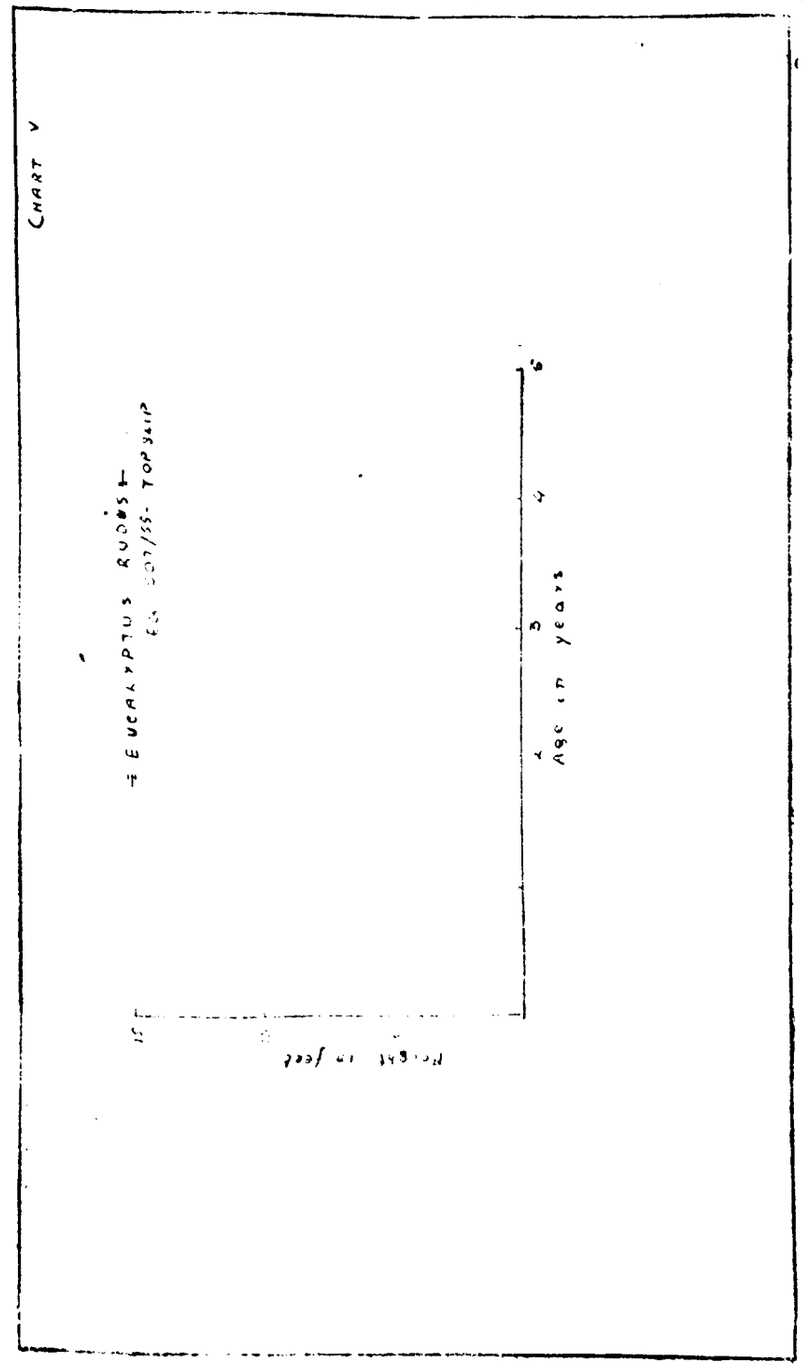


CHART V
EUCALYPTUS RUDIS
Age in years

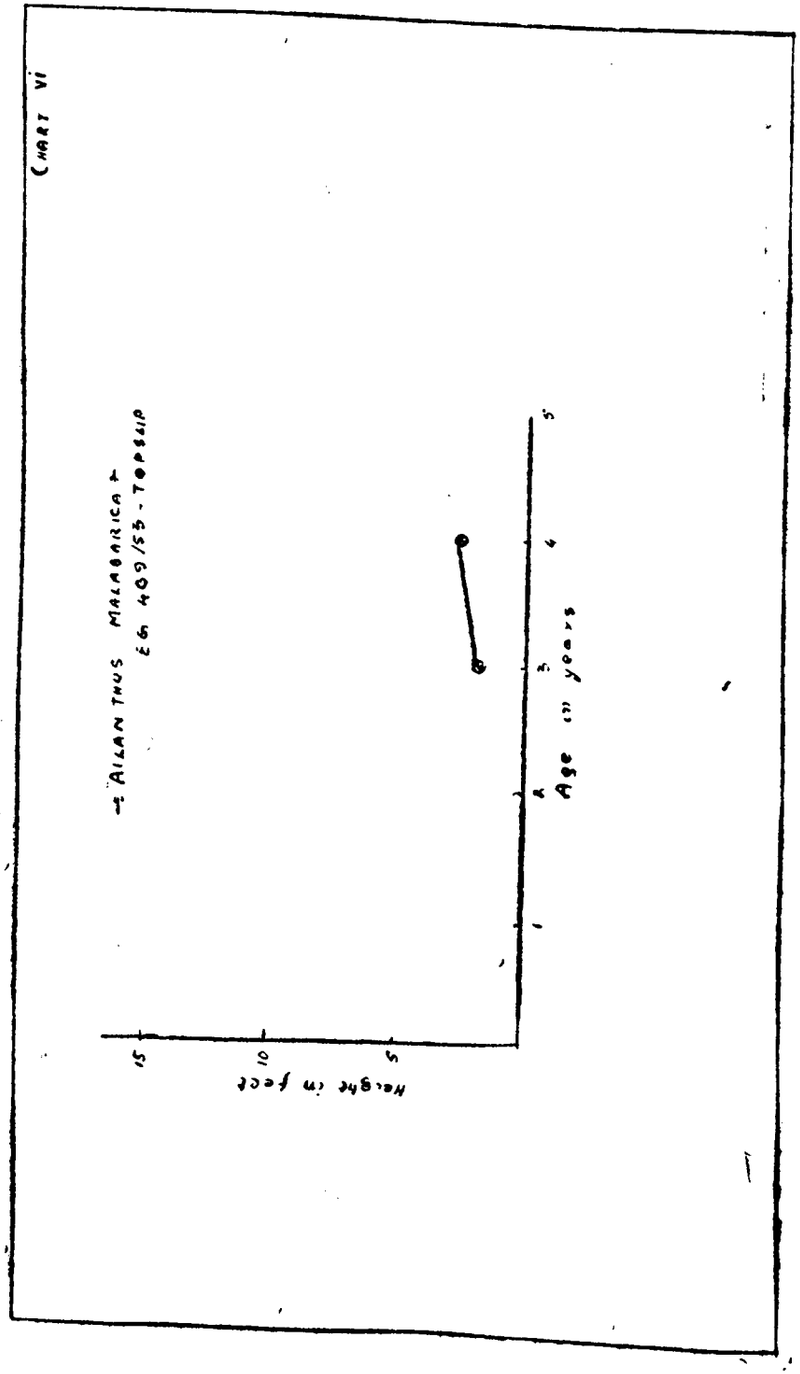


CHART VI
ALLANTHUS MALABARICA
EA 409/55 - TOPSLIP
Height in feet
Age in years

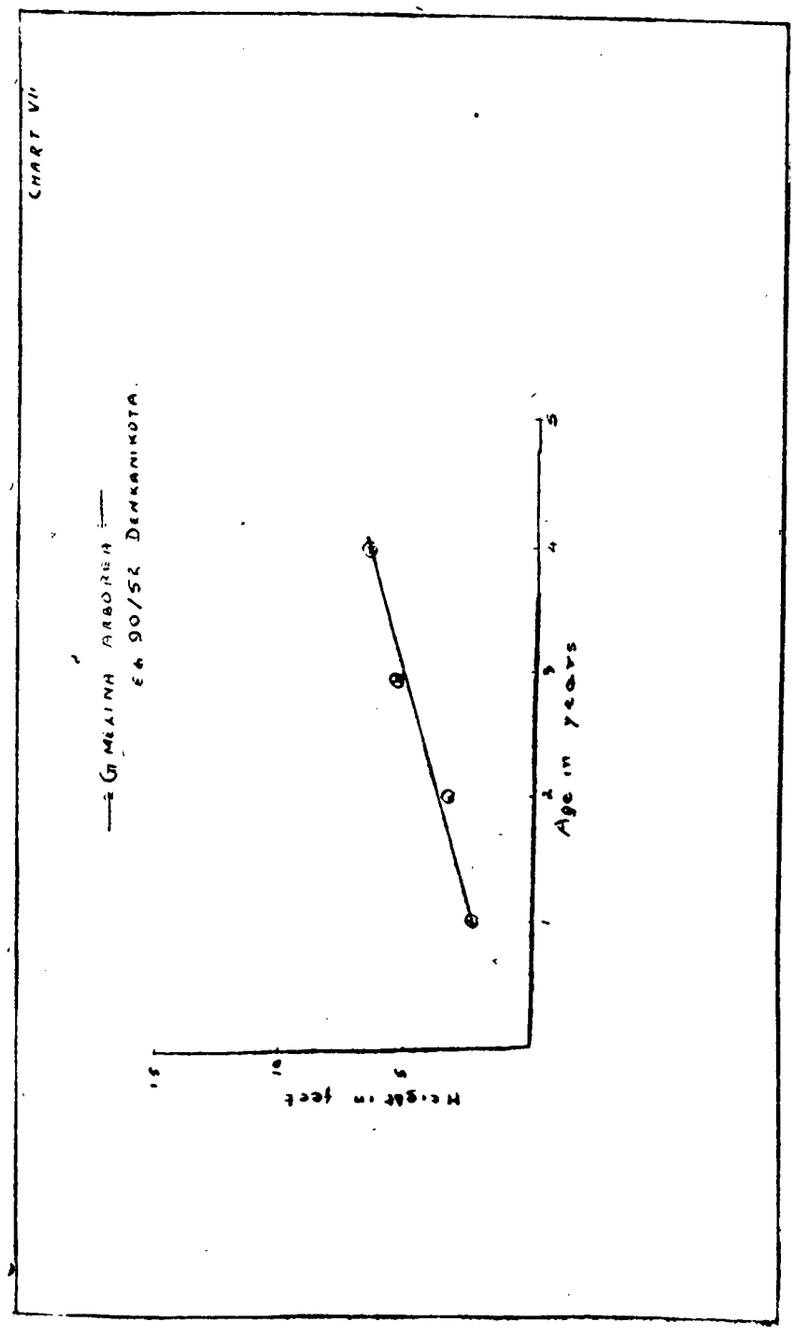


CHART VII
GMELINA ARBOREA
EA 90/58 DENKANIKOTA
Height in feet
Age in years

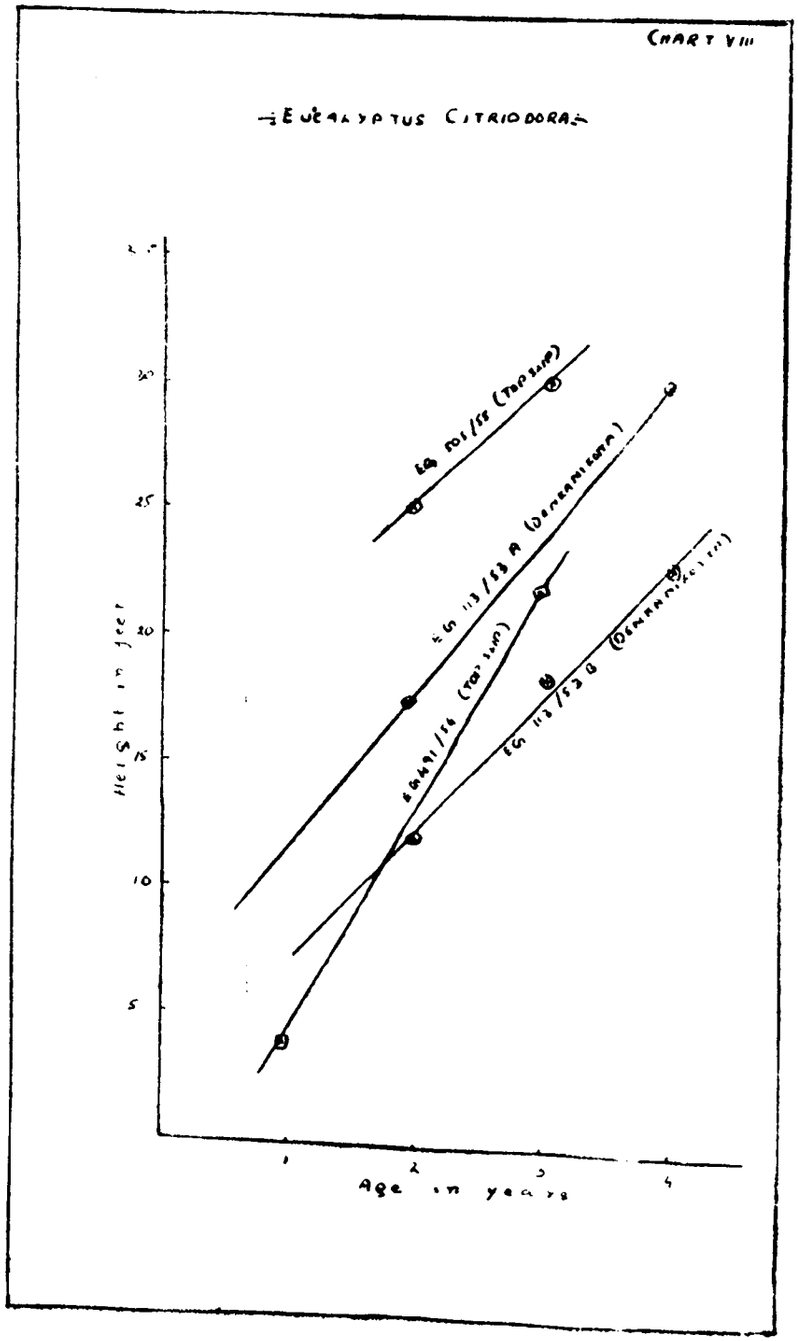
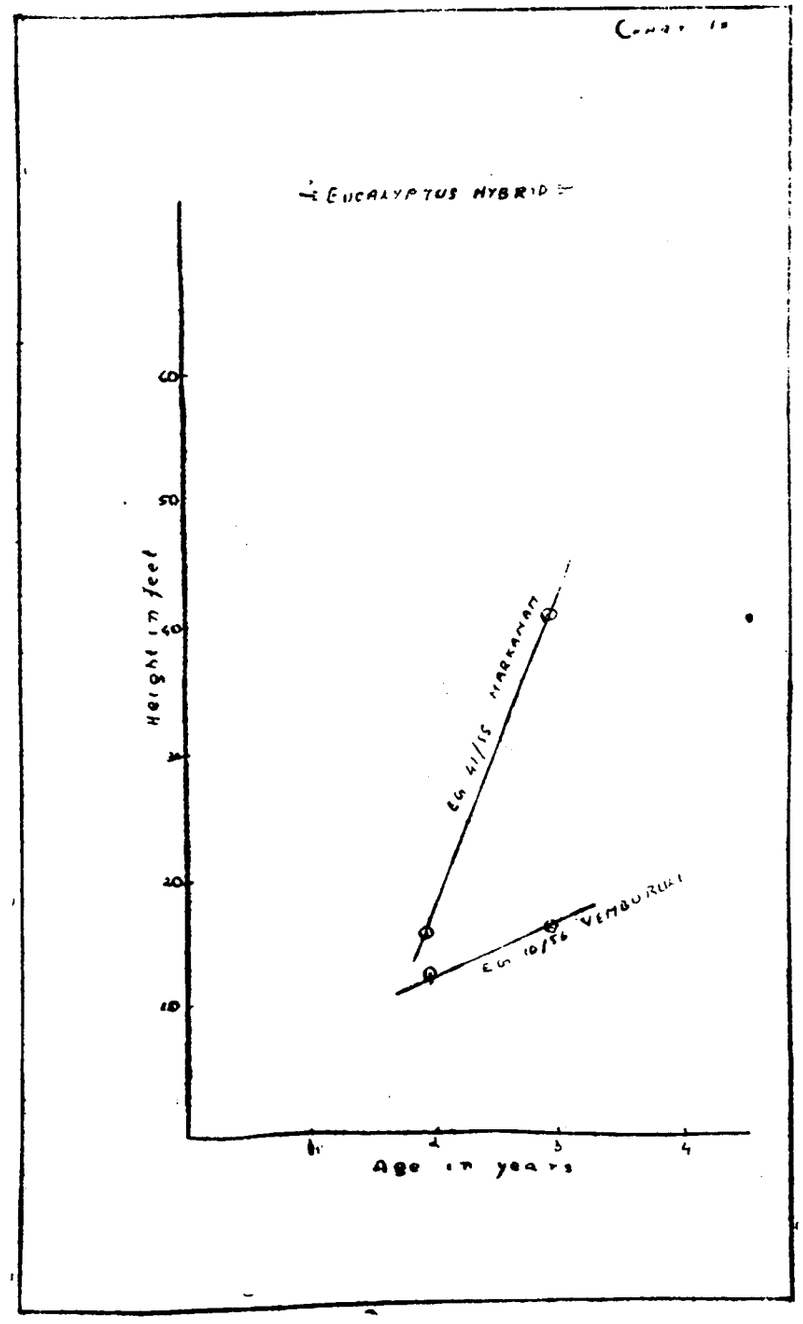


CHART VIII
EUCALYPTUS CITRIODORA
EG 101/55 (TOPSLIP)
EG 113/53 A (DEHRADUN)
EG 113/56 (TOPSLIP)
EG 113/53 B (DEHRADUN)
Height in feet
Age in years


EUCALYPTUS HYBRID
EG 41/55 MARAYOOR
EG 10/56 VEMBURAI
Height in feet
Age in years

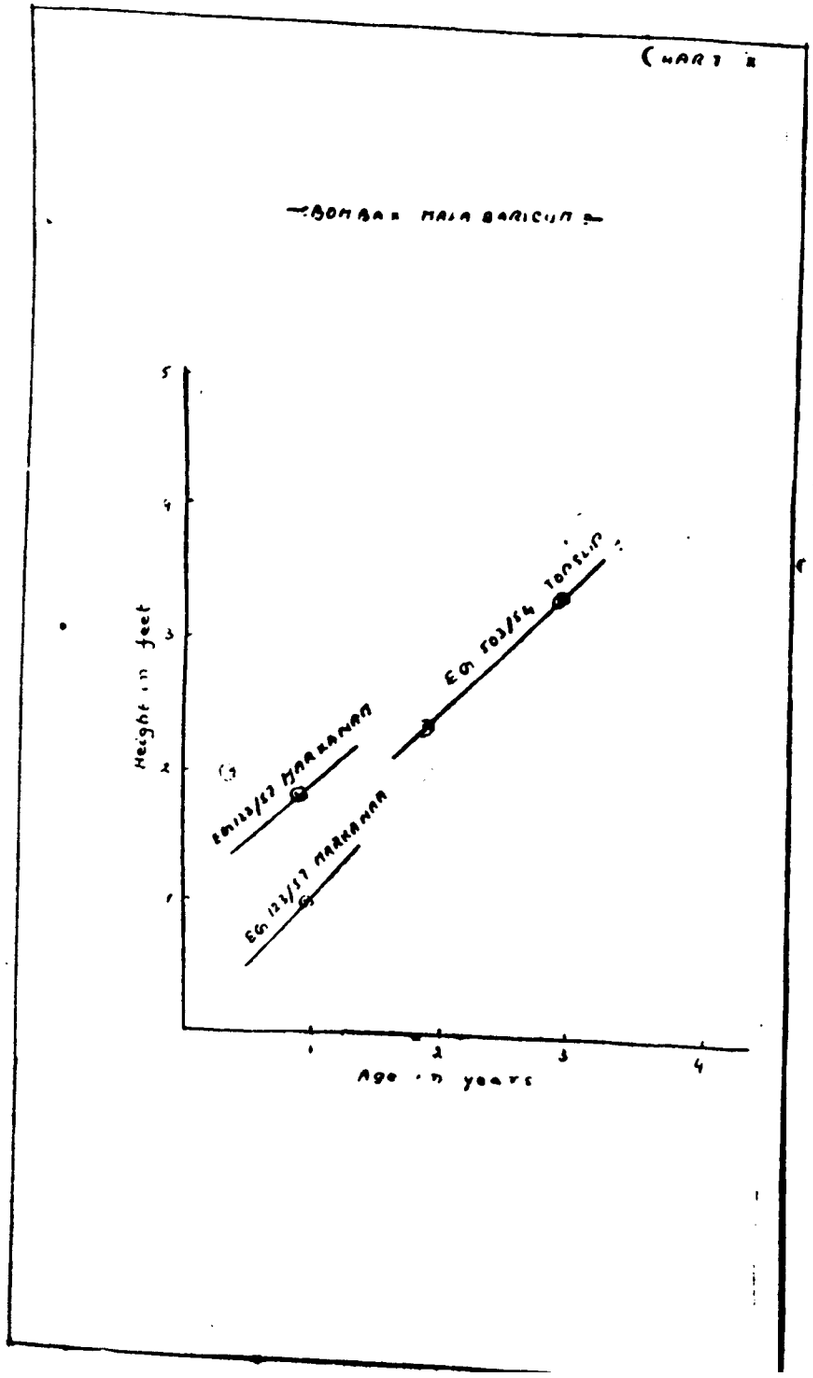


CHART X
BOMBAX MALABARICUM
Height in feet
Age in years
EG 123/53 MARKANDAM
EG 123/53 MARKANDAM
EG 54/56 TOPSLIP

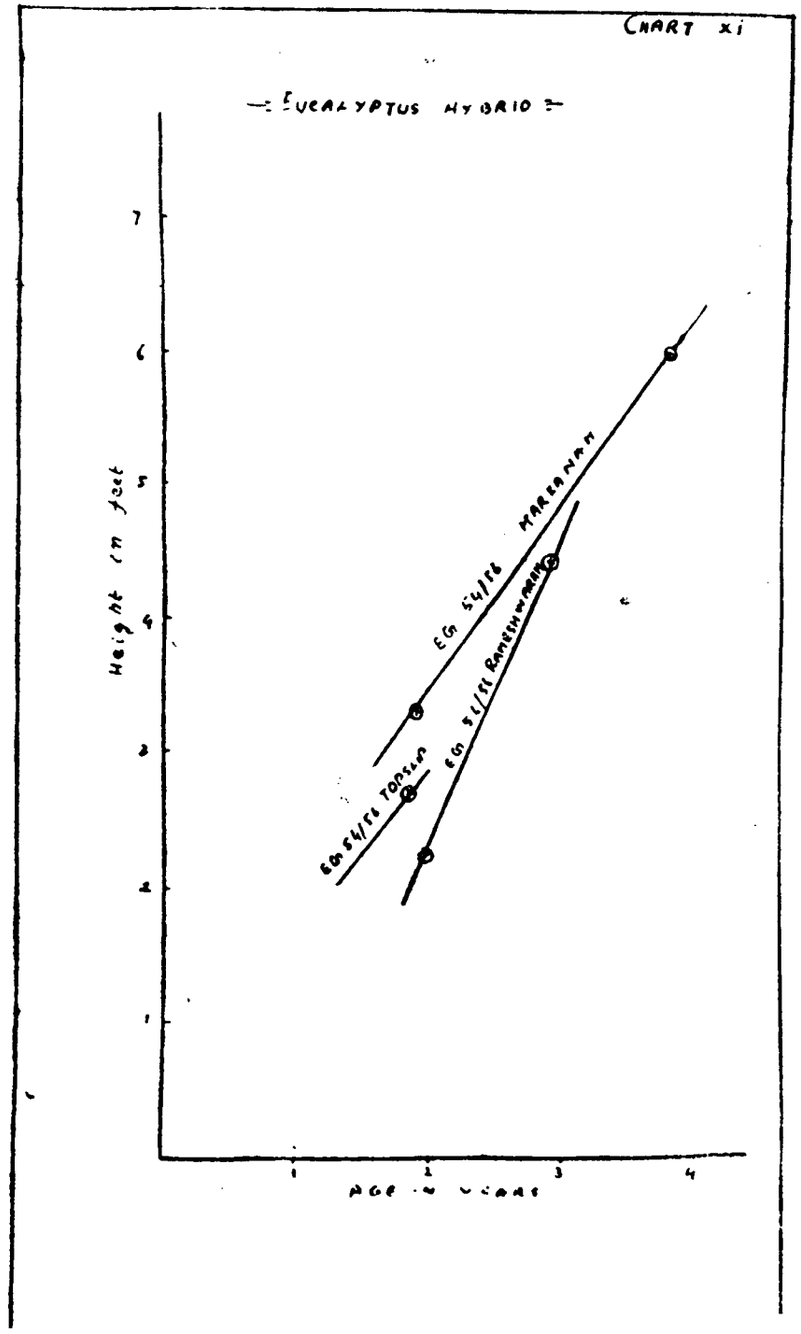


CHART XI
EUCALYPTUS HYBRID
Height in feet
Age in years
EG 54/56 MARKANDAM
EG 54/56 TOPSLIP
EG 54/56 RAMESWARAM

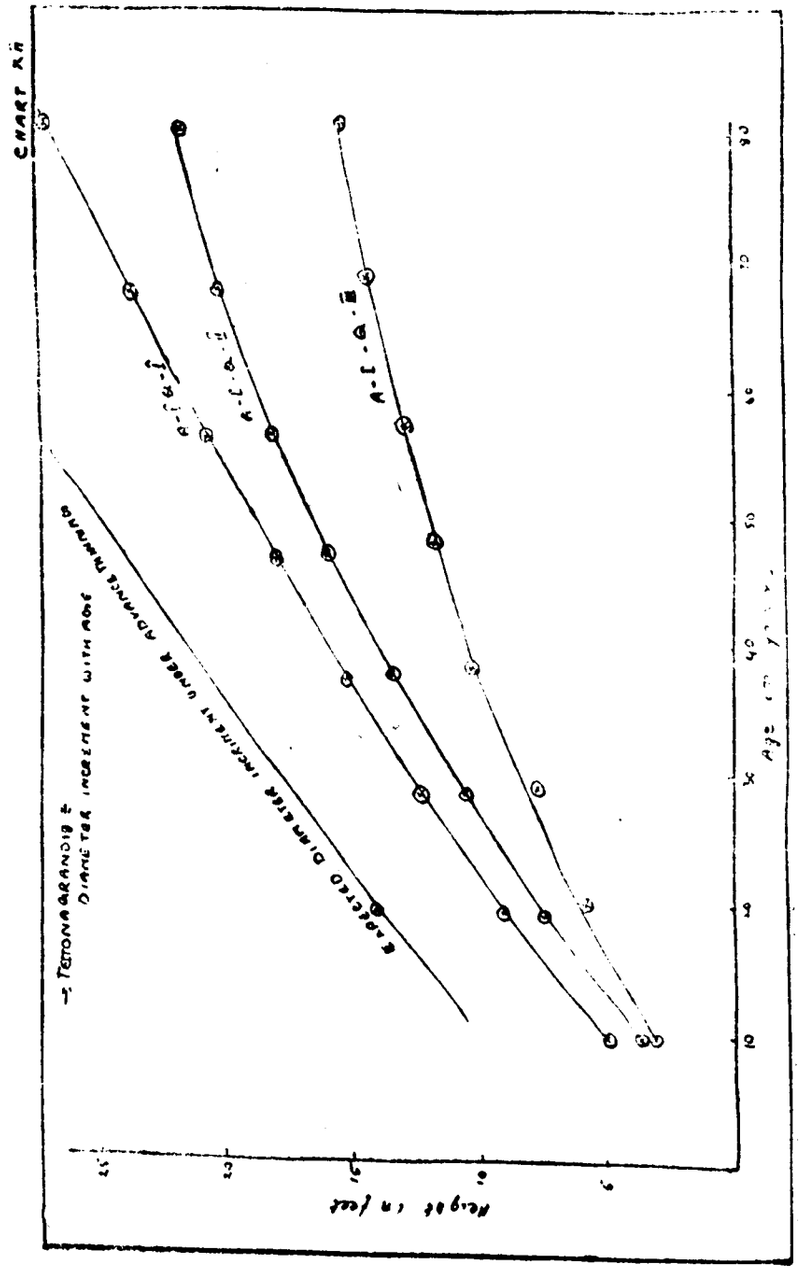


CHART XII
Height in feet
Age in years
A-I-Q-III
A-I-Q-II
A-I-Q-I
TETONARANDIS ± DIAMETER INCREMENT WITH AGE
EXPECTED DIAMETER INCREMENT UNDER ADVANCE TREATMENT

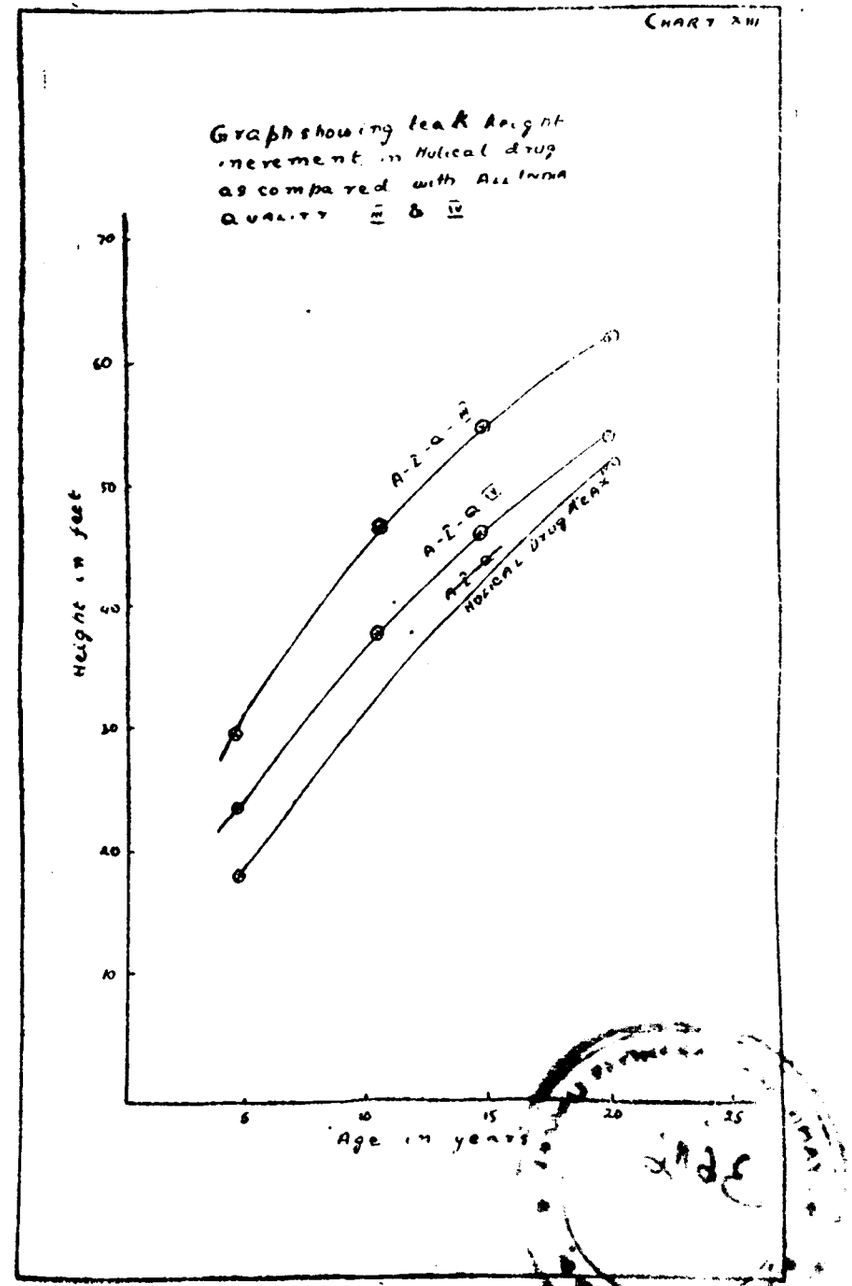
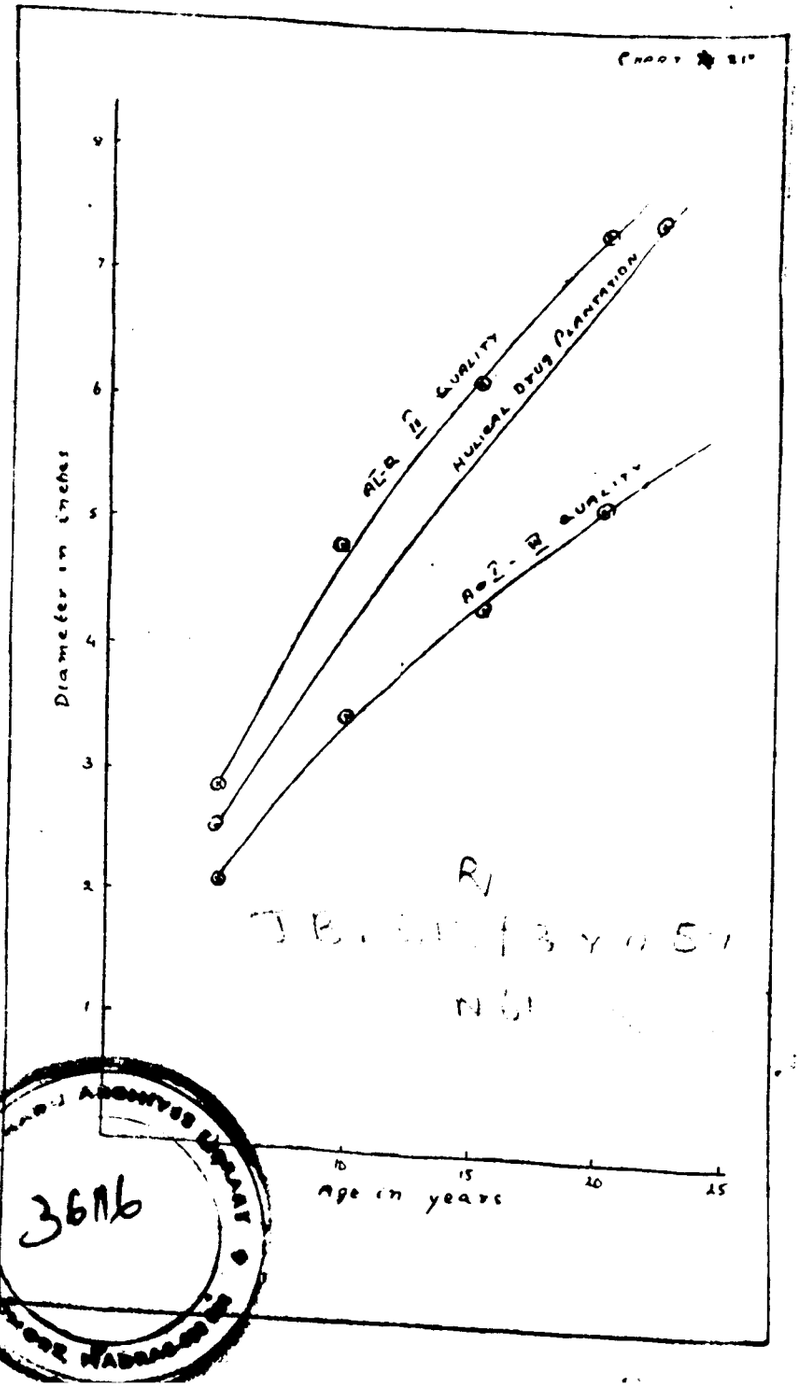


CHART XIII
Graph showing tree height increment in Helical drug as compared with All India Quality III & IV
Height in feet
Age in years
A-I-Q-III
A-I-Q-II
A-I-Q-I
HELICAL DRUG AREA


Diameter in inches
Age in years
10
15
20
25
A1-2 - II QUALITY
MEDICAL DRUG PLANTATION
A-2 - III QUALITY