

The CEYLON FORESTER

Vol. VII, Nos. 1 & 2 (New Series)

January-December, 1965



Published by the Forest Department, Ceylon

PRINTED AT THE GOVERNMENT PRESS, CEYLON, ON PAPER MANUFACTURED AT THE
EASTERN PAPER MILLS CORPORATION, VALAICHCHENAI, CEYLON

Price : Rs. 5

OUR CONTRIBUTORS

S. Muttiah—Junior Assistant Conservator of Forests. Divisional Forest Officer, Trincomalee.

K. Vivekanandan—Research Assistant (Biological Section), Forest Research Branch, Colombo.

S. N. U. Fernando—Junior Assistant Conservator of Forests. Principal, Ceylon Forest College, China Bay.

D. A. L. Warnakula—Junior Instructor, Ceylon Forest College, China Bay.

THE CEYLON FORESTER

The Ceylon Forester is published biannually by the Forest Department, Ceylon.

The Department does not hold itself responsible for opinions expressed in articles published. Criticism of Government policy or other Government departments will not be published without the prior approval of the Permanent Secretary, Ministry of Land, Irrigation and Power.

All correspondence regarding contributions, subscriptions, &c., should be addressed to—

The Hony. Editor,
The Ceylon Forester,
Forest Department,
9, Kew Road,
Colombo 2.

Contributors will be supplied with 12 extra copies of their contributions together with illustrations free of charge if 2 pages or more in length.

Important Notice

Due to the increased costs of production, the rates of sale of The Ceylon Forester have been increased as follows:—

Subscriptions—

			Rs. c.
Annual	..	..	5 00
Single copies	..	..	3 00

(Special concession rates applicable to Ceylon Forest Department staff will be notified through D. F. OO.).

CONTENTS

	PAGE
EDITORIAL	1
A COMPARISON OF THREE REPEATED INVENTORIES OF SUNDAPOLA MIXED SELECTION WORKING CIRCLE AND FUTURE MANAGEMENT <i>S. Muttiah</i>	3
AN EXPERIMENT TO DETERMINE THE CAPACITY OF NINE WOOD-BOTTING FUNGI, INCLUDING <i>Polystictus Sanguineus</i> AND <i>Lentinus Giganteus</i> , TO CAUSE DECAY OF <i>Grevillea Robusta</i> WOOD <i>K. Vivekanandan</i>	36
A REPORT ON THE SEMINAR AND STUDY TOUR ON THE PROTECTION AGAINST FOREST DISEASES AND INSECTS HELD IN THE U. S. S. R. <i>K. Vivekanandan</i>	39
INSECTS COMMONLY FOUND IN THE TEAK NURSERIES OF CEYLON <i>S. N. U. Fernando</i>	54
TEAK IN CEYLON NURSERIES <i>S. N. U. Fernando</i>	57
සිංහල තේක්ක සහ එහි පැවැත්ම <i>ඩී. ඩී. ඇල්. වර්ණකුල</i>	60

The Ceylon Forester

Jan.-Dec., 1965

Vol. VII, Nos. 1 & 2 (New Series)

Hony. Editor .. A. E. K. TISSEVERASINGHE

Editorial Office .. FOREST DEPARTMENT

9, Kew Road
COLOMBO 2

"The forest is a peculiar organism of unlimited kindness and benevolence that makes no demand for its sustenance and extends generously the products of its life activity: it affords protection to all beings, offering shade even to the axeman who destroys it"—Gautama Buddha.

EDITORIAL

Once again we have to apologise to our readers for publishing a double issue of this journal. On this occasion our fault has been aggravated by the fact that the journal is also late in making its appearance. Our only excuse is the fact that our technical staff are preoccupied with development work which is directly related to production and hence do not have the leisure which is necessary for doing experimental work and reporting results. Although the work of the Forest Department has increased considerably in the last few years, the number of officers engaged in research has actually dwindled and this accounts for the difficulty we have in publishing a journal twice a year. We do hope our readers will bear with us during this period which we hope is temporary.

Plantation Forestry.—An article in this issue on the increment of Mahogany (*Swietenia macrophylla*, King) demonstrates the value of plantations. The growing stock in an extent of 178 acres is valued at Rs. 1,110,984 i.e., Rs. 6,242.00 per acre. This produces annually an increment of 17,211.85 cubic feet of timber valued at Rs. 60,525.00.

This was also shown under different and more heart-breaking circumstances. In December, 1964 a destructive cyclone swept a belt of country stretching from Trincomalee to Mannar. The Teak plantations of the Vavuniya District which were in the path of this Cyclone were extensively damaged—indeed, virtually destroyed. One group of plantations was about 40 years old and the other group consisted of young plantations less than 15 years old. The latter could be rehabilitated by coppicing but in respect of the former all that could be done was to salvage the usable timber and make plans for regeneration of the plantation. In Tonigala Teak plantation which is about 140 acres in extent it was possible to salvage about 100,000 cubic feet of timber valued at more than 1 million rupees. The value of this plantation if it could have grown to maturity, undamaged, would have been at least twice this figure.

In the last year 13,000 acres of new plantations have been raised. This compares with a total of 1,562 acres planted in 1955. We expect these plantations to provide the bulk of our timber requirements for the future.

U. N. Special Fund Project

In our last issue we welcomed Messrs. K. K. Lund and J. Huuhtanen to our midst. Now the full complement of staff has arrived in the country and we heartily welcome Messrs. V. Scherbachenko, C. G. W. Mason and Harold Sutter who joined us during the course of the year. Work on the mechanisation of logging and extraction is proceeding apace and various types of equipment are being tried in our different Forest Types.

Congratulations

We heartily congratulate Mr. R. A. de Rosayro (Ralph) who retired from the Ceylon Forest Department as Senior Assistant Conservator of Forests and who was a regular contributor to this journal who has now been appointed Regional Forestry Officer of F. A. O. in Africa with headquarters in Accra. We wish him well in his assignment which we have no doubt he will carry out with acceptance.

A Comparison of Three Repeated Inventories of Sundapola Mixed Selection Working Circle and Future Management

By S. MUTTIAH

SUMMARY

THE Chief advantages of adopting the Selection System in the Sundapola mixed selection working circle are enumerated. The Circle consists of one felling series and five cutting sections. Since the beginning of planned management in 1955, three continuous inventories have been completed—

I—A comparison of these inventories show the following :—

1. Broad leaved Mahogany, the dominant species, has increased in composition at the expense of all other species in cutting sections 1, 2, 3 and 5 while there has been a slight reduction in cutting section 4 as a result of two fellings. Seedling regeneration is very sparse due to probable factors discussed but 'stick' regeneration or saplings are adequately represented in the entire working circle.

2. The stem number curves of cutting sections 1-4 have shown a change from even-aged or 'Skewed' type to selection type distribution. Cutting section 2 is closest to selection curve. Cutting section 5 is still even-aged due to poor recruitment from the under wood. Hence the stocking of stems per acre has remained more or less static in this section while it has doubled or even trebled in all other sections.

3. The volumes per acre (of Mahogany) have changed from very low to low and are over 1,000 H. ft. as at 1964-65 in each cutting section. The increase of volume has been accompanied by an increase in the volume of the category of large trees which forms a main feature of selection forestry. This increase has been greatest in cutting section 3 and least in cutting section 4, largely due to removals of old, defective trees.

4. The mean stem or tree of mean girth has shown a fall in B. H. G. in cutting sections 1-4 due to heavier representation, in terms of numbers, of the smaller size classes. It has registered an increase in B. H. G. in cutting section 4 which is still even-aged.

5. The increments calculated by the 'Check Method' have shown that the absolute values have not changed in cutting sections 1 and 2 which had not been worked during the last working plan period, while there had been an increase in sections 3 and 4 which had been subject to fellings. The mean increment per cents in cutting sections 1-4 are fairly high indicating that the stands, as a whole, are growing vigorously. All the categories of trees are putting on satisfactory increment rates except the large trees in Section 4 for probable reasons discussed. The increment of cutting section 5 have not been calculated due to lack of data on the fellings.

6. There has been an appreciable change in the capital value of the Mahogany woods resulting in a simple interest accumulation of 7.2 per cent. per annum, exclusive of fellings. The present value on a conservative estimate amounts to over one million rupees.

II.—The future management during the next 10 years is discussed. The desired growing stock is tentatively fixed at 3,500 H. ft. per acre (all species), out of which Mahogany would probably amount to 3,000 H. ft. per acre. It is premature to fix the volume distribution among the different categories of trees viz: small, medium and large, but over 40 per cent. should be in the last category. Since the prime need is to obtain the desired growing stock in the shortest possible time, it is hoped to capitalise 75 per cent. of the increments, the total increment of cutting section 5 being arbitrarily fixed at a very conservative 5 per cent., and to fell only 25 per cent. This will in practise result in heavier exploitation percents than in the past but it will not exceed 18 per cent. as in the case of cutting section 3. A felling plan has been drawn up. Fellings will take place only in the first 5 years followed by a time of passage of 5 years. The distribution of the prescribed yield among the different size classes is discussed under the felling rules.

INTRODUCTION

The Sundapola mixed Selection Working Circle consisting mainly of broad-leaved (or Honduras) Mahogany (*Swietenia macrophylla*) comprises one felling series and five cutting sections of almost equal extent, totalling 178.0 acres. Four cutting sections in one compact block are located at Sundapola while the fifth is at Kumbalpola, about 4 miles away from Kurunegala and Sundapola. The idea of managing these forests under the 'Selection System' rather than under the drab uniformity of an 'Even-aged System' was conceived by Tisseverasinghe in 1955 from an examination of the enumeration data during the preparation of a Working Plan for the Jak Mahogany Plantations. The adoption of this Silvicultural system was not on account of hilly terrain or exposure to strong winds, neither of which would apply to these forests, but instead to obtain the many advantages derived from selection forestry. These may be summarised as follows:—

1. The site factors are exploited to the maximum by trees of all ages occupying different strata of the air and soil.
2. There is no need to maintain as high a proportion of young stems to old as in a Uniform system. Conversely, a large proportion (by volume) is concentrated on the bigger trees. This has a special significance with Mahogany for which the demand is mainly for saw timber and not for small sizes.
3. Trees can be retained as long as they are putting on valuable increment so that there is a corresponding increase in value for such large size trees with good bole formation.
4. The trees are somewhat slow, even-grown and knot-free throughout considerable bole lengths, resulting in timber of high quality.
5. All seed years can be used and seedlings well sheltered, thereby reducing the costs of formation to a negligible amount.

6. System is highly flexible and silviculture is little trammelled by management.

7. It is claimed by the protagonists of the system that the growing stock and out turn are higher than under more uniform systems. This is a matter for conjecture since nowhere have both systems been compared on the same site.

8. It is biologically a better system as it approximates more closely to a Natural Forest with a mixture of species (though this need not be the case always) and age classes. Consequently, it is less subject to the degradations of insects and fungi than uniform forests.

9. Aesthetically, it is very attractive and engages the continuous professional skill of foresters.

To gain these manifold advantages as well as, according to Tisseverasinghe (1957), to preserve the pioneer efforts of scientific forestry in this country, this system had been decided upon in spite of all the difficulties such as expense, lack of properly trained staff and the case with which it can degenerate into uncontrolled exploitation. The history and past management of Sundapola Plantation together with an analysis of the data from the first 100 per cent. enumeration carried out in 1955 have been dealt with in an earlier article. Since then, two more inventories have been completed, the second in 1960 by the Forest School under the direction of the Principal, and the third in 1964-65, almost single-handed by Beat Forest Officer (Working Plans), Mr. G. S. Jayasinghe, under the supervision of the writer. Cutting Section 5 had been, unfortunately, overlooked in the 1960 enumeration. These enumerations have been carried out as carefully as possible, but in a tedious procedure of this nature experimental errors cannot be ruled out. It is contended that errors, if any, are negligible so as not to detract from the importance of the main study.

It is now apposite to analyse these inventories, determine the increments by the application of the 'Check Method' and decide on the future management of these forests. A knowledge of the increments would be invaluable in fixing the prescribed cut during the next working plan period, i.e., 1966 to 1975-76. The present juncture is also opportune for assessing how far each management unit has progressed towards a selection forest.

PART I—COMPARISON OF THE INVENTORIES

The enumeration data of 1960 appear at Table 1 and that of 1964-65 at Table 2. An analysis of the past data are taken up under the following heads :—

(a) *Species Composition*—

An examination of the three sets of data shows that Mahogany clearly holds a dominant position at the expense of all other species, by virtue of

its remarkable capacity to regenerate. In cutting section 4, however, it had held this position from the very beginning of planned management. The increase in percentage composition over the period 1955 to 1964-65 is reflected in the Table given below :—

Cutting Section	Mahogany (Nos. per acre)		
	1955	1960	1964-65
1	59.0	64.6	71.0
2	59.1	69.7	69.8
3	72.0	78.8	84.2
4	84.0	87.8	81.0
5	55.4	—	59.5

It will be seen that over the nine-year period, this species has increased in composition by about 10 per cent. in cutting sections 1, 2 and 3, but by only 4 per cent. in cutting section 5; while there has been an actual reduction of 7 per cent. in cutting section 4, largely as a result of recruitment of the 'other species' (Milla, Badulla, Nedun, etc.) into the measurable girth classes. An inspection of the forests shows that there is adequate 'stick' regeneration of Mahogany more or less throughout, while that of the remaining species is comparatively scanty. However, there are two exceptions to this common observation, that of Mahogany on the ridge tops in cutting section 4 where it is poorly represented and in the north-eastern portion of cutting section 1 where it is outstripped by carpet regeneration of Balsam of Peru. It is possible that the poor regeneration of Mahogany on the ridge tops is due to the wash away of the seeds by the rains which follow seed fall.

The percentage of Jak and Teak, which range in importance next to Mahogany, have progressively dropped all round during this interval. The indications are that there would be a greater preponderance of the shade bearing Mahogany over the light demanders in course of time, particularly as the latter are gradually removed either as silvicultural or final fellings. This would, no doubt, be a pity as one of the interesting aspects of selection forestry namely, the growth of a judicious mixture of species would be lost. Theoretically, this could be compensated by artificial group regeneration of these species, but in practise this would result in management problems so that recourse to planting is considered neither feasible nor necessary. Even a semi-shade bearer like Halmilla has not been successfully established in gaps under artificial conditions. However, every effort should be made to foster these valuable species whenever they occur naturally.

One aspect of Mahogany regeneration needs mention. A study of the forest floor shows a marked absence of seedling regeneration except along the roads and ridges. This might be due to the inability of the light-winged seeds to reach the soil surface within the plantation especially as there is a thick leaf litter layer, and possibly due to lack of light under a dense canopy. These two factors could be overcome after the process of fellings when more light would reach the forest floor and scarification

of the soil results from felling and extraction. It is also observed that Mahogany fruits and seeds have been damaged by rock squirrels which are prevalent in these areas but failure of seedling regeneration due to this cause can be discounted in view of profuse seedfall occurring with regularity. It would be a good idea to examine the effect of all these causes on seedling regeneration by laying out trial plots.

(b) *The Growing Stock—*

As pointed out, the only species out of those present, that lends itself to selection working is Mahogany. All other species are of secondary importance and would be retained as long as possible for the sake of maintaining a mixture of species. Hence the measurement of the growing stock has been restricted to Mahogany only. The distribution of stem numbers and volume per acre by girth classes in the different cutting sections in 1960 and 1964-65 are given in Tables 1-4.

(i) *Stem Number Curves—*

The comparative curves at each enumeration for the different cutting sections are depicted in Figures 1-5.

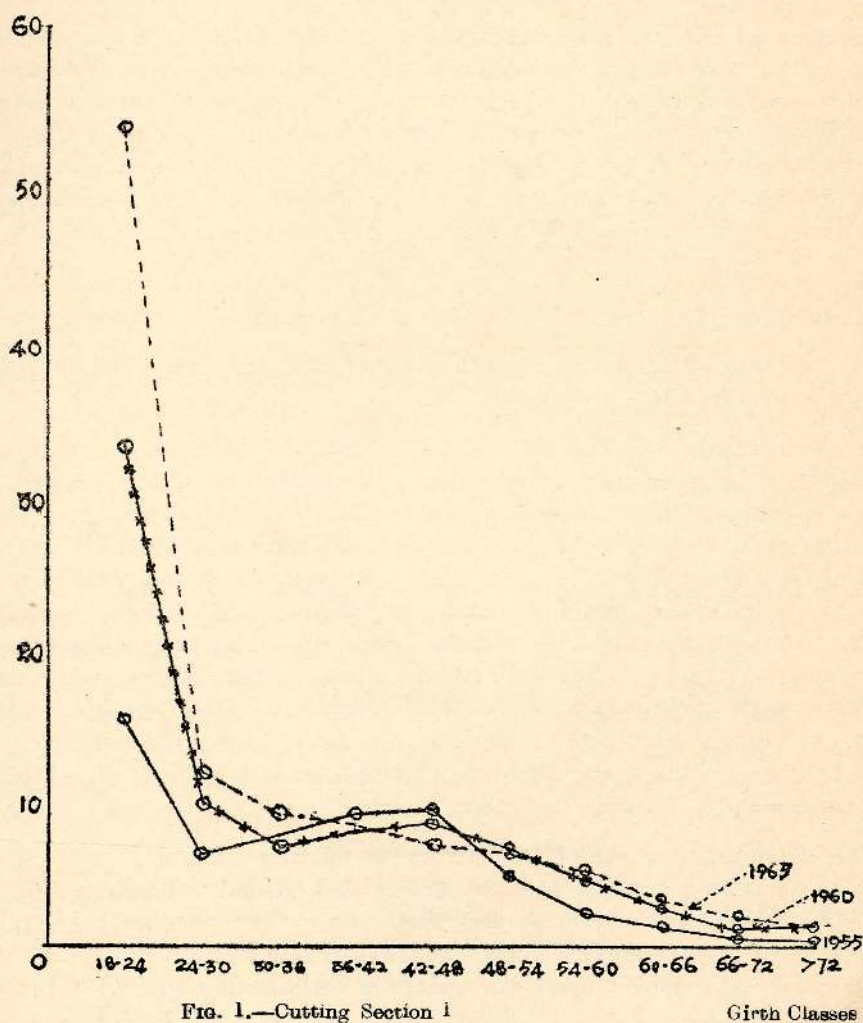
An examination of the curves in cutting section 1 shows that there has been a progressive change from a more or less even-aged curve to the exponential type curve characteristic of selection distribution. Another feature is that this change has been accompanied by an increase in the total stocking of the measurable stems from 54.8 per acre in 1955 to 80.6 in 1960 and finally to 105.3 towards the end of 1964 or roughly double the earlier stocking. As the graph indicates this steep rise has been mainly due to an increase in the number of small trees as a result of large-scale recruitment from the underwood. The changing nature of these curves during both periods has been solely the result of the interaction of climate and site factors alone on tree growth since records indicate that no fellings had been done.

The changing pattern of the curves in cutting section 2 is similar to cutting section 1 except that the graph had already shown a selection type distribution at the start and this feature had become more accentuated with the passage of time. In 1955, this cutting section out of all others, corresponded closest to selection distribution and it still does. The total number of stems per acre had increased from 56.6 in 1955 to 87.7 in 1960 and to 115.9 in 1964, again due to adequate 'external' recruitment. As in the case of cutting section 1, here too no fellings had been done as a result of the slowing down of the entire thinning programme of the Jak and Mahogany plantations towards the latter half of the working plan period. This was partly due to a lack of staff, but more essentially due to administrative difficulties regarding the method of disposal of thinnings.

The curves for cutting section 3 are comparable as regards the general shape with the corresponding ones for cutting section 1 but differ in exhibiting a very high recruitment rate from the under storey and a rather high density of stocking. The number of stems per acre had risen from 70.6 in 1955 to 115.2 in 1960 and finally to the high figure of 174.3 in 1964, but of which 92.7 stems are in the smallest girth class.

STEM—NUMBER CURVES

No./Acre



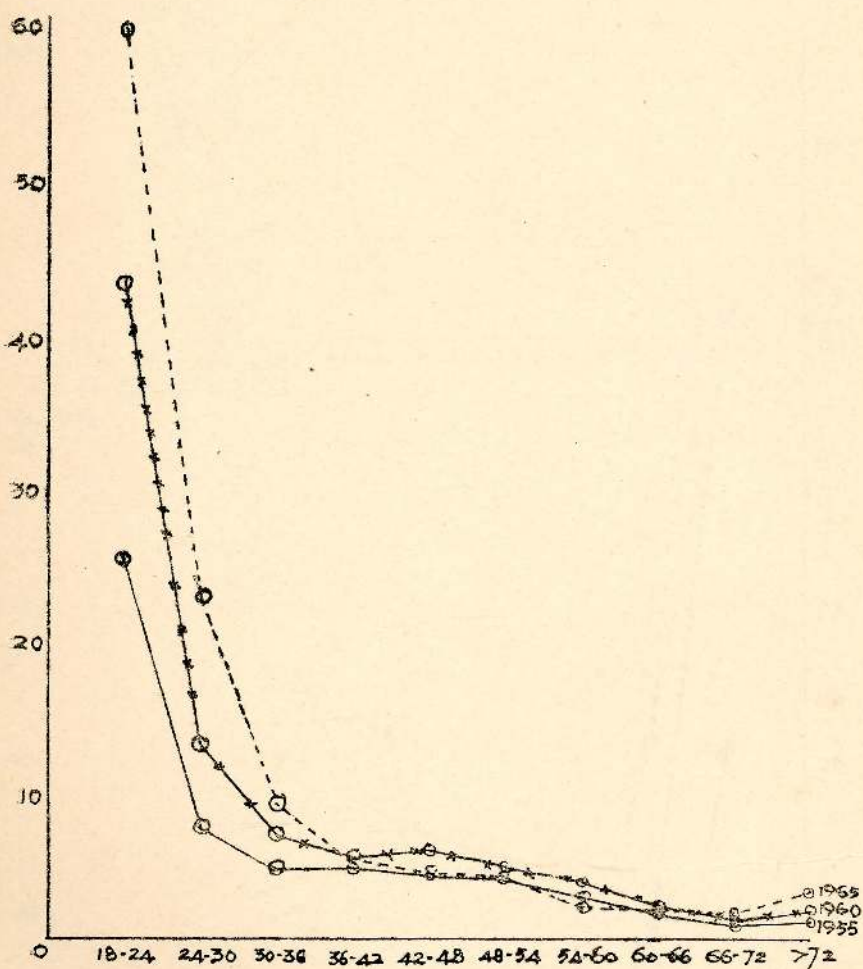


FIG. 2—Cutting Section 2

GIRTH CLASSES

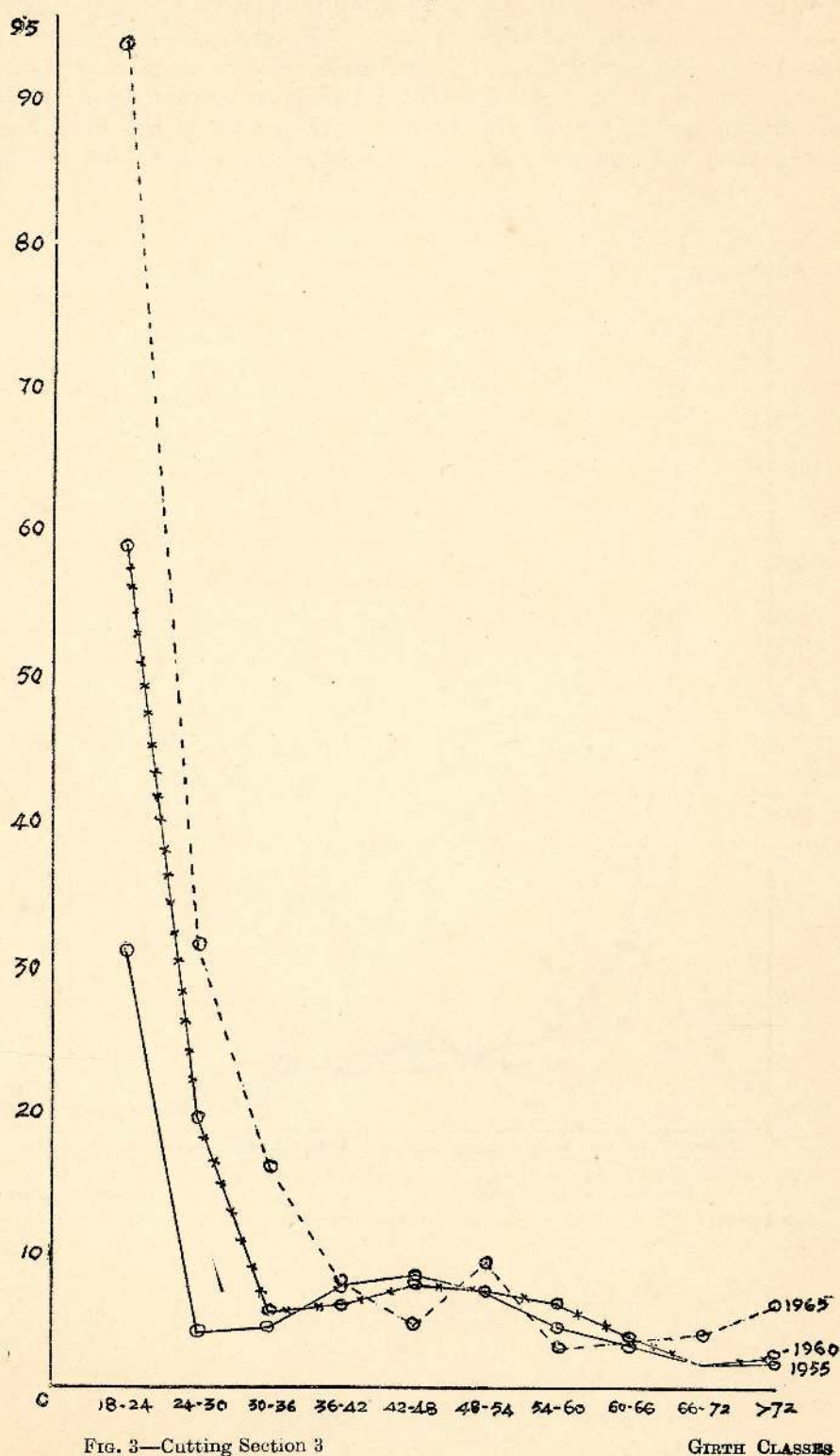


FIG. 3—Cutting Section 3

GIRTH CLASSES

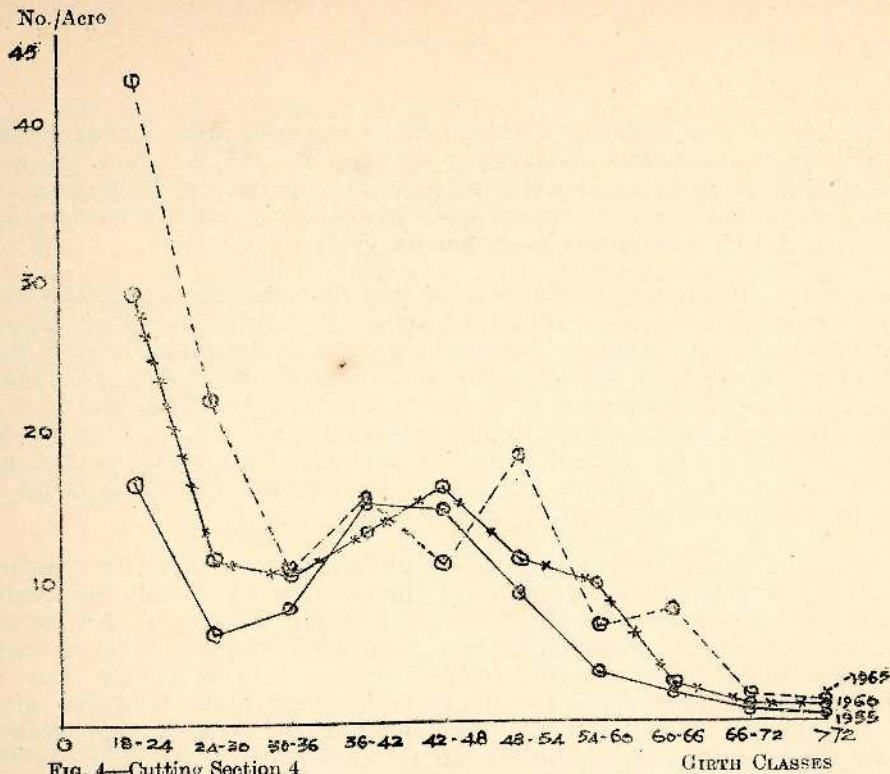


FIG. 4—Cutting Section 4

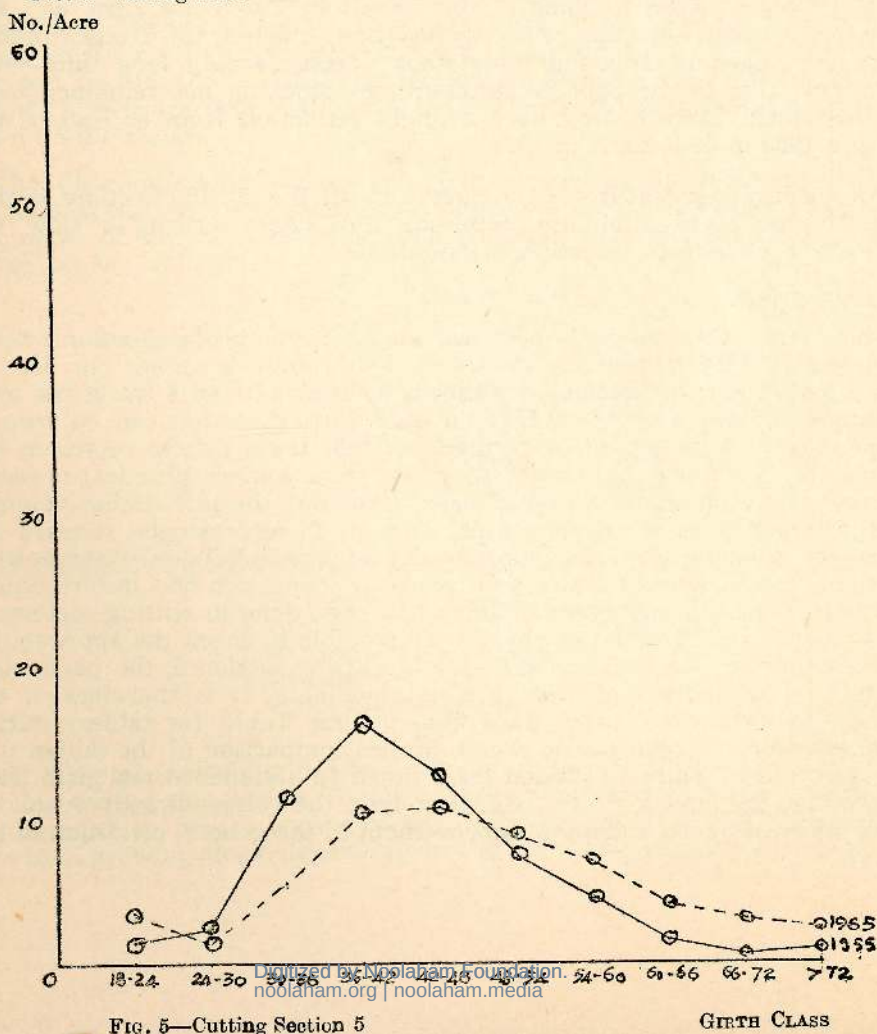


FIG. 5—Cutting Section 5

Unlike in the other cutting sections there has been also a considerable increase in the proportion of large trees, over 66" B.H.G. Both the high incidence of recruitment and the increase in proportion of large trees can be attributed to the growing space made available by fellings done in 1956. Details of fellings are given in Appendix IV.

The curves for cutting section 4 show that there has been a change from nearly even-aged to one approaching selection distribution, even though in a discontinuous manner. This might be due to the forest having been subject to two fellings, once in 1958 and again in 1961. A more smooth curve could be expected after a few years when the stand has had time to reach greater stability under the new growing conditions. The curve for 1964 shows that recruitment from the underwood is adequate but not excessive while the stocking per acre has increased from 71.5 stems in 1955 to 100.2 in 1960 and last to 131.8 in 1964.

The curves for cutting section 5 are unique in that they are typically even-aged, characteristic of binomial distribution. The only noticeable changes are a reduction in the "hump" and the shifting of the median position of the curve somewhat to the right in 1965. The rate of recruitment from the understorey remains insignificant so that a change over to selection distribution would inevitably take a long time. However, after the fellings carried out in 1958 there is abundant "stick" regeneration of Mahogany and there should be an improvement of the curve in the next 10 years. Even in some of the forests in the Swiss Jura, e.g., Les Verrieres, where selection working had been started, the transformation from even-aged to selection forest took a considerably long time—over 30 years. Due to the poor recruitment, the stocking has remained more or less static, there having been a slight reduction from 56.3 stems per acre in 1955 to 54.1 stems in 1965.

An encouraging feature of the curves in all the cutting sections is that the "humps" are gradually flattening out, characterising a slow but perceptive change to selection distribution.

(ii) Volumes—

The timber volumes have been calculated from the local volume table prepared in 1956 for cutting section 3. The volume stocking per acre in the different cutting sections are shown in Tables 3 and 4 while the total volumes of trees over 18" B.H.G. in each cutting section can be seen in Appendices 1-4. It should be pointed out that these figures represent the "utilisable" volumes only since they represent a more practical measure of trees from the point of view of easily assessing the saw timber volumes of the larger trees at any one time. Though Tisseverasinghe stressed the necessity to determine the applicability of the L.V.T. to other cutting sections as and when fellings took place in them, this had unfortunately not been done. In any event, fellings had been done in cutting sections 3, 4 and 5 only and it would not have been possible to check the applicability to the other two sections. In the case of cutting section 5, the particulars of fellings of individual trees are not available. It is therefore of the utmost importance to draw up a final volume Table (or tables) during the next working plan period. For a proper comparison of the tables, it is necessary to measure the felled trees down to a standard top girth. It is likely that the figures would be higher than the values already evaluated since there has been a definite improvement in the general condition of the stands.

For the present purpose of determining the growing stock and increments, the general applicability of the L.V.T. to the entire working circle was roughly verified by measuring the top heights of each cutting section, since it can be assured that this factor is the best and easily measurable index of the productivity of the different sites. This was done in the following way. Minor topographical differences in each cutting section were noted and subjective 1/10th acre sample plots were laid to cover any such differences. The general topography can be described as gently undulating except in cutting section 4 where it is somewhat hilly. There was a total of 3 plots in each cutting section: one on top of a ridge, the second on the mid-slope and the third on the lower slope or in a valley. The total heights of the 10 largest girthed trees in each plot were measured using a 'Haga' altimeter and the average top height of a total of 30 trees was computed for each cutting section. The results as at July, 1965, are as follows:—

<i>Cutting Section</i>	<i>Top Height</i>
1	.. 77.3
2	.. 73.7
3	.. 88.9
4	.. 83.8
5	.. 83.1

In view of the plantations being more or less of the same age (about 60 years) and due to the narrow marginal difference between the maximum and minimum top heights, it is permissible to use the L.V.T. already constructed to the entire forest. It appears that cutting section 3 is slightly more productive than the others. There is uniformity in the nature of the top soil in the different cutting sections, it being a sandy loam with a slight gravelly fraction in the mid, lower slopes and valleys but a gravelly loam on the ridges.

The distribution of volume by girth classes in the different cutting sections at the two subsequent enumerations is shown in Tables 3 and 4. A summary of the changes in volume per acre over the 9-year period is given below:—

<i>Cutting Section</i>	<i>Volume per Acre H. ft.</i>			<i>% Volume Increase</i>
	1955	1960	1964-65	
1	.. 676.6	.. 931.4	.. 1,060.8	.. 54.5
2	.. 665.0	.. 882.7	.. 1,081.4	.. 62.6
3	.. 971.0	.. 1,135.5	.. 1,618.1	.. 66.6
4	.. 977.2	.. 1,329.3	.. 1,738.3	.. 77.8
5	.. 942.5	.. —	.. 1,226.8	.. 31.0

If the following classification of volume per acre is accepted, viz.:—

- < 1,000 H. ft.—Very low
- 1,000–2,000 H. ft.—Low
- 2,000–3,000 H. ft.—Moderately high
- 3,000–4,000 H. ft.—High
- > 4,000 H. ft.—Very high,

then the timber stocking can be described as having shifted from very low to low during this period. It has to be remembered that the volumes of 'other species' which consist of anything varying from 15.45 per cent. of the total growing stock, depending on the cutting section, have been totally

ignored. It is evident from the above Table that there has been a significant increase in the growing stock over what prevailed in 1955. At that time the stocking had been very low mainly as a result of over-exploitation during the war years. The increase in volume is most pronounced in cutting sections 3 and 4 where silvicultural fellings had been carried out. The reasons for the lower percentage volume increase in cutting section 5 can be attributed to restricted recruitment and to a certain extent on the clear felling and removal of trees in a $2\frac{1}{2}$ acre section in 1958 and in a $\frac{1}{2}$ acre section in 1963 for the construction of the two Kumbalpola Teak Nurseries

In selection working, it is not only necessary to have a knowledge of the absolute stocking but also the distribution among the different girth classes. For convenience, these girth classes have been grouped into large, medium and small trees, as required by convention. The relative volumes and percentages of these categories of trees are shown in Appendix IX. Since one of the main advantages of the selection system is the sustained production of a substantial proportion of large-size timber per unit area, it is necessary to examine these figures critically as this aspect will have an important bearing on future planning and management. An examination of the figures shows that the greater proportion of the total volume per acre is concentrated without exception on the medium trees and this was most marked at the beginning when the forests were more even-aged in character. With the introduction of selection working there has been a shift of increased volume production on the large trees. This is reflected in the relative volume percentages of the large trees given below :—

Cutting Section	1955				1964-65			
	Absolute Vol. H. ft. per acre (‘Large’ trees)		Percentage of total volume		Absolute Vol. H. ft. (‘Large’ trees)		Percentage of total volume	
1	..	63.1	..	9	..	196.0	..	19
2	..	149.0	..	21	..	331.2	..	30
3	..	220.4	..	22	..	606.5	..	37
4	..	60.0	..	7	..	168.7	..	10
5	..	82.8	..	9	..	296.0	..	24

The absolute volumes of the large trees have, in fact, doubled or even trebled in certain cutting sections. The volume of the large trees in cutting section 4 is the lowest because records show that a fair number of old, defective trees with reduced vigour had been removed in the process of fellings. Considering the short period involved, there is reason to be optimistic that these forests, with the possible exception of cutting section 5 which remains problematic, are progressing well towards a selection forest. The question of the ‘ideal’ growing stock that should be strived for and how it should be distributed among the size classes would be discussed more fully under “Future Management”.

(iii) *Mean Stem*—

The mean stem or tree of mean girth has changed as follows :—

Cutting Section	1955		1960		1961-65	
	B. H. G.	Vol. H. ft.	B. H. G.	Vol. H. ft.	B. H. G.	Vol. H. ft.
1	36.0	9.0	34.2	7.9	31.5	6.2
2	34.1	7.9	32.3	7.0	29.2	5.0
3	34.6	8.0	30.6	5.9	30.3	5.6
4	37.7	10.3	36.7	9.6	35.8	8.9
5	41.7	—	—	—	47.4	19.6

Unlike a slight increase in the B.H.G. of the mean stem which would be expected in a 'normal' Selection forest, the opposite tendency has been noted in this working circle, except in Cutting Section 5. This is understandable since this forest is in a period of transition and there is a paucity of large trees compensated by a weightage of small trees. However, the values at Sundapola should increase as the fellings which are due now, are carried out in the next felling plan with consequent reduction of the surplus number of small trees. The B.H.G. of the mean stem in Cutting Section 5 remains high because the forest is still even-aged.

(c) *Increment*—

The increment calculations have been made by the familiar "check method" devised by Biolley and Gurnard¹. This method enables a study to be made of the history and performance of the individual size classes which constitute the growing stock. The calculations have been made for the Sundapola Cutting Sections 1-4 only and appear at Appendix I to VIII. It has not been possible to evaluate the increment for Cutting Section 5 for the mere reason that details of past fellings have not been traceable. This underlines the great responsibility cast on the officers expected to maintain all the necessary records; otherwise a lot of labour and effort would be lost in vain and the management of the forest would be adversely affected in the long run.

For the sake of clarity, the essential details of the increment calculations are tabulated below—

Cutting Section	Total Volume H. ft.	Total Increment, including Recruitment		
		Over whole are H. ft.	Per acre per annum H. ft.	Percentage per annum
1 (33.0 acres)	{ V 1955—21,985 V 1960—30,875 V 1964—39,311 }	8,890 .. 8,436 ..	58.5 .. 59.3 ..	8.8 6.3
2 (36.0 acres)	{ V 1955—23,538 V 1960—32,216 V 1964—40,013 }	8,668 .. 7,797 ..	52.2 .. 52.6 ..	9.0 5.6
3	{ V 1955—36,444 V 1960—43,708 V 1964—61,488 }	10,783 .. 22,717 ..	61.2 .. 106.0 ..	6.4 9.2
4	{ V 1955—34,586 V 1960—48,237 V 1965—63,128 }	14,377 .. 17,780 ..	87.2 .. 95.6 ..	8.8 7.9

The exploited material, wherever they occur, have been measured by the same standing unit so that no inaccuracy in the increment calculation

has been introduced on this score. The increment percentages are high, as would be expected with a fast growing species such as broad leaved Mahogany.

In Cutting Sections 1 and 2, there has been hardly any change in the absolute values of the increment during the two periods but there has been a slight drop in the increment per cent. mainly as a result of the fall off in increment of the small trees during the second period probably as a result of increased competition and partly due to the increased growing stock. It is difficult to find out the extent to which changes in climate over the year, particularly rainfall, have contributed to this drop in increment. An examination of the total annual rainfall figures (Table 5) collected at nearby Baddagamuwa Rain Gauge Station since 1956 to date, shows that there has been relatively lesser rainfall during the second period; the mean for the first five years being 85.1" as compared with 74.8" for the second period. It is very doubtful that rainfall has been responsible for this, for, if it were so, there should be a uniform drop in increment throughout the whole working circle. Unlike other areas, cutting Section 3 shows a rise in the increment per cent. so that the effect of rainfall need not be given much consideration.

In Cutting Sections 3 and 4, there has been an increase in the absolute values of increment, probably as a result of the beneficial effect of silvicultural operations carried out in both these sections. The effect is more marked in 3 than 4.

It is relevant at this stage to comment on the recruitment rate from the underwood and the relative vigour of the different categories of trees as expressed by their increment rates. The recruitment at Sundapola during second period varies from 1—3 per cent. being lowest in Cutting Section 1 and highest in Section 3. All the different categories of trees are maintaining satisfactory increment rates except the large trees in Cutting Section 4 where the increment rate has shown a sharp drop to 1.3 per cent. during the second period notwithstanding the fact that the recruitment from the lower category of 'medium' trees has remained practically constant. This might be due to the presence of several forked trees among the larger category, the point of branching being only 15—20' from the ground. The nett result is the dissipation of growth on two main branches instead of on a single bole and a consequent reduction of the rate of girth increment at the measureable level of the main stem. It is doubtful if this branching habit is due to the more gravelly soil found here, since tall trees with well formed boles do exist close to these malformed ones. It is necessary to watch the increment rate of these trees for another 10—20 years before any definite conclusion can be reached.

That the main stands as a whole are growing vigorously is evident from the fairly high values of the main increment per cents., i.e., exclusive of recruitment from the underwood given below :

Cutting Section		Mean Increment	
		1955-1960	1960-64/65
1	..	7.1	5.0
2	..	5.9	4.2
3	..	4.6	6.6
4	..	7.7	6.4

The increment rates in the unthinned and unfelled stands in Cutting Sections 1 and 2 are lower than those of 3 and 4, indicating an imperative need to thin them during the early part of the next working plan period.

(d) *Capital Value*—

The change in capital value of the Mahogany woods can be appreciated from the following table :—

Cutting Section		1955		1964/65	
		Vol. H. ft.	Total Value	Vol. H. ft.	Total Value
1	..	22,150	Rs. 4.50 per H. ft.	39,311	Rs. 4.50 per H. ft.
2	..	23,538		40,013	
3	..	36,444		61,488	
4	..	34,586		63,128	
5	..	33,000		42,945	
		149,718	Rs. 673,735.50	246,885	Rs. 1,110,983.50

The rate of Rs. 4.50 per H.ft. represents the average 'in-situ' value, i.e., the sale rate prevailing at Kurunegala Depot (Rs. 5.50) less the cost of felling and extraction from site to the depot. The sale rate quoted is for the minimum acceptable size at depots, and rises up to Rs. 8.90 per H. ft. for logs above 5' mid-girth and over 20' in length. It is assumed in the valuation that the same price is applicable to both small and large size timber but, in point of fact, the lower rate for the smaller sizes would be amply compensated by the enhanced rate for the high quality, larger sizes. Since there has been an increase in production of larger trees, the standing value of the crop as at 1964-65 is bound to be much higher than that indicated above. Thus the value of over one million rupees can be treated as a conservative estimate. What is most required at the present time is to ascertain the *change* in capital value rather than to obtain an accurate assessment of the absolute value of the woods.

It would be seen that during the nine-year period, the forest has appreciated in value by over 4 lakhs of Rupees or the simple interest equivalent of 7.2 per annum, exclusive of the yield from fellings. As the data on fellings are not available by species in all cases, it has not been possible to reckon the yield from Mahogany in the calculation of interest. Details of the total produce and total nett revenue during the period under review are given in Table 6.

The attainment of a reasonable rate of interest shows that this investment is indeed a profitable one.

PART II—FUTURE MANAGEMENT

The future management of this forest, like that of similar forests during a period of conversion to a selection forest, is a challenging one in that only the broad principles can be laid down in attaining the normal growing stock suited to the site (or sites) based on a study of its past history and performance. When individual units of the forest are taken up for working, emphasis must be placed in obtaining a better silvicultural condition as a result of the fellings. This would be done within the framework of the prescribed yield. Experience in Switzerland and France has shown that the desired growing stock with selection distribution cannot be achieved within a short duration but after a long period of continued and careful working of the forests. For example, the communal forest of Les Verrieres in the Swiss Jura had been worked from 1900 to 1943 before it approached the 'ideal' growing stock. Similarly the forest of Ambusson had been worked from 1875 to 1944 before it was considered to have reached the 'ideal' growing stock¹. How long it will take to convert this working circle is not at all possible to predict now, but it might be possible to do it sooner than the examples quoted above since we are dealing with a fast growing species. The results obtained so far in this working circle bear testimony to this contention. It is necessary not only to establish the 'normal' growing stock in the overall picture of the entire forest but in every part of it. According to the stem number curves it is easier and quicker to achieve this condition in Cutting Sections 1—4 than 5.

(a) Desired Growing Stock—

In the absence of any data in this country, it is useful to consider the 'normal' growing stock per unit area in forests subject to selection working in other countries. It is apt to examine the figures in some of the Swiss forests which are regarded as excellent examples of selection working. The figures of volume per acre in certain forests at the beginning of selection working and until recent times are reproduced below¹:—

<i>Couvet</i>	.. 1st Working Circle	.. 4,400 H. ft. (1890)	.. 3,900 H. ft. (1946)
	2nd Working Circle	.. 2,600 H. ft. (1890)	.. 3,020 H. ft. (1946)
<i>Roveresse</i>	..	.. 2,615 H. ft. (1891)	.. 3,230 H. ft. (1943)
<i>Les Verrieres</i>	..	.. 3,580 H. ft. (1900)	.. 3,545 H. ft. (1943)

The figures of volumes were high even at the beginning since they were well stocked, even-aged forests. It would, no doubt, be erroneous to presume that the above values can be arrived at or even attained in this working circle since the site and climatic factors are so widely different. But at Sundapola and Kumbalpola where the soils are fairly fertile except on the few isolated ridge tops in Cutting Section 4 and where there is adequate and fairly even distribution of rainfall during the year, the productivity of the sites can be said to be high. This is supported by the high values of top heights as well as by the phenomenal increase in percentage volume, particularly at Sundapola, over the past management period. From a consideration of all these factors, it is felt that an average volume of 3,500 H. ft. per acre (inclusive of all species) could be arrived at, of which Mahogany would amount to about 3,000 H. ft. since there is every indication that this species would constitute 80-90 per cent. of the

growing stock in the next 20-30 years. This volume could be expected to be achieved quicker with Cutting Sections 3 and 4 than the rest, provided, there is no sharp drop in the increment rates.

The next question which arises is how the volume of the stand should be distributed among the different categories of trees. As emphasised earlier, one of the main objectives of selection forestry is the concentration of a major share of the growing stock volume in the larger trees and this phenomenon enables the principle of sustention to be maintained with considerable ease. This would be the case particularly in a true selection forest, so that, in the working circle under discussion all efforts should be channelled to achieve this objective while obtaining a fair financial return in the interim period. As regards the best distribution of the growing stock, reference has to be made again to that obtaining in true selection forests. In Couvet¹, the desired distribution by volume is 20 (small): 30 (medium): 50 (large) on the better sites but 20: 40: 40 on the less favourable sites. These proportions have, more or less, been achieved in practise both in Couvet and in Les Verrieres. Appendix IX shows the distribution obtaining locally. It would be seen that the best distribution is found in Cutting Section 3 where it is 31: 32: 37. It is noteworthy that the percentage of large trees here has risen from 19 in 1960 to 37 at the end of 1964. This is probably due to the removal as fellings of a fair proportion of large and less vigorous trees especially those over 96 in. B. H. G., during the period 1955-1960, thus making way for considerable recruitment from the lower category of medium trees. Amenable site conditions in this part of the forest have been also responsible for this favourable growth. The volume distribution most removed from a desired one is found in Cutting Section 4 where it is 26: 64: 10, probably because the area had been subject to two fellings. It would be a few more years before the stand has stabilised itself as a result of these fellings and a higher proportion of large trees can be expected in the future. Similar building up of the large trees can be also expected in all the other sections where the medium trees are heavily represented. In the planning of fellings, emphasis should be placed not only in attaining more smooth stem number curves but also in reserving sufficient number of trees for growth into the larger category which are lacking at the moment. For this reason alone, it will not be easy to obtain smooth stem number curves in practise until the desired growing stock is reached.

(b) *Prescribed Cut and Felling Plan—*

The fixing of the prescribed cut during the next 10 years is based on a consideration of the following factors: the increment, the present condition of the stand, the experience gained as a result of past exploitation and most important of all, the attainment of the desired growing stock

No

in the quickest possible time. The absolute necessity to carry out thinnings and fellings throughout this area needs to be stressed since the distinctly advantageous effect of these operations on volume increment in Cutting Sections 3 and 4 has already been evidenced.

In Cutting Sections 3 and 4, the past exploitation per cents. have varied from 2.9 per cent. of the growing stocks. Since the low values of volume per acre are a constant feature of these management units, there is an imperative need to capitalise a substantial portion of the increment. At the same time the quantum of fellings should be such that there is sufficient growing space available for the residual stand while providing for the activation of growth. Under these circumstances, it is felt that only 25 per cent. of the increment should be removed by way of main exploitations, the balance being capitalised. This will result in slightly greater exploitation per cents. than in the past, but not exceeding 18 per cent. It will be interesting to note the effect of these heavier fellings on volume increment in the future. The felling plan depicting the total prescribed cut and the subsidiary apportionment plan setting out the fellings by cutting sections and felling years is given in the annexed pages. Fellings will commence in Cutting Section 2 and end up with Section 4 last, since the latter has been treated twice in the last working plan period. The fellings are confined to the first five years only, the idea being to let the effect of the fellings take maximum effect in the stands before commencement of the next felling cycle.

(c) *Felling Rules—*

The allocation of the cut to individual cutting sections is not as difficult in practise as its distribution to the individual size classes. Care has to be taken to see that healthy, vigorous trees are not unduly sacrificed for the sake of maintaining smooth stem number curves. All trees over 96 in. B. H. G. have, of necessity, to be felled to avoid loss through splitting during the process of fellings as observed by Tisseverasinghe² in the case of such trees. The removal of these trees which are few in number in each cutting section would not result in an appreciable reduction in the volume stocking. These fellings would considerably enhance the total value of the yield. In the opinion of the writer the removal of trees on the basis of a girth limit need not be considered as something alien to the principles of selection forestry since these trees would have reached the stage when their rates of increment are falling off and consequently, they cannot be described as really vigorous. At what age (or size) the increment tapers off is not known, but observations on linear girth increment are being made in certain cutting sections. Adoption of this felling girth limit would also contain to some degree the advantages derived from a financial rotation.

In addition to trees over 96 in. B. H. G., dead, dying or diseased trees have to be removed on silvicultural grounds. Cutting Section 4 contained the majority of such unhealthy and defective trees but after the last two felling operations, only a few are left behind.

FELLING PLAN FOR THE NEXT WORKING PLAN PERIOD—1965-1975-76

Cutting Section	Area acres	Growing Stock		Total Increment (Annual)			Prescribed cut—H.ft. (25% of increment)	To be capita- lised H.ft. (75% of increment)	Percentage growing stock 1964-65	
		per acre H.ft.	Total H.ft. (1964/65)	percent- age	per acre H.ft.	entire area			to be cut	to be capita- lised
1	..	1,061 ..	39,311 ..	6.3 ..	59.3 ..	1,950..	19,500 ..	4,875 ..	14,625 ..	12.4 .. 37.2
2	..	1,081 ..	40,013 ..	5.6 ..	52.6 ..	1,890..	18,900 ..	4,725 ..	14,175 ..	11.8 .. 35.4
3	..	1,618 ..	61,488 ..	9.2 ..	106.0 ..	4,030..	40,300 ..	10,075 ..	29,225 ..	17.5 .. 48.0
4	..	1,738 ..	63,128 ..	7.9 ..	95.6 ..	3,440..	34,400 ..	8,600 ..	25,800 ..	13.6 .. 41.0
5	..	1,237 ..	42,945 ..	5.0* ..	61.3? ..	2,140(?)	21,400(?)	5,350 ..	16,050(?)	12.4 .. 37.4(?)
	178.0		246,885				134,500	33,625		

* The figure of 5 % has been arbitrarily fixed at a conservative level.

TABLE 1.—Distribution of Growing Stocks of all Species—Stems per Acre—Sundapola

May 19 June, 1900

Cutting Section	Species	18"-24"	24"-30"	30"-36"	36"-42"	42"-48"	48"-54"	54"-60"	60"-66"	66"-72"	-72"	Total No. Stems per Acre	Percentage composition
1 33 Acres	Mahogany	.. 32.73	.. 9.64	.. 6.38	.. 7.5	.. 8.03	.. 6.48	.. 4.39	.. 2.36	.. 1.06	.. 1.36	.. 80.6	.. 64.6
	Jak	.. .3	.. .24	.. .61	.. .79	.. 1.03	.. 1.61	.. 1.39	.. .85	.. .58	.. 1.46	.. 8.9	.. 7.1
	Teak	.. 1.53	.. 2.91	.. 3.88	.. 4.43	.. 3.3	.. 1.7	.. 1.09	.. .3	.. .24	.. .08	.. 19.4	.. 15.5
	Other Species	.. 5.52	.. 3.09	.. 2.43	.. 1.43	.. 1.55	.. .73	.. .33	.. .3	.. .06	.. .58	.. 16.0	.. 12.8
												124.9	.. 100.0
2 36 Acres	Mahogany	.. 42.83	.. 12.78	.. 6.67	.. 5.36	.. 5.8	.. 4.91	.. 3.75	.. 2.27	.. 1.25	.. 1.94	.. 87.7	.. 69.7
	Jak	.. .65	.. .33	.. .39	.. .89	.. 1.5	.. 1.47	.. 1.08	.. .33	.. .38	.. .47	.. 7.6	.. 6.0
	Teak	.. .36	.. .5	.. 1.44	.. 2.94	.. 2.61	.. 1.55	.. .81	.. .31	.. .03	.. .02	.. 10.6	.. 8.4
	Other Species	.. 5.02	.. 3.33	.. 3.44	.. 2.8	.. 1.69	.. 4.9	.. .67	.. .36	.. .65	.. 1.05	.. 20.0	.. 15.9
												125.9	.. 100.0
3 38 Acres	Mahogany	.. 58.21	.. 19.74	.. 5.24	.. 5.88	.. 7.34	.. 6.6	.. 5.92	.. 3.53	.. 1.55	.. 2.05	.. 115.2	.. 78.8
	Jak	.. .89	.. .76	.. .45	.. 1.06	.. 2.1	.. 2.13	.. 2.42	.. .95	.. .18	.. .18	.. 11.3	.. 7.7
	Teak	.. .39	.. .71	.. 2.00	.. 2.07	.. 3.18	.. 2.07	.. 1.11	.. .32	.. .22	.. .15	.. 12.3	.. 8.4
	Other Species	.. 2.55	.. 1.76	.. .81	.. .26	.. .47	.. .45	.. .24	.. .26	.. .18	.. .26	.. 7.5	.. 5.1
												146.0	.. 100.0
4 36 Acres	Mahogany	.. 23.63	.. 10.64	.. 9.64	.. 12.41	.. 15.22	.. 10.53	.. 8.92	.. 2.39	.. 1.08	.. .92	.. 100.2	.. 87.8
	Jak	.. .31	.. .39	.. .67	.. .67	.. .67	.. .47	.. .33	.. .05	.. .05	.. .11	.. 3.9	.. 3.4
	Teak	.. .22	.. .53	.. .67	.. .81	.. .42	.. .22	.. .16	.. —	.. .02	.. .02	.. 3.0	.. 2.6
	Other Species	.. 3.17	.. .72	.. .90	.. .65	.. .65	.. .25	.. .31	.. .14	.. .08	.. .19	.. 7.2	.. 6.2
												114.3	.. 100.0

TABLE 2—Distribution of Growing Stocks of all Species—Stems per Acre—Sundapola
August, 1964 to February, 1965

Cutting Section	Species	18°-24°	24°-30°	30°-36°	36°-42°	42°-48°	48°-54°	54°-60°	60°-66°	66°-72°	-72°	Total No. Stems per Acre	Percentage composition
1 33 Acres	Mahogany	53.48	11.48	8.61	7.76	6.7	6.24	5.0	2.5	2.0	2.5	105.3	71.0
	Jak	.03	.24	.52	.73	1.3	1.73	1.36	1.0	.8	.37	8.5	5.7
	Teak	.48	2.36	4.15	4.27	2.82	2.57	1.27	.73	.15	.15	22.0	14.8
	Other Species	4.14	2.69	2.76	1.00	.67	.42	.27	.30	.06	.37	13.0	8.5
												148.8	100.0
2 36 Acres	Mahogany	50.34	22.39	8.67	5.44	4.22	4.39	4.25	2.05	1.92	3.19	115.9	69.8
	Jak	.92	.36	.28	.72	1.17	1.72	1.19	.37	.47	.69	8.5	5.1
	Teak	.22	.22	.67	2.0	2.72	2.06	.94	.56	.19	.06	9.7	5.8
	Other Species	8.33	4.11	3.88	3.67	2.72	1.42	1.34	.69	.39	5.28	31.8	19.3
												165.9	100.0
3 38 Acres	Mahogany	92.73	30.79	15.42	6.92	4.32	3.53	2.83	3.42	3.68	5.79	174.3	84.2
	Jak	.08	.34	.70	.82	1.0	2.05	1.32	1.97	.5	.47	10.0	4.8
	Teak	.40	.42	1.5	2.24	1.58	2.26	1.29	1.24	.39	.33	11.6	5.6
	Other Species	4.46	1.72	1.6	1.24	.63	.3	.25	.34	.29	7.2	11.5	5.4
												207.4	100.0
4 36 Acres	Mahogany	42.03	21.14	9.97	14.69	10.19	17.39	6.22	7.25	1.64	1.33	131.8	81.0
	Jak	.75	.31	.67	.83	.58	.61	.41	.03	.17	.17	4.6	2.8
	Teak	.12	.08	.67	1.36	.61	.61	.17	.22	—	.03	4.0	2.5
	Other Species	8.36	3.67	3.78	2.19	1.01	1.06	.4	.5	.17	.84	22.1	13.7
												162.5	100.0
5 35 Acres	Mahogany	3.2	1.4	5.3	9.9	10.2	8.5	6.6	3.8	2.7	2.5	54.1	59.5
	Jak	.55	.29	6.0	6.5	4.6	2.7	0.9	0.7	0.2	0.2	25.3	27.3
	Teak	—	.06	0.3	0.5	0.3	0.6	0.2	0.06	0.03	0.06	2.7	3.0
	Other Species	1.7	1.5	1.3	1.3	0.8	1.2	0.4	.14	0.06	0.4	8.6	9.7
												90.7	100.0

TABLE 3—Distribution of Mahogany by Volume per Acre—Sundapola
May/June, 1960

Cutting Section	18°-24°	24°-30°	30°-36°	36°-42°	42°-48°	48°-54°	54°-60°	60°-66°	66°-72°	72°-78°	78°-84°	84°-90°	90°-96°	96°-102°	over 102°	Total
1	65.5	38.6	48.2	82.5	141.8	160.8	142.4	97.5	53.6	101.0	..	..	..	..	..	931.4
2	85.6	51.1	40.6	61.1	102.1	119.1	121.5	94.1	68.1	138.4	..	..	..	..	..	882.7
3	116.4	43.8	36.7	64.8	129.2	153.8	191.8	171.6	78.4	139.0	..	..	..	..	..	1,135.5
4	57.8	42.5	69.4	130.4	267.9	261.1	288.9	98.4	54.7	58.1	..	..	..	..	..	1,329.3
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

TABLE 4—Distribution of Mahogany by Volume per Acre—Sundapola

August, 1964/February, 1965

Cutting Section	-24"	24"-30"	30"-36"	36"-42"	42"-48"	48"-54"	54"-60"	60"-66"	66"-72"	72"-78"	78"-84"	84"-90"	90"-96"	96"-102"	over 102"	Total
1.	.. 107.0	.. 45.9	.. 60.2	.. 88.4	.. 117.9	.. 154.8	.. 162.0	.. 128.6	.. 101.0	.. 36.7	.. 23.7	.. 22.3	.. 2.8	.. 9.5	.. —	.. 1060.78
2.	.. 118.6	.. 89.6	.. 60.7	.. 62.1	.. 74.3	.. 108.8	.. 109.9	.. 125.9	.. 96.8	.. 77.3	.. 53.3	.. 56.8	.. 18.1	.. 11.6	.. 17.3	.. 1081.04
3.	.. 135.5	123.2	.. 107.6	.. 78.9	.. 76.0	.. 212.8	.. 87.0	.. 141.0	.. 186.1	.. 200.6	.. 87.8	.. 84.0	.. 34.3	.. 13.7	.. —	.. 1618.12
4.	.. 79.7	.. 80.1	.. 132.5	.. 167.5	.. 178.9	.. 430.6	.. 201.6	.. 298.7	.. 82.8	.. 65.5	.. 7.9	.. 9.9	.. —	.. 2.6	.. —	.. 1738.3
5.	.. 6.4	.. 5.6	.. 37.0	.. 112.6	.. 131.0	.. 216.0	.. 216.0	.. 156.2	.. 136.2	.. 81.5	.. 50.5	.. 7.0	.. 2.5	.. 11.4	.. 6.9	.. 1220.8

TABLE 5—Total Annual Rainfall

Badagamunwa Rain Gauge Station

1956	..	62.4	} 85.1"
1957	..	103.2	
1958	..	81.6	
1959	..	94.2	
1960	..	84.0	} 74.8"
1961	..	80.4	
1962	..	75.6	
1963	..	79.2	
1964	..	73.2	
1965	..	66.0	

TABLE 6—Nett Revenue from Intermediate yields

				<i>Rs.</i>	<i>c.</i>
Cutting Section 3—(1956)	..	3394, c. ft.	..	..	5,091 00
		44 Class I Poles	..	..	8 80
		264 Class II Poles	..	..	26 40
		239 c.yds. Firewood	..	..	239 00
					5,365 20
Cutting Section 4—(1957)	..	674.0 c. ft. logs	..	..	3,033 00
		749 c. ft. log (auctioned)	..	..	1,123 50
		90 Class I Poles	..	..	18 00
		300 Class II Poles	..	..	30 00
		70 c.yds. Firewood	..	..	70 00
					4,274 50
Cutting Section 4—(1960-61)	..	1,233 c. ft. logs	..	..	1,849 50
		110 c.yds. Firewood	..	..	110 00
					1,959 50
Cutting Section 5—(1958)	..	539 c. ft. logs	..	..	2,425 50
		1,031 c. ft. logs (auctioned)	..	..	1,546 50
		339 Class I Poles	..	..	67 80
		1,503 Class II Poles	..	..	150 30
		852 Class III Poles	..	..	42 60
		258 c.yds. Firewood	..	..	258 00
					4,490 70

(Particulars of fellings on 2½ acres clearfelled, not available).

APPENDIX 1

Increment Calculation of Cutting Section 1 (33.0 acres) for the period 1955-1960

(After Boley-Gurnard's Method)

Group	Size Class	Initial G. S. 1955		Initial G. S. 1960		Exploitation		Calculation of Increment in initial volume				Increment %			
		No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	Increment in 4.6 years	Whole area		Increment per acre per year		
Large Trees	96"	—	—	4	416	—	—	4	416						
	90"—96"	—	—	5	465	—	—	5	465						
	84"—90"	1	82	8	655	—	—	8	655						
	78"—84	4	284	10	710	—	—	10	710						
	72"—78"	9	545	18	1090	—	—	7	423	11	667				
	66"—72"	20	1,010	35	1,768	—	—	—	—	35	1,768				
		34	1,921	80	5,100	—	—	34	2,069	40	2,435	748	22.6	4.9	8.4
Medium Trees	60"—66"	45	1,854	78	3,220	—	—	46	2,435						
	54"—60"	72	2,833	145	4,698	—	—	78	3,220						
	48"—54"	161	3,993	214	5,307	—	—	145	4,698						
	42"—48"	291	5,122	265	4,964	—	—	214	5,307						
		569	13,802	702	17,889	—	—	86	1,500	179	3,104	3358	117.3	25.5	6.3
Small Trees	36"—42"	288	3,283	251	2,861	—	—	170	3,164						
	30"—36"	236	1,699	227	1,589	—	—	251	2,861						
	24"—30"	199	796	318	1,272	—	—	227	1,589						
	18"—24"	492	984	1,080	2,100	—	—	318	1,272						
		1215	6762	1,876	7882	—	—	240	450	840	1,710	2574	78.0	16.9	8.8
		1,818	21,985	2,653	30,375	—	—	1,215	9,336	1065	7309	2574	78.0	16.9	8.8
								1,818	29,165			7180	217.9	47.3	7.1
										Recruitment	1710	51.7	11.2	1.9	1.9
										Total Increment	8890	269.6	53.5	8.8	8.8

APPENDIX II

Increment Calculation of Sundapola Cutting Section I—For period 1960-1965

Group	Size	Class	Initial G.S. 1960			Final G.S. 1965			Exploitation			Final G.S. and Exploitation			Calculation of Increment on Initial Volume					Percentage increment per acre		
			No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	Initial G.S. and Exploitation	Recruitment	increment in 5 years	Whole area	Per acre					
Large Trees																						
	96"		4..	416..	5..	520..									5..	520..						
	90"		5..	465..	6..	560..									6..	560..						
	84"		8..	655..	16..	1,310..									16..	1,310..						
	78"		10..	710..	21..	1,490..									21..	1,490..						
	72"		18..	1,090..	34..	3,400..									32..	3,200..	2..	200..				
	66"		33..	1,768..	66..	3,335..											68..	3,335..				
			80	5,100	148	10,615									80	7,080	68	3,535	1,976	60.0	12.0	7.7
Medium Trees																						
	66"														63..	3,535..						
	60"		78..	3,220.0..	177..	4,820..									117..	4,820..						
	54"		145..	4,698.0..	165..	5,350..									165..	5,350..						
	48"		214..	5,307.0..	206..	5,110..									206..	5,110..						
	42"		265..	4,664.0..	221..	3,380..									146..	2,230..	75..	1,150..				
			702	17,889.0	709	18,660									702	21,045			3,166	95.8	19.2	3.5
Small Trees																						
	36"		251..	2,861..	256..	2,920..									75..	1,150..						
	30"		227..	1,559..	284..	2,070..									256..	2,920..						
	24"		318..	1,272..	379..	1,516..									284..	2,070..						
	18"		1,080..	2,160..	1,765..	3,530..									379..	1,516..						
			1,876	7,882	2,684	10,036									882..	1,760..	883..	1,770..				
			2,658	30,875	8,541	39,311									1,876	9,416			1,534	43.5	9.3	3.9
			2,658	30,875	8,541	39,311									2,658	37,541	1,026	6,455	6,666	202.3	40.5	4.3

APPENDIX III

Increment Calculation of Sandspola Cutting Section 2 (36.0 acres) 1953-1960

[illegible]

APPENDIX IV

Increment Calculation of Sundapola Cutting Section 2—1960—1965 (36.0 acres)

Group	Size	Class	Initial C. S. 1960			Final C.S. 1965			Exploitation			Final C.S. and exploitation			Calculation of Increment on Initial				Increment per acre	Per year	Percent-age
			No.	Vol.		No.	Vol.		No.	Vol.		No.	Vol.		Initial C.S. and increment	Recruitment	Volume increment in 5-0 years	Whole area			
Large Trees	..	96"	7..	808	..	10..	1,136..	..	..	..	..	..	..	10..	1,136..	..	..	..	..	..	..
	90"	96"	4..	372..	..	7..	631..	..	..	..	..	..	..	7..	631..	..	..	..	..	..	..
	84"	90"	5..	409..	..	25..	2,045..	..	..	..	..	..	..	25..	2,045..	..	..	..	..	..	..
	78"	84"	28..	1,988..	..	27..	1,917..	..	..	..	..	..	..	27..	1,917..	..	..	..	..	..	..
	72"	78"	28..	1,694..	..	46..	2,783..	..	..	..	..	..	..	46..	2,783..	..	..	..	..	..	..
	66"	72"	45..	2,273..	..	69..	3,485..	..	..	..	..	..	..	2..	101..	67..	3,384..	..	..	..	..
			117	7,544	184	12,017	..	..	..	..	..	..	117	8,633	..	1,039	39.2	7.8	2.9	..	
Medium Trees	..	66"	..	..	..	..	..	..	..	..	..	..	..	67..	3,384..	..	..	..	..	..	..
	60"	66"	82..	3,378..	..	110..	4,592..	..	..	..	..	..	..	110..	4,592..	..	..	..	..	..	..
	54"	60"	135..	4,374..	..	153..	4,957..	..	..	..	..	..	..	153..	4,957..	..	..	..	..	..	..
	48"	54"	177..	4,390..	..	158..	3,918..	..	..	..	..	..	..	153..	3,918..	..	..	..	..	..	..
	42"	48"	209..	3,678..	..	152..	2,675..	..	..	..	..	..	..	115..	2,025..	37..	650..	..	..	..	..
				603	15,820	573	16,082	..	..	..	..	..	..	603	18,316	..	2,906	83.0	16.7	3.8	..
Small Trees	..	42"	..	..	..	..	..	..	..	..	..	..	..	37..	650..	..	..	..	..	..	..
	36"	42"	193..	2,200..	..	106..	2,234..	..	..	..	..	..	..	196..	2,234..	..	..	..	..	..	..
	30"	36"	240..	1,728..	..	312..	2,184..	..	..	..	..	..	..	812..	2,184..	..	..	..	..	..	..
	24"	30"	460..	1,840..	..	806..	3,294..	..	..	..	..	..	..	805..	3,294..	..	..	..	..	..	..
	18"	24"	1,542..	3,084..	..	2,136..	4,272..	..	..	..	..	..	..	1,084..	2,167..	1,052..	2,105..	..	..	..	..
				2,435	8,852	3,450	11,914	..	..	..	..	..	..	2,435	10,459	..	1,607	44.7	8.9	3.6	..
			3,155	322,136	4,207	40,013	..	..	..	..	..	..	3,155	37,908	1,156	6,139	5,692	166.9	33.4	3.5	..

APPENDIX V
Increment Calculation of Sundagola Cutting Section 2 (38.0 acres) 1935-1989

Group	Size	Class	Initial G.S. November 1955		Final C.S. June 1960		Exploitation 1955-1960 E % = 9.4		Final G.S. and Exploitation		Initial G.S. and Recruitment		Calculation of Increment on Initial Volume		Increment %				
			No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	Increment in 4.6 years	Increment per year per acre					
Large Trees	96"	..	9..	1,016..	—	—	9..	1,016..	9..	1,016..	—	—	—	—	..				
	90"	96"	4..	372..	6..	553..	4..	372..	10..	930..	—	—	—	—	..				
	84"	90"	9..	736..	6..	409..	3..	245..	8..	654..	—	—	—	—	..				
	78"	84"	12..	852..	26..	1,775..	8..	588..	33..	2,343..	—	—	—	—	..				
	72"	78"	30..	1,815..	42..	2,541..	1..	60..	43..	2,601..	—	—	—	—	..				
	66"	72"	61..	3,087..	89..	4,495..	1..	50..	90..	4,545..	22..	1,111..	63..	3,434..	..				
			125..	7,872..	107..	9,778..	26..	2,311..	193..	12,089..	125..	8,655..	—	..	783..	21..	4.4..	2.2	
Medium Trees	60"	..	113..	4,656..	134..	5,550..	1..	41..	135..	5,561..	63..	8,434	—	—	—	—	..		
	54"	60"	160..	5,184..	225..	7,290..	7..	227..	232..	7,517..	232..	7,517..	—	—	—	—	..		
	48"	54"	255..	6,324..	251..	6,225..	9..	223..	260..	6,448..	260..	6,448..	—	—	—	—	..		
	42"	48"	298..	5,245..	279..	4,910..	21..	370..	300..	5,250..	131..	2,302..	169..	2,978..	—	—	..		
			826..	21,409..	889..	23,945..	38..	861..	927..	24,806..	826..	25,262..	—	..	3,853..	101..	22.0 ..	3.9	
Small Trees	36"	42"	272..	3,101..	216..	2,460..	14..	160..	230..	2,690..	169..	2,978..	—	—	—	—	..		
	30"	36"	160..	1,152..	199..	1,433..	11..	79..	210..	1,512..	230..	2,690..	—	—	—	—	..		
	24"	30"	150..	600..	417..	1,668..	6..	24..	423..	1,692..	423..	1,692..	—	—	—	—	..		
	18"	24"	1,155..	2,310..	2,212..	4,424..	7..	14..	2,219..	4,438..	705..	1,400..	1,514..	3,038..	—	—	..		
			1,737..	7,163..	3,044..	9,955..	38..	277..	3,082..	10,332..	1,737..	10,272..	1,751..	9,450..	3,109..	82..	17.4..	9.3	
Total			..	2,688..	36,444..	4,100..	43,708..	102..	3,449..	4,202..	47,227..	2,688..	44,189..	—	..	7,745..	204..	43.8..	4.6
						Recruitment			..			803..			17.4..			1.8	
						Total Increment			10,783..			284..			61.2..			6.4	

APPENDIX VI

Increment Calculation of Sundapola Cutting Section 3 for period 1960-1965

[illegible]

APPENDIX VII

Increment Calculation of Sundapola Cutting Section 4 (36.0 acres) for period 1955-1966

(After Biolley-Guarnaud's method)

Group	Size	Class	Initial G.S., 1955			Final G.S., 1960			Exploitation 1955-1960 E% OE 2-1			Final G.S. and Exploitation			Initial G.S. and Increment			Calculation of Increment on Initial Volume			Percentage
			No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	Whole area	Increment in 5 years	Per acre
Large Trees	96"	96"	1.	104.	—	—	—	—	1.	104.	1.	104.	1.	104.	—	—	—	—	—	—	—
	90"	90"	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	84"	90"	1.	82.	1.	82.	2.	164.	3.	246.	3.	246.	3.	246.	—	—	—	—	—	—	—
	78"	84"	1.	71.	7.	497.	1.	71.	8.	568.	8.	568.	8.	568.	—	—	—	—	—	—	—
	72"	78"	10.	605.	25.	1,513.	3.	182.	28.	1,695.	26.	1,574.	2.	121.	—	—	—	—	—	—	—
Medium Trees	66"	72"	25.	1,263.	39.	1,970.	1.	51.	40.	2,021.	—	—	40.	2,021.	—	—	—	—	—	—	—
	—	—	38	2,125	72	4,062	8	572	80	4,634	38	2,492	42	2,142	367	10.2	2.04	3.45	—	—	—
	60"	66"	66.	2,719.	86.	3,343.	1.	41.	87.	3,584.	42.	2,142.	—	—	—	—	—	—	—	—	—
	54"	60"	112.	3,029.	321.	10,400.	1.	32.	323.	10,432.	323.	10,432.	—	—	—	—	—	—	—	—	—
	48"	54"	302.	7,490.	379.	9,399.	—	—	379.	9,399.	379.	9,399.	—	—	—	—	—	—	—	—	—
Small Trees	42"	48"	496.	8,730.	548.	9,645.	4.	70.	552.	9,715.	145.	2,545.	407.	7,170.	—	—	—	—	—	—	—
	—	—	976	22,568	1,334	32,987	6	143	1,341	33,130	976	28,102	407	7,170	5,584	15.7	31.4	4.9	—	—	—
	36"	42"	519.	5,918.	447.	5,096.	1.	11.	448.	6,107.	407.	7,170.	—	—	—	—	—	—	—	—	—
	30"	36"	276.	1,987.	347.	2,498.	—	—	347.	2,498.	448.	5,107.	—	—	—	—	—	—	—	—	—
	24"	30"	213.	852.	383.	1,532.	—	—	383.	1,532.	347.	2,498.	9.	36.	—	—	—	—	—	—	—
Small Trees	11"	24"	568.	1,136.	1,031.	2,062.	—	—	1,031.	2,062.	—	—	1,031.	2,062.	—	—	—	—	—	—	—
	—	—	1,576	9,893	2,203	11,188	1	11	2,209	11,199	1,576	16,271	1,040	2,098	6,378	17.7	35.4	14.0	—	—	—
	—	—	—	—	—	—	—	—	—	—	1,040.	2,098.	—	—	—	—	—	—	—	—	—
	—	—	2,590	34,536	3,614	48,237	15	726	3,630	48,963	3,630	963	1,489	11,410	12,279	43.6	87.2	7.1	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

APPENDIX VIII

Increment Calculation of Cutting Section 4 for the Period 1960-1965

[illegible]

APPENDIX IX
Relative Volumes and Percentages of Size—Groups

	Cutting Section					Year
	I	II	III	IV	V	
Small Trees	..	..	..	..	..	..
	206.9 (31%)	175.8 (20%)	190.0 (20%)	278.4 (28%)	274.1 (29%)	1955
	234.8 (25%)	244.4 (23%)	261.7 (23%)	300.2 (23%)	—	1960
	301.5 (23%)	331.0 (31%)	495.2 (31%)	459.8 (26%)	161.6 (13%)	1964/65
Medium Trees	..	..	..	..	..	..
	406.6 (69%)	340.7 (52%)	560.6 (58%)	638.8 (65%)	585.6 (62%)	1955
	542.0 (58%)	436.8 (50%)	656.4 (58%)	916.3 (69%)	—	1960
	563.3 (53%)	418.9 (39%)	516.2 (32%)	1,109.8 (64%)	769.2 (63%)	1964/65
Large Trees	..	..	..	..	..	..
	63.1 (9%)	149.0 (21%)	220.4 (22%)	60.0 (7%)	82.8 (9%)	1955
	154.6 (17%)	201.5 (22%)	217.4 (19%)	112.8 (8%)	—	1960
	196.0 (19%)	331.2 (30%)	606.5 (37%)	168.7 (10%)	206.0 (24%)	1964/65
Total Volumes	..	..	..	..	..	..
	676.6	665.0	971.0	977.2	942.5	1955
(H. ft. Per acre)	..	..	..	..	..	..
	931.4	882.7	1,135.5	1,320.3	—	1960
	1,060.8	1,081.4	1,618.1	1,738.3	1,226.8	1964/65

An Experiment to Determine the Capacity of Nine Wood-Rotting Fungi, including *Polystictus sanguineus* and *Lentinus giganteus*, to Cause Decay of *Grevillea robusta* Wood

By S. N. U. VIVEKANANDAN

SUMMARY

THE ability to bring about the rapid decay of *Grevillea robusta* A. Cunn. (Silky Oak) wood by *Polystictus sanguineus*, *Lentinus giganteus* and seven other fungi, isolated from decaying shade tree stumps found on tea estate, was studied in the laboratory using the standard Kolle flask method (British Standard 838 : 1961). Only *P. sanguineus*, *L. giganteus* and WR 13* caused rapid decay of *G. robusta* wood. *P. sanguineus* appeared to be more superior to the last two in this respect. Of these three, only WR 13 seems to occur naturally in the up-country and will be tested further in field studies.

INTRODUCTION

Grevillea robusta A. Cunn. is grown on tea estates especially in the up-country to provide shade and shelter for the tea and the stand is thinned or replaced periodically to prevent over-shading. The stumps of felled trees attract several wood-rotting fungi including a few which cause serious root diseases of tea. At present, wherever possible, the stumps are removed by hand or by winch, but this is expensive and laborious. In the majority of cases, therefore, the stumps are not removed and are left on the field to undergo natural decay. This takes several years and the stumps frequently gives rise to *Ustilina* or Brown Root disease (*Fomes noxius*). This investigation was carried out at the request of the Plant Pathology Division of the Tea Research Institute to study the possibility of employing non-parasitic wood-destroying fungi to bring about rapid decay of these stumps.

MATERIALS AND METHODS

17 fungi associated with decaying stumps of *G. robusta*. *Eucalyptus saligna* and *Albizzia moluccana* were isolated and cultured on Difco malt agar in the laboratory at St. Coombs. Only seven of these exhibited good growth and they were used in this investigation. Two standard wood destroying fungi *Polystictus sanguineus* and *Lentinus giganteus* were also included for comparison.

The following culture medium was used for the wood block tests :—

Vitrol (malt base)	..	..	20 g
Glucose	..	..	20 g
Agar	..	..	20 g
Vitamin B	..	..	trace
Tap water	..	..	1 litre

(pH was adjusted to 7.)

* Identified as *Polyporus* spp at the Royal Botanic gardens, Kew.

60 ml of this medium was poured into each Kolle flask, plugged with cotton wool and sterilized at 15 lb/sq. in. for 30 min. The flasks were inoculated the following day with the test fungi and test blocks of *G. robusta* were introduced after sufficient growth of the fungi was attained. Test blocks were prepared from seasoned wood and were finished to a size of 50 × 25 × 15 mm and cut so that the long axis was parallel to the grain of the wood. The blocks were sterilized, dried at 105° C for 24 hours and the initial dry weight determined. A pair of them was introduced into each flask aseptically and exposed to the fungus for about four months. Five flasks were used for each test fungus. The blocks were then removed, freed from adhering mycelium, dried as before and the final weight determined. The loss in dry weight was calculated and the extent of decay assessed.

RESULTS AND CONCLUSIONS

The results are shown in Table 1 from which it is evident that of the nine fungi tested only *P. sanguineus*, *L. giganteus* and WR 13 are capable bringing about rapid decay of *G. robusta* wood. Of these three only WR 13 was isolated from decaying shade tree stumps. As this fungus occurs

TABLE 1.—MEAN PERCENTAGE LOSS IN DRY WEIGHT OF GREVILLEA ROBUSTA WOOD AFTER EXPOSURE TO VARIOUS WOOD-ROTTING FUNGI FOR 4 MONTHS

Fungus		Mean percentage loss in dry weight	
<i>Polystictus sanguineus</i>	..	..	36.33
<i>Lentinus giganteus</i>	..	..	25.48
WR 4	..	..	1.28
WR 5	..	..	1.80
WR 6	..	..	1.44
WR 11	..	..	3.53
WR 13	..	..	25.94
WR 14	..	..	2.18
WR 17	..	..	5.59

naturally in the up-country tea estates, it is likely to prove suitable for effecting rapid destruction of *G. robusta* stumps. Field studies should now be undertaken to test this. It would also be interesting to find out whether WR 13 can, after invading *G. robusta* stumps, also afford protection against root disease fungi like *Ustilina deusta* and *Fomes noxius* either by checking their advance and or by replacing them to some extent in infected stumps. Recently, Rishbeth (1963) has shown that *Peniophora gigantea* does in fact afford such protection to pine stumps against *Fomes annosus*. Further, if WR 13 is going to be widely used for inoculating *G. robusta* stumps, a method will have to be devised for the large-scale production of inoculum sources. There is thus plenty of scope for further studies.

ACKNOWLEDGMENT

The writer wishes to thank Mr. K. Ganesan, Timber Utilization Research Officer, Forest Department, and Dr. N. Shanmuganathan, Plant Pathologist, Tea Research Institute of Ceylon, for valuable guidance in the course of this investigation.

REFERENCES

- BRITISH STANDARD 838 (1961)—Methods of test for toxicity of wood preservatives to fungi, p. 9.
- RISHBETH, J. (1963)—Stump protection against *Fomes annosus*, III. Inoculation with *Peniophora gigantea*. *Ann. appl. Biol.*, 52, 63.

A Report on the Seminar and Study Tour on the protection against Forest Diseases and Insects held in U. S. S. R.*

By K. VIVEKANANDAN

1. INTRODUCTION

A seminar and study tour on "The Protection against forest diseases and insects" organized by the Food and Agricultural Organization of the United Nations was held in U. S. S. R. from 10th July, 1965 to 10th August, 1965.

Twenty-two delegates representing twenty two countries† participated in the Seminar and Study tour.

The preliminary and final talks were held in Moscow, which lasted about 10 days. Four days were spent in Leningrad and a week each in Sochi and Tashkent.

During the field trips the delegates were shown the different forestry practices in the various climatic regions. Information was also obtained on the use of different machines and equipments. Several Research Laboratories, experimental stations, Dendariums, Botanic gardens, Groves, Museums, Parks and gardens, health resorts, Orchards, Vineyards, Collective farms, State farms and several other important places were visited during the tour.

2. GENERAL

The total area of forest in the U.S.S.R. is approximately 1,237,500,000 hectares (ha) and represents 33.2% of the land area. With the population amounting to 220 million the average area of the forest is 3.40 ha per capita (Ceylon a little more than 1.5 ha per capita).

The forests are distributed unevenly and several types are recognized. Forests are concentrated in the north (Temperate Zone) and less dense in the steppes and arid areas. Montane forests are confined to the south (Caucasus etc.) and far east.

*Text of the official report reproduced here by kind permission of the Conservator of Forests.

† Ceylon, Dahomey, Ethiopia, Greece, Guinea, India, Iraq, Israel, Japan, Kenya, Laos, Liberia, Madagascar, Malaysia, Nepal, Nigeria, Syria, Tangania, Thailand, Tunisia, Turkey, Upper Volta.

4—R 13289 (3/66)

The forest vegetation of the U.S.S.R. is classified into the following eight types :—

- | | |
|---|----------------------------|
| (i) Dark coniferous forests | |
| (ii) Pine forests | } Light coniferous forests |
| (iii) Larch forests | |
| (iv) Birch-Aspen forests | |
| (v) Broad leaved forests | |
| (vi) Coniferous broad leaved forests | |
| (vii) Montane forests | |
| (viii) Saxaul stands and brush deserts. | |

Dark coniferous forests are concentrated in the Caucasus and in the temperate zones. The principal species are spruces, firs and cedar pine.

Light coniferous forests are made up of two main types—Pine forests and Larch forests. The former is represented by five sub-species of Scots pine (*Pinus sylvestris*) and the latter by several species of *Larix*.

The Birch-Aspen forests are represented by species of *Betula* and *Populus tremula* (Aspen) which are actually secondary forests growing towards a climax. These forests are the principal raw material for lumbering and wood-based industries.

The broad-leaved forests are richer in composition and the most valuable ones are the Oak forests occupying about 3 million hectares and supplying about 280 million cubic metres of timber per annum.

The montane forests are concentrated in the Caucasus and here five forest belts could be distinguished which are determined by topography.

In the arid areas are found the Saxaul forests represented by species of *Halophyllum* which are good indicators of dry situations and they are valuable in that they provide protection against wind erosion and also serve as pastures.

PARTICULARS OF % COMPOSITION OF SPECIES IN THE U.S.S.R.

<i>Coniferous Species</i>		<i>Broad leaved species</i>
Larix 38%	..	Betula 13%
Pinus 16%	..	Populus 2%
Picea 11%	..	Halophyllum 3%
Cedrus 5%	..	Quercus 1.3%
Abies 3%	..	Others 2.7%
Others 5%	..	

Based on the usage the forests of the U.S.S.R. are divided into State forests (97.1%) and Collective farm forests (2.9%). The Coniferous forests in the northern (European) and Siberian region are rich in Pine, Spruce, Larch, Cedar Pine and Fir. The middle and the Ukraine region has Oak, lime and maple. Large stands of beech, firs and spruce are found in the Caucasus and also yew, box, chest-nut and tung plantations. In the dry regions are found the saxaul forests.

The State forests of the U.S.S.R. are divided into three groups based on their economic value.

1st group (about 6.1%)—comprises forest reserves, shelterbelts, resort forests and green belts in individual areas and cities. In these forest clear felling is prohibited, only improvement, sanitary, and selective fellings are allowed.

2nd group (8.7%)—comprises mainly forests in the individual and densely populated areas and in the forest steppe zones (Uzbek S.S.R., Tadjik S.S.R. Turkmen S.S.R. etc.). Felling is permitted on a well drawn prescription and management plan.

3rd group (85.2%)—In this group are included forests which do not belong to group 1 and 2 viz. forests of the northern and eastern parts of the country. Bulk of the timber is obtained from these forests by the application of common forestry practices.

The annual felling area in the whole of U.S.S.R. is about 2.5 million ha with a yield of 370 million cubic metres.

Great emphasis is paid to reforestation and afforestation work, especially in the glades and barren areas. In 1963, 1,903,000 ha came under reforestation scheme and about 1,183,000 ha were planted. The area under afforestation in the U.S.S.R. is greater than other countries (U.S.A. 840,000 ha, U.K. 27,000 ha, Finland 20,000 ha, Italy 15,000 ha and German Federal Republic 25,000 ha).

Reclamation of water logged areas by advocating drainage—ameliorative measures to increase forest productivity is also given much importance. In 1962, 93,000 hectares were drained and it is proposed to increase this to 300,000 hectares by 1970. Better productivity is also obtained by improvement cutting and sanitary fellings.

Forest genetics has been used in the improvement and breeding of species. Several interspecific and intergeneric hybrids have been obtained.

In the field of forest protection great strides have been made. The accent is on the use of chemicals which are applied mechanically. The forest fire fighting section is better organized and equipped with several modern gears.

3.—SILVICULTURE

The following topics were discussed :—

(a) Plant breeding and Selection

The aim of the plant breeder is to get improved and better plants which are resistant to pest and diseases and exhibit healthy growth in the regions where they are planted.

The Soviet plant breeders have achieved the following :—

- (i) *Breeding of Aspen (Populus tremula)* Aspen suffers from a common trunk disease called the "heart rot", which affects the heartwood of the trees. By a process of selection they have obtained a strain of Aspen, which is resistant to "heart rot" and exhibited heterosis.
- (ii) *Hybridization of European filbert (Corylus avellan)* European filbert (*Corylus avellan*) are found in the natural forests and are of poor quality—but they are frost resistant. Sub-tropical filbert (*Corylus tabulosa*) are of good quality but less resistant to frost. Hybrids of better quality and high degree of frost resistance have been obtained by cross pollinating these two species.
- (iii) *Hybrids of Walnuts (Juglans)* *Juglans regia* (Persian walnut) is not frost resistant whereas *Juglans manchurica*, (Manchurian walnut) and *Juglans cinerea* (Butternut) are resistant to frost. Hybrids which could withstand long period of frost have been obtained by interspecific hybridization. Crossings between Walnuts (*Juglans*) and Hickory (*Carya*) have been successfully performed.
- (iv) *Lombardy Poplar* It is referred to as the "Peace tree" and is used for planting in towns, villages, gardens and parks. Its' aesthetic value is highly priced and it is said to give a soothing effect to the nerves of the Soviet people.

Interspecific hybridizations have been carried out between the following :—

- (a) *Populus alba* (white poplar) × *P.bolle* (Bolle poplar)
- (b) *Populus tremula* (aspen) × *P.bolle* (Bolle poplar)
- (c) *Populus nigra var pyramidalis* (Italian poplar) × *P.nigra* (Black poplar)

Several other hybrids of Sequoia, Elms, Pines, Larches, and other useful trees have also been successfully produced.

(b) Use of Herbicides and Arboricides

Weeds in plantations and nurseries tend to retard their healthy growth. The control of weeds has been the subject of much investigation not only in the Soviet Union but in other countries as well. Several types of chemicals and a variety of methods of application of these chemicals have been investigated in addition to the standard herbicides and arboricides.

(i) HERBICIDES

(a) NURSERIES

Preparations of Methylbromide, Chloropicrin, Vidasol (Aminotriazol), Symmetric triasins, (Simasin, Atrasin, Propasin, Ipasin and others), Dalapon with 2, 4 Dichlorophenoxy acetic acid (2,4.D), Dinitrocresol is being used in the nurseries. Among these preparations, symmetric triasins are found to be very effective against seedlings of weeds.

(b) PLANTATIONS

Vidasol, Dalapon, and Urea preparations such as Monuron, Diuron, feruson and Semasin are very effective in the elimination of weeds in plantations. Another advantage is that these herbicides remain in the soil for a longer period without undergoing disintegration.

(ii) ARBORICIDES

Arboricides are used in the elimination of unwanted trees and shrubs in plantations. Majority of the arboricides are selective in that they act only on certain species of plants. For instance in a mixed stand of coniferous and broad-leaved trees the arboricides affect only broad-leaved trees. The commonly used arboricides are the esters and sodium salts of 2, 4, dichlorophenoxy acetic acid and 2, 4, 5 trichlorophenoxy acetic acid and Arsenic preparations.

(iii) MODE OF APPLICATION

In addition to standard techniques such as aerial spraying, ground spraying, painting and injection a new technique called the AEROSOL treatment is employed both in the application of chemicals in the control of weeds and unwanted trees and also in the control of forest diseases and insects. Essentially Aerosol is made by vaporizing benzene and mixing with oil soluble chemicals and sprayed in the form of a cloud which could cover a wider area than the conventional spraying method.

(c) Forestry in Mountain regions

(i) CAUCASUS

The Caucasus mountain lies south of the European part of the U.S.S.R. and is divided into two regions :

Northern Caucasus and Trans Caucasus.

The maximum height is in the region of 4000-5000 metres.

Five principal forest belts are recognized :

- (a) The belt of Oak forests of sub-montane regions (up to 600—700m. from sea level).
- (b) The belt of beech forests (700—1000m. from sea level)
- (c) The belt of Abies—Spruce forests (1000—2000m. from sea level)
- (d) The Sub-Alpine belt (2000—2200m. from sea level).
- (e) The Alpine belt (more than 2200 m. from sea level)

The total forest area is about 8.6 million hectares and about 33% is occupied by beech stands (*Fagus orientalis*). The soil is calcareous and is reddish in the south and yellow in the northern parts.

The following species are found :—

(i) Broad-leaved species which comprise the main stand are :—

Quercus petraea—Durmast oak)

Quercus iberica—(Iberian oak)

Quercus imertina—(Imertin oak)

Quercus hartwissiana—(Hartric oak)
Castanea sativa—(Chestnut)
Fagus orientalis—(Eastern birch)
Alnus barbata—(Barbed alder)
Tilia caucasica—(Caucasican linden)
Acer campeotic—(hedge maple)
Acer laetum—(light maple), and
Carpinus caucasica—(Caucasican hornbeam)

Besides these there are also species of *Diospyros peterocarya*, and *Ficus*.

The undergrowth consists of species of *Rhododendron*, *Ilex* and *Ruscus* spp.

There are plenty of lianas e.g. *Hedera colchica*, *Periploca graeca*, *Smilax excelsa*, and *Vitis* spp.

Chestnut is predominant on low calcareous soil and on humus calcareous soil are found *Buxus colchica* (Box tree) and Grecian laurel (*Laurus nobilis*). The conifers are represented by *Taxus baccata* (Yew tree) and *Pinus pithyusa* (Pitzurida pine).

The heterogeneous composition and relief of the Caucasus demand different techniques of exploitation and planting. In the Black Sea coast of the Caucasus slopes up to 20°, which are rich in oak and chestnut are clear felled. In other areas specific felling techniques are advocated. Felling, logging and extraction are mechanized.

When reforestation is undertaken great importance is paid to soil conservation measures, which are aimed at preventing soil erosion. Depending on the slope different techniques are practised. On mountain areas with slopes up to 9° the entire area is mechanically ploughed and planted. In areas with slope between 9°-13°—ploughing and planting is done in strips. In region with slopes greater than 13° terracing is advocated.

(ii) MOUNTAINS IN CENTRAL ASIA

The Central Asia occupies a territory of 180 million hectares and almost 1/3rd of it is mountainous (58 million ha.). The maximum height is about 7,000 metres. The Central Asia is characterized by dry continental climate with wet spring, dry summer and very cold winter. Two big rivers Syr-Daria and Amu-Daria along with Ili, Chu and Tales are the sources of irrigation. Soil is varied ranging from typical dark grey soil in the foot hills to cinnamonic soil rich in humus in the higher elevations.

Afforestation techniques are similar to those advocated in the Caucasus. In addition to growing of timber species, orchards and vineyards are also established.

(d) Afforestation in Sandy areas

In Central Asia there are two big deserts: Karakums and Kizilkums (total extend being about 80 million ha.). The annual temperature is around 17° C (maximum 48° C and minimum 29° C). The annual precipitation is 80-150 m.m. The winter is short, summer hot and long—prolonged stormy winds are common. 7-8 per cent. of the area is shifting sand and the rest covered by vegetation.

There are two great rivers Amu-Darya and Syr-Darya.

The vegetational climax is represented by: *Salsola richteri*, *Salsola paletzkiana*, *Calligonum arborescens* and other species of *Calligonum* and most important of all, the Saxual (*Haloxylon*) which is a dominant form. White saxual (*H. persicum*) is commonly found in dry, saline areas associated with species of *Carex* and serve as pasture for cattle and sheep in the Kara-Kum. The black saxual is found in sandy-loamy soils and unlike the white saxual it can withstand salinity to a greater extent. It provides excellent fuel and is also used in sand fixation and afforestation of the deserts.

In the past considerable damage was caused by shifting sand to irrigated lands. About one hundred hectares of irrigated land were annually buried. Many empirical methods were used without success. Scientific approach to the problem of fixing sand began in 1927.

The following methods are used :—

- (i) Mechanical protectors made of local grass which are planted in rows or cages.
- (ii) Establishment of life barriers by sowing seeds of Saxual by 'airplanes'.

(e) Shelterbelts

The steppes in the Central Asia are the main regions of Agriculture. The soil is highly fertile but the drawbacks are salinity the strong desiccating wind and dust storm coupled with high temperature and low humidity. These climatic conditions are unfavourable for the establishment of vegetation. Several measures are taken to ameliorate the climatic and edaphic conditions in these regions—salinity is reduced by resorting to drainage measures and the effect of strong desiccating wind is minimized by the establishment of shelterbelts.

The following species are used in Shelterbelts :—

- (a) *Robinia pseudoacacia*
- (b) *Gleditschia triacanthus*
- (c) *Populus nigra*
- (d) *Populus bolliana*
- (e) *Ulmus pinnata-ramosa*
- (f) *Quercus pedunculata*
- (g) *Platanus orientalis*
- (h) *Fraxinus viridis*
- (i) *Fraxinus pubesceus*
- (j) *Acer platinoides*
- (k) *Salix alba*
- (l) *Juniperus* spp.
- (m) *Deodar orientalis*
- (n) *Ailanthus* spp.
- (o) Several shrub species.

Among these *Robinia pseudoacacia*, *Fraxinus pubesceus* and *Ulmus pinnata-ramosa* are highly drought resistant and can tolerate salinity to a high degree.

There are three distinct types of shelterbelts, viz., windproof, permeable and porous.

The effect of shelterbelt on the yield of cotton has been studied in the Fergana region, situated south east of Tashkent. There is strong wind in these regions (17-30 metres per second). In the absence of shelterbelts the cotton seeds which are sown are covered and deeply buried in sand by the strong wind. Considerable damage is done to the aerial parts of the plants, generally the tender parts get scorched and broken off resulting in low yield. The establishment of shelterbelts has tremendously improved the yield of cotton.

EFFECT OF SHELTERBELTS ON THE YIELD OF COTTON IN THE FERGANA REGION

<i>Type of Area</i>	<i>Cotton in 100 Kg/Hectare</i>			
	1961	1962	1963	Average
Without Shelterbelt	.. 14.2	.. 15.2	.. 22.7	.. 17.4
Shelterbelt covering less than 50% of the area	.. 17.5	.. 21.0	.. 25.0	.. 21.2
Shelterbelt covering more than 50% of the area	.. 21.9	.. 26.9	.. 31.4	.. 26.5

4. PROTECTION

(A) Organization

The forest protection service in the U.S.S.R. is under the control of the Republic Central Boards; under which there are several Forest Plantation Boards (equivalent to divisions) and Forest Husbandaries (equivalent to ranges).

Research work is carried out by Forestry institutes and Forest experimental stations. The institutes have pathological, entomological, toxicological and other laboratories.

Periodic ground and air inspections are carried out to detect any outbreak of diseases or pests and as soon after the detection of any disease or pests intensive investigations are carried out by the Pathologists and Entomologists to find out the causative organisms and remedial measures are recommended.

ORGANIZATION OF FOREST PROTECTION SERVICE IN U.S.S.R.

Main Dept. for Forest protection against fire, diseases and pests
(Under Specialists on forest protection)



Board on Forest Protection
(Each republic has an independent Board)



Regional Boards on Forest Protection
(Under Senior Forest Pathologists and Entomologists)



A group of Forest Farms
(Under inter-district forest pathologists and entomologists)



16 Forest Farms *
(Supervised by Forest Protection Engineers)

* Forest Farm is about 10-15 Ha. in extent.

(B) The Common Pests and Diseases

(i) THE COMMON PESTS OF PLANTATION SPECIES IN U. S. S. R.

<i>Host</i>	<i>Pest</i>	<i>Parts Affected</i>	<i>Type of Attack</i>
1. Coniferous (General)	plants		
	<i>Dendrolimus sibiricus</i> * ..	Foliage	.. Defoliation
	<i>Dendrolimus pini</i> *		
	<i>Panolis flamea</i>		
	<i>Bupalus piniarius</i>		
	<i>Hylobius abietis</i>		
	<i>Monachamus species</i>		
	<i>Evetvia turiona</i>		
	<i>Diprion sertifer</i> *		
	<i>Blastophagus piniperda</i> ..	Bark and trunk	.. Borers
	<i>Ips species</i>		
	<i>Phaenops cyanea</i>		
	<i>Pissodes piniphillus</i>		
	<i>Pityogenes icutensis</i>		
	<i>Monachamus species</i>		
	<i>Dendroctonus species</i>		
	<i>Polygraphus species</i>		
	<i>Aradus cinnamomeus</i> ..	Seedlings in Nurseries	Damage to tender parts
	<i>Hylobius abietis</i>		
	<i>Evetria buoliana</i>		
	<i>Evetria duplana</i>		
2. Broad leaved species (General)			
	<i>Porthetria dispar</i> ..	Foliage	.. Defoliation
	<i>Euproctis species</i>		
	<i>Malacosoma neustria</i>		
	<i>Dusychira pudibunda</i>		
	<i>Phalera bucephala</i>		
	<i>Notodonta anceps</i>		
	<i>Operopnthera burmata</i>		
Fagus	..	<i>Carpocapsa grossana</i> ..	Seeds
Poplar	..	<i>Cryptorrhynchus spp.*</i> ..	Stem
		<i>Parantherene spp.*</i>	.. Borer
		<i>Agrius viridis*</i>	
		<i>Melanophila picta*</i>	
		<i>Saperda populnea*</i>	
Quercus (Oak)	..	<i>Tortrix viridana*</i> ..	Foliage
		<i>Operopnthera burmata</i>	.. Defoliation
		<i>Hibernia defoliaria</i>	
		<i>Ocnoria dispar*</i>	
		<i>Euproctis chrysorrhoea</i>	
		<i>Carpocapsa splendana*</i> ..	Acorns
		<i>Carpocapsa grossana*</i>	
		<i>Curculio glandium*</i>	
Juglans (Walnut)	..	<i>Hypnomeuta malinellus</i> ..	Leaf
		<i>Hypnomeuta padellus</i>	Leaf
			.. Leaf eaters
			Leaf eaters

* Dangerous pests.

(ii) COMMON DISEASES OF PLANTATION SPECIES IN U.S.S.R.

(a) FOLIAGE DISEASES

<i>Disease</i>		<i>Causative Organism</i>	<i>Species Attacked</i>	<i>Distribution</i>
Brown patch leaf	..	<i>Cylindrosporium castanicola</i> , Berl.	<i>Castanea sativa</i> Mill	N. Caucasus and other regions
Leaf black spot	..	<i>Pestalotia funera</i> . Fr.	<i>Quercus Suber</i> L ..	do.
Do.	..	<i>Marssonina juglandis</i> p. Magn.	<i>Juglans regia</i> L ..	do.
Anthraxose	..	<i>Gleosporium platani</i> (Lev.) Qud.	<i>Platanus orientalis</i>	do.
Mildew	..	<i>Mycrosphaerella alphitoides</i> , Griff.	<i>Quercus iberica</i> and <i>Castanea sativa</i>	do.
Do.	..	<i>Oidium dubium</i> Yaek	<i>Quercus suber</i> ..	do.
Do.	..	<i>Phyllactinia suffulata</i> , Sacc	<i>Fagus orientalis</i> ..	do.
Red rot of conifer needles	..	<i>Bophodermium pinastri</i>	<i>Pinus</i> (all species)	do.
		<i>Lophodermium juniperinum</i>	<i>Juniperus oxycedrus</i>	do.

(b) STEM AND BRANCH DISEASES

1. <i>Rust</i>	..	<i>Gymnosporangium</i> spp.	<i>Juniperus</i> (all species)	Caucasus and other regions
2. <i>Necroses</i>				
(a) Black	..	<i>Melanconium juglandium</i> Kze.	<i>Castanea sativa</i> Mill and <i>Juglans regia</i> L	do.
Do.	..	<i>Cytospora ceratophora</i> Sacc	<i>Castanea sativa</i> Mill	do.
Do.	..	<i>Diatrype stigma</i> Fr.	<i>Quercus</i> (all species)	do.
(b) Brown	..	<i>Phomopsis castanicola</i> W	<i>Castanea sativa</i> ..	do.
Do.	..	<i>Phoma juglandis</i> ..	<i>Juglans regia</i> L. ..	do.
3. <i>Blight</i>	..	<i>Endothia parasitica</i> (Murr) And et And	<i>Castanea sativa</i> <i>Quercus iberica</i> , <i>Fagus-orientalis</i> and <i>Quercus suber</i>	
4. <i>Hydrops</i>	..	<i>Ervinia multivora</i>	<i>Abies normandiana</i>	
5. <i>Cancer</i>	..	<i>Pseudomonas tumefaciens</i>	<i>Castanea sativa</i>	
6. <i>Rot</i>				
(a) Brown rot	..	<i>Polyphorus sulphureus</i> Fr.	<i>Castanea sativa</i> ..	General
		<i>Daedalea quercina</i> Fr.	<i>Quercus iberica</i> ..	do.
		<i>Fistulina hepatica</i> Fr.		do.
Do.	..	<i>Fomes juniperinus</i> Fr.	<i>Juniperus excelsa</i>	do.
Do.	..	<i>Polyporus dryadeus</i> Gr.	<i>Quercus</i> (all species)	do.
(b) White rot	..	<i>Ganoderma lucidus</i> Sacc.	<i>Quercus</i> (all species)	do.
Do.	..	<i>Ganoderma applanatus</i> Fr.	<i>Carpinus caucasica</i>	do.
Do.	..	<i>Ganoderma pinicola</i> Fr.	<i>Fagus orientalis</i> and <i>Abies normandiana</i>	do.

(ii) COMMON DISEASES OF PLANTATION SPECIES IN U. S. S. R.

<i>Disease</i>	<i>Causative Organism</i>	<i>Species Attacked</i>	<i>Distribution</i>
(b) White rot	.. Polyporus squamosus Fr.	Fagus orientalis ..	General
Do.	.. Fomes fomentarius Fr.	do. ..	do.
Do.	.. Stereum hirsutum Fr. Hydum lac-teum Fr.	Quercus (all species)	do.
(c) Yellow	.. Fomes houtigi Fr.	.. Abies normandiana Sov.	do.
Heart rot	.. Fomes rimosus (Beak). Fr.	Pistachia vera L. ..	do.
Fruit rot	.. Monilia pistaciae-Zapr.	do. ..	do.

(iii) DISEASE CAUSED BY PARASITIC ANGIOSPERM

Dying off*	.. Razoumowskia oxycedri, Hoftn.	Juniperus (all species)	Widespread
------------	----------------------------------	-------------------------	------------

* Similar to Loranthus attack on Teak found in the Dry Zone forests of Ceylon.

(C) Control Measures

(a) PROPHYLACTIC MEASURES

(i) SANITARY FELLING

This operation involves the removal of trees which promote the breeding of forest pests and pathogens.

The sanitary felling includes—

- (1) removal of dead trees ;
- (2) removal of trees infected with pests and pathogens ;
- (3) felling of trees to be utilized as "CATCH TREES".

(II) DISPLAY OF "CATCH TREES"

Week, infected, defective and remnants of felled trees are used as "Catch trees"—These catch trees act as an alternate host and attract the pathogens and pests without allowing them to spread among the healthy trees. The "Catch trees" are displayed at a definite time of the year, which is predetermined by taking into consideration the local climatic conditions.

(III) BREEDING OF DISEASE-RESISTANT TREES

(b) CHEMICAL CONTROL

- (1) D. D. T.-5.5 per cent.-10 per cent. dust are used to control foliage pests of conifers and broad-leaved species. (About 15-20 kg. are used per hectare.)

Oil emulsions of D. D. T. are also used—

about 12-15 litres of emulsion are used per hectare amounting to 1 kg. hectare of D. D. T.

- (2) Benzene hexachloride—Application similar to D. D. T.
- (3) Sulphur—Used against mildews 25-35 kg. ha.
- (4) Bordeaux mixture—Used against mildews 3.5 per cent. solution.

- (5) *Dinitrocresol*—1 per cent solution used against fungal disease.
- (6) *Zinc phosphide*—used as a bait mixed with cake meal to combat pests of grains and seeds.
- (7) *Sulphates of anabasin, nicotine thiophosphates*—used against sucking insects.
- (8) *Sevin or Calcium arsenate*—used against leaf pests.
- (9) 4 per cent. Phenol
- (10) 10 per cent. Keam and 6 per cent. 2,4D
- (11) Granozen (1 g/1 kg. of seed)
- (12) Mercuran (1.5 g/1 kg of seed)
- (13) Tetramethyl thiuran—disulphide
- (14) Phosphamid
- (15) Chlorophos
- (16) Dinitrorhoden benzene—used against seedling diseases in nurseries
- (17) Endobacterin—3
- (18) Dendrobecelin
- Effective against
spores of fungi
Effective against
pests and diseases
of seeds.
Effective against pests of conifers.
Effective against pests of conifers and orchard
plants.

(c) BIOLOGICAL CONTROL

Investigations are being carried out on biological control of pests.

Dendrolimus pini, a serious pest of pines is controlled by two hypoparasites belonging to the order Coleoptera—*Telonomus* and *Trichogramma*.

(d) MODE OF APPLICATION

In addition to common methods of application such as dusting, spraying (ground and aerial), a special technique called AEROSOL is employed in the application of oil soluble pesticides, insecticides and also herbicides and weedicides.

Essentially the Aerosol consists of vapours of benzene mixed with oil soluble chemicals and sent out in the form of a cloud which covers a larger area than the conventional spraying methods.

5. FORESTRY INSTITUTES, ETC. VISITED DURING THE TOUR

1. All Union Scientific Research Institute of Silviculture and Mechanization in Forestry (Puskino, Moscow)

It has five hundred specialists on the professional staff, and among them there are ninety doctors of Science and doctors of Philosophy and 250 masters and bachelor of Science. There are ten experimental stations under its supervision. The institute has the following laboratories:—Soil, Biology, Physiology, Silviculture, Mensuration, Mechanical, Fire Control, Designing, Entomology, Pathology, etc. About 1.1 million rubles are allocated by the Government to carry out research, etc., in this institute.

2. Leningrad Scientific Research Institute of Forestry

The staff consists of a director, three deputy directors and a scientific staff of 35 members; among these are 6 Ph.D. and D.Sc. holders and 25 Senior Scientists.

The institute has 15 departments and laboratories dealing with the different aspects of Forestry.

3. Lindulov forest (Larch stand)

This forest was founded in 1738 by FOCKEL on the advice of Peter the First to grow Larch and Oak to build ships.

It is situated 63 km N. W. of Leningrad and 7 km from the coast of the Gulf of Finland.

The soil is podsolized, sandy loam, well drained with fair proportion of humus. It is 50 m above sea-level and undulating.

Seeds of *Larix sibirica* were brought from Archangelsk and planting on an area of 22 ha took place from 1843 onwards. These trees exhibit remarkable growth and have been described in Russian Literature.

The Larches are mixed with Spruces and pines in the present state.

The maximum diameter recorded for Larch is 68 cm. on and maximum volume is 5.9 m

4. Siversky forestry farm, Leningrad

It is situated 70 km south of Leningrad, in the southern part of the taiga zone. This farm is under the Leningrad Forest Research Institute and various forestry experiments are carried out here. There are experimental nurseries, laboratories, cone-drying equipment, fire and chemical experimental stations etc. Work is mechanized and about 250 workers are employed.

In this farm the delegates were shown experimental plots which have been treated with arboricides, sample plots where drainage has been tried and also modern forest fire fighting gears and their usage.

5. Forest Research Station, Sochi

It is situated on the Black sea coast of the Caucasus and founded in 1944. These is a dendarium and nursery and the total area is about 60 hectares.

The station has the following sections : Silviculture, Forest Parks, Forest protection, Forest mechanization and Soil science. There are 32 Specialists attached to the station among them there 8 Candidates of Science and 24 Science degree holders.

6. Sochi Dendarium

This is situated in the Sochi Forest Research Station and was founded in 1892. It is situated under sub-tropical climatic conditions and there are more than 1600 species from various parts of the world grown here.

Topics presently studied here are—

- (i) Chestnut forests and the reason for their extinction
- (ii) Cultivation of Cork Oak
- (iii) Acclimatization of exotics and study of their growth characters.

7. Taxus and Box grove, Sochi

Situated 16 km south of Sochi and covers about 300 hectares. Some specimens of *Taxus baccata* (Yew) are more than 1000 years old.

8. "Southern Crops" Park

Situated near Adler, south of Sochi, is about 16 ha in extent. There are about 400 tree species among them there some unusual species such as *Liriodendrons*, *Magnolias* and *Victoria regia*.

9. Scientific Institute of Middle-Asia—Tashkent

There are eleven departments dealing with the different aspects of forestry and the main field of activity are the fixation of sands, afforestation and pasture improvement in sand deserts.

Several collective farms, state farms, and botanical gardens etc., were also visited during the tour.

5. SOME TECHNIQUES AND EQUIPMENT ETC. WHICH COULD BE TRIED IN CEYLON

(a) Breeding of teak by application of technique used in the hybridization of Poplars

Poplars, like Palmyrah (*Borassus flabellifer*) are dioecious. Cross fertilization between favourable species is affected by using mature cutting with floral buds. The cuttings are grown in culture solutions and when the floral buds open artificial pollination is carried out. This method has a distinct advantage in that it can be performed in the laboratory and several crossings could be carried out during a short period of time.

This technique with a slight modification could be used in the breeding of Teak (*Tectona grandis*). It is generally believed that the meristems are as old as the tree. If vegetative buds from teak trees which are flowering are grafted on to striplings of teak, the grafted bud should flower early, and the flowers of these could be pollinated by pollens from similar grafts having beneficial qualities.

(b) Chemical control of *Razoumowskia oxycedri* on *Juniperus*

Species of *Juniperus* are attacked by the Angiospermic stem parasite *Razoumowskia oxycedri* and it is controlled by the application of chemicals such as 2,4.D ; and Sodium arsenite.

A similar problem is encountered in the dry zone teak forests of Ceylon. In plantation which are moderately thinned the trees are parasitized by species of *Loranthus*. Some empirical control methods have been tried in the past without much success.

It is worth trying the application of chemicals such as 2,4.D and sodium arsenite etc. ; on a very systematic way. But one of the drawback is that both teak and *Loranthus* being broad-leaved species the application of hormonal herbicide such as 2,4 D will affect both species.

(c) Shelterbelts

The Mannar area (North Western Coastal part of Ceylon) is characterized by strong desiccating wind and salinity of soil. The establishment of "Shelterbelts" with species such as *Robinia pseudoacacia*, *Gleditschia triacanthus* etc. could be tried in these areas with a view of improving the climate.

The establishment of shelterbelts in the Up-Country could be intensified by the introduction of new species.

(d) "Aerosol"

This could be used in the application of herbicides, weedicides, pesticides and insecticides. It has the following advantages:

- (i) Operation cost is low compared to conventional methods of application of herbicides etc.
- (ii) Aerosol spray covers a larger area than other sprays.
- (iii) In one shift 500—100 hectares could be sprayed.

(e) The weedicides, herbicides, pesticides and insecticides mentioned earlier could be tried to determine their effects under local conditions.

6. CONCLUSION

The Soviet forests being very extensive the accent is on mechanization and every aspect of plantation, management and exploitation work is done mechanically. In the field of afforestation in the mountains and steppes great strides have been made. The work carried out in the Caucasus and "Hungry steppes" in the Fergana region are outstanding examples of contribution of forestry in the amelioration of the microclimate and soil conditions. The "Hungry Steppes" which were vast areas of deserts before the October revolution have been changed into fertile land with vast acreage of Cotton, vineyards and orchards by the establishment of shelterbelts and green zones.

Forest protection work is given top recognition. There are several research institute where mycological, phytopathological, entomological researches are carried out. A considerable sum of money is spent on these researches. The fire fighting service is better organized, and is equipped with modern gears.

The application of new herbicides, weedicides, pesticides and insecticides have been tried with tremendous success.

7. ACKNOWLEDGMENT

The writer wishes to thank the Government of Ceylon for nominating him to represent Ceylon at the Seminar and Study Tour and also the Food and Agriculture Organization of the United Nations and the Soviet Government for extending the invitation to attend the Seminar and Study Tour.

Insects commonly found in the Teak Nurseries of Ceylon

By S. N. U. FERNANDO

SOME of the most common insect pests which causes damage to Teak in the nurseries of Ceylon, are listed below. Included in this list are two useful predators that prey on Aphids.

The Teak nurseries of Ceylon are located in the Dry Zone which receives an annual rainfall of 50" to 75" mainly during the North East Monsoon that blows from October to January.

<i>Biological type</i>	<i>Insect</i>	<i>Function</i>
Seed borer	.. <i>Lasioderma serricorne</i> (Anobidae)	Bores holes in seeds
Root destroyer	.. <i>Oryctes rhinoceros</i> (Scarabaeidae)	Cuts seedlings in two at root
Defoliators	.. (a) <i>Hyblaea puera</i> (Lepidoptera)	Skeletonises leaf or eats all soft tissue except large ribs.
	(b) <i>Aularches</i> (Acrididae)	.. Mines holes in leaf
Skeletonisor	.. <i>Hapalia</i>	.. Only skeletonises leaf
Sap suckers	.. Aphids	.. Cause leaf curl and shrivel
Predators	.. <i>Adonia variegata</i>	.. Feeds on Aphids
	<i>Chilomenes sexmaculata</i> (Coccinellidae)	.. do.

(a) Seed borers

The seed borer of Teak, *Lasioderma serricorne* is a member of the Anobidae but it could be easily mistaken for a Scolytid. The insect is brown in colour, and is about 2 mm. in length. This insect does damage in the winged imago stage by boring into the living seed and thereby destroying it.

To determine the extent of damage this insect causes to seed, 4 random samples of 1,000 seeds were taken from each of three localities in the Batticaloa district and all seeds that were bored in them were counted. The results tabulated below indicate that these insects cause extensive damage to Teak seeds; for every 15 lbs. of seed sown in a nursery bed, as is the practice today, 21 lbs. could be rotten, if they have originated from Pullumalai.

<i>Seed origin</i>	<i>Total no of seeds examined (4 samples)</i>		<i>No. of seeds bored by <i>Lasioderma</i></i>		<i>Per cent. of seeds damaged</i>
Vellawali	..	4,000	..	600	15%
Vakeneri	..	4,000	..	720	18%
Pullumalai	..	4,000	..	520	13%

(b) Skeletonisers

Hapalia macheralis (Pyralidae)

This insect feeds mainly on Teak. Its eggs are green in colour, and they are usually laid singly on the underside of a Teak leaf. The newly-hatched caterpillar is initially white in colour but it soon changes to green. This caterpillar measures from 22 to 25 mm. in length. Each segment of its body has four black dots marked on it. Another character this larvae has, in common with other Pyralidae, is the setae that cover its body. This

larva, lives and feeds under an open shelter made of strands of white silk. It is only this larval stage that does damage to Teak. The larval stage was estimated to last from 8 to 12 days.

All stages of this larva feed on the soft green tissue of a leaf, but unlike in the case of *Hyblaea*, no veins are eaten. The leaf thus has the appearance of being skeletonised.

The larva pupates in a soft silky cocoon built on the underside of a leaf. This cocoon is readily indentified as that belonging to *Hapalia* by the linear row of small holes along its margin with the leaf.

In the case of *Hapalia* skeletonising occurs repeatedly, as there are several generations a year.

Endrex was found to be very effective in preventing injury to Teak from this source; the same dosage that was used towards off *Hyblaea*, can be used in this case too, but spraying must be done often at least once a month.

It may be noted that the damage to Teak seedlings from *Hapalia* is not so great as that from *Hyblaea*.

(c) Root destroyers.

(Cockchafers)

The most common root destroyer of Teak seedlings in Ceylon nurseries is the Rhinoceros beetle, *Oryctes rhinoceros*. This beetle does damage only in the larval stage. The larva lives underground, and it eats the roots of very small Teak seedlings which are less than a month old and no more than a quarter of an inch thick.

The larva is very large and can measure up to 70 mm. in length when fully developed. It also has the characteristic 'C' shape of the cockchafers. The distinguishing features of this larva are its distended greyish blue anal segment and the two conspicuous lateral rows of spiracles on its abdomen.

The primary food of these cockchafers is really the weed *Cyperus rotundus* which abounds in these nurseries, but they switch on to Teak seedlings when this weed is scarce, as for example, when the beds are weeded.

An effective method of controlling these pests is to dig them out wherever they are found and to kill them. Deep trenches dug between two successive nursery beds also confine the movements of these grub.

(d) Defoliators

(i) *Hyblaea puera* (Lepidoptera)

The insect which causes the most extensive damage to Teak saplings in the nurseries of Ceylon, is *Hyblaea puera*. Teak appears to be its principal food plant but it also has an alternative source of food, *Vitex pinnata*.

The eggs of this insect are white in colour, and are laid singly on a leaf. The eggs are first noticeable in August in the nurseries. The eggs stage was estimated to last 3 to 4 days. The newly hatched caterpillar is greenish yellow in colour and when fully grown it measured from 20 to 30 mm. in length. The mature caterpillar can be of various colours but it has conspicuous longitudinal lines marked on its dorsal and lateral sides;

another feature is its black head. The larval period was estimated and it appears to last from 10 to 15 days on the average. The easiest way of recognizing this caterpillar is by the nest it builds. The larva feeds in the night on the Teak leaves but during the day it hides in a silken shelter made of pure white strands of silk. This shelter is built on the underside of a leaf inside a rolled-over portion of it. The shelter is very compact. In its initial stages the larva skeletonises the leaf when feeding and in its later stages it eats all the soft tissue, except the big veins.

The larva pupates on the leaf in a silken cocoon it builds for itself. The pupae are dark brown in colour and they vary in length from 14 to 18 mm. The pupal period is short and it was estimated to last about 5 days which usually falls in September.

After September, no further defoliation was noticed from this source. Large numbers of these insects die if rains occur. During the North East Monsoon the nurseries were absolutely free of this disease.

The incidence of this disease was highest in August and September. Complete control of the disease was effected by spraying Endrex 20 insecticide in early August. Though varying dosages of this insecticide were tried, such as 3, 6 and 9 ozs. to a gallon of water, it was found that 3 ozs. to the gallon was quite adequate to effect complete control of the disease. Besides, the spraying needs to be done only once a year.

(ii) *The short horned grasshoppers (Acridae)*

The species of short horned grasshopper that causes injury to Teak seedlings is *Aularches miliaris*. The hopper has a conspicuous tubercle on its ventral side between its anterior pair of legs. The adult hopper feeds on Teak leaves. These insects are most common from May to November. They too die off in large numbers during the rains. It was also found that the dosage of Endrex which was effective in controlling *Hyblaea*, was effective in preventing the hoppers i.e., 3 ozs. per gallon of water but in this case, the spraying must be done monthly.

(e) *The Sap Suckers*

These yellow Aphids are easily recognized by the pair of tubercles projecting from the dorsal side of the abdomen. These insects suck the sap of the Teak leaves causing the margins of the leaves to curl and shrivel. These Aphids are also responsible for the black sooty mould one often sees on Teak leaves. This fungus lives on the sugar secreted by the Aphids.

In the case of Aphids too, Endrex must be sprayed monthly to effect complete control.

It was also found that two Coccinellids, *Adonia vareigata* and *Chilomenes sexmaculata*, prey on Aphids.

Adonia is orange yellow in colour with black markings or spots, while *Chilomenes* is yeellow with black spots. These Coccinellids must be encouraged at all costs because they effect biological control of the Aphids; Endrex, unfortunately, has the reverse effect.

Teak in Ceylon Nurseries

By S. N. U. FERNANDO

THE knowledge on nursery Tea (*Tectona grandis*) is very limited in Ceylon. Generally, this information is called from neighbouring sources, particularly Indian, but it may not be really applicable in Ceylon; for this reason, an endeavour was made to gather some important information pertaining to Teak in Ceylon nurseries too.

These Teak nurseries are located in the Dry Zone (Temp. 80°F) which receives an annual rainfall of 50 to 75", mainly during the North-East Monsoon from October to February. The beds in these nurseries are of standard size and they measure 40 ft. by 4 ft. These beds are clean weeded regularly and watered daily.

Normally, 15 lbs. of seed are sown in each nursery bed. This quantity is considered to be over and above what is required to give a full stocking of plants in a bed. The plants that germinate are allowed to grow for 6 to 9 months, before they are considered ready for planting out. At these ages the plants are 2 to 3 ft. in top height.

The maximum capacity of a nursery bed

A sample of 500 fully stocked beds was selected in the best stocked nursery in Ceylon at planting out time, and a count was taken of all the plants in each of these beds. All the plants in these beds were uprooted and counted again. The final results indicated that only 4 beds yielded over 2,000 plants, i.e. 2,250, 2,050, 2,020 and 2,011. Therefore 2,250 can be considered to be the maximum capacity of a nursery bed in Ceylon, to date.

The average stocking of a nursery bed

The random sample of 30 beds was selected in a nursery at pricking out time. As before, all the plants in these beds were uprooted and counted. These beds yielded a stocking of 41,700 plants: this gives an average of 1,390 plants per bed. Of these, about 1,000 plants are utilizable for plantation work (as 27 per cent. of the plants in a bed are generally unutilizable).

Results of the count

862, 1,981, 1,643, 1,613, 1,306, 1,406, 831, 1,625, 982, 801, 1,002, 1,385, 1,356, 1,297, 1,698, 1,456, 1,447, 1,253, 760, 762, 1,630, 1,634, 1,678, 1,954, 1,565, 1,435, 1,595, 1,620, 1,610, 1,513 = 41,700 plants.

= 1,390 (Average) per bed.

TABLE SHOWING THE PERCENTAGES OF UTILIZABLE AND UNUTILIZABLE STUMPS IN A SAMPLE OF 24 BEDS

Stump sizes	Total Percent-																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
0.0.4" (Unutilizable)	1010	576	748	264	208	224	124	54	300	760	881	260	238	335	209	266	250	220	160	806	669	435	483	301
0.4" to 0.8" (Utilizable)	1094	960	1142	871	760	463	519	397	1226	1141	874	384	785	1176	1120	1203	900	1002	728	1042	1150	901	863	1225
Over 0.8" (Utilizable)	146	121	121	171	138	144	73	150	152	153	139	70	128	126	115	154	121	130	72	165	121	111	103	142
																								9%

Percentage of utilizable stumps per bed

A sample of 24 beds was selected at random in a nursery, in which the plants were ready for pricking out. The plants in each bed were uprooted and they were separated into 3 size classes on the basis of the measurements they show at the thickest point of the roots. The stumps in the smallest size class (0 to 0.4") were considered to be unutilizable. Thus the table annexed indicates that only 73 per cent. of the stumps in the beds were utilizable while the balance 27 per cent. were unutilizable.

Storage of stumps

Fresh stumps, stored for varying periods in an exposed place, showed different powers of sprouting when planted out (see table below). It appears that stumps of average size (0.4 to 0.8") can be stored for 2 to 3 weeks without appreciably losing their vitality. In India too, stumps retain their vitality for similar periods. This experiment was carried out in duplicate.

<i>Period of storage (Weeks)</i>	<i>No. of stumps stored in 2 lots of 100 each</i>	<i>No. of stumps that sprouted after planting</i>	<i>Percentage of stumps that sprouted vitality</i>
1 week	200	196	98%
2 weeks	200	194	97%
3 weeks	200	164	82%
4 weeks	200	156	78%
5 weeks	200	96	48%
6 weeks	200	20	10%
7 weeks	200	0	0%
8 weeks	200	0	0%

Time of sowing and pretreatment

The current nursery practice in Ceylon is to pretreat seeds for 2 weeks by alternately soaking them in water and drying them out daily, before they are sown. These seeds are sown in March, immediately after the N. E. Monsoon. However, it was thought that if the seeds were sown during the monsoon itself, then no pretreatment would be necessary, as the pretreatment is bound to occur on the ground. Therefore, 30 beds were sown (with 15 lbs.) with seeds without any kind of pretreatment, in the latter part of the monsoon rains, in January. Great care was also taken to see that all the seeds were disease free, and that all were from one source (Vellaveli). When the seedlings were mature they were uprooted and counted. The 30 beds yielded 49,350 plants, which gives an average stocking of 1,645 plants per bed ; this is well over the average for the whole nursery (as seen earlier).

Therefore, the time consuming and the costly step of pretreatment of seeds could be eliminated, provided advantage is taken of the monsoon rains.

BIBLIOGRAPHY

- GRIFFITH (1941)—*Indian Forest Record*, Vol. 4. No. 5.
TROUP, R. S. (1921)—*Silviculture of Indian trees*, Oxford.

සිංහල තේක්ක සහ එහි පැවැත්ම

ඩී. ඒ. ඇල් වර්ණකුල විසින්

වර්තමාන ලාංකිකයන් වටිනා බඩ සෑදීමට තේක්ක දැව දඩු අගේ කරන බව අපට රහස්‍යක් නොවේ. සෑම නිවසකම තේක්ක ලියෙන් හෝ තේක්ක සහ බුරුනා ලී මිශ්‍රනයෙන් හෝ තනන ලද ගෘහ භාණ්ඩත්, වෙනත් බඩ බාහිරාදියත් ඇතිවීම, එම තේක්ක ලියේ පුරසාරම මොනවට ගෙනහැර දක්වයි. එපමණක් නොව, ලී උපයෝගී කළ හැකි සෑම දෙයකටම තේක්ක ලී යෝග්‍ය බව දැව දඩු කර්මාන්තයෙහි නිපුණ අය පවසති. ගබඩාවන්හි, නා නා කර්මාන්ත සඳහා එදිනෙදා අලෙවිවන ලී අතර, නොයෙක් ශ්‍රේණිවල තේක්ක දැව දකින්නට පුළුවන. ඉන් රැන්ගුන් තේක්ක, ඉන්දියන් තේක්ක, සියම් තේක්ක, සිංහල හෝ ලංකා තේක්ක වශයෙන් වර්ග කර ඇති තේක්ක දැව අප කාටත් හුරු පුරුදුය.

තේක්ක දැව ශ්‍රේණි කීපීමේදී මේ ගස වැඩුන රට මුල් කරගෙන, බුරුමය, ඉන්දියාව, ලංකාව යන්නේ වර්ග කර ඇතත් ඒ දැව උද්භිද විද්‍යාඥයන් නම් කරන ලද “ටෙක් ටෝනා ග්‍රාන්ඩිස්” නොහොත් අප රටේ ව්‍යවහාර කරන තේක්ක නම දරන වාක්ෂයෙන් ලබාගන්නා ලද දැවය. ලංකාවට නුදුරින් ඇති බුරුමය, ඉන්දියානු අර්ධද්වීපය, සියම්, ජාවා සහ අනෙකුත් ඉන්දියානු කොදෙව්වල ස්වභාවයෙන්ම මේ වාක්ෂය සමූහය වැඩෙන කැල ඇත. අප රටට සැහසුම් සිය ගණනකින් එතෙර ඉන්දියාවේ මලබාව, ප්‍රැවැන්කෝර්, පින්තවෙලි යන ප්‍රදේශවල තේක්ක ගස දකින්නට ඇතත් මුහුදින් මෙතෙර හෙලදිවෙහි මෙම ගස ස්වභාවයෙන් වනාන්තරවල දකින්නට ඇත. අප විශ්ලී කලාපයේ කැලාවල දකින්නට ඇති තේක්ක අන්‍ය රටවලින් අප රටට ලැබුණු දායාදයේ වෙති. කෘතීම පුනර්ජනනයෙන් කැල වගා කීපීමෙහි දක්ෂ වන විද්‍යාවාදීන් ස්වභාවයෙන් තේක්ක පිහිටි කැල ප්‍රදේශවල පවත්නා දේශගුණය, වර්ෂාපතනය, උෂ්ණත්වය, පස යනාදිය අප රටෙහි ඇති පස, දේශගුණය යනාදීන් සමග සංසන්දනය කළහ. ඉන් පසු ලංකාවේ වන පාලකවරුන් විසින් විශ්ලී කලාපයේ ඇති අප වනාන්තරවල සාර්ථක ලෙස බෝකර, නැවත වන වගා ක්‍රමය අනුව අක්කර දහස් ගණන් අමිශ්‍ර තේක්ක කැල පිහිටුවා ඇත.

ගසෙහි උස මහත.—ප්‍රැවැන්කෝර් රටේ අවෙන්කොයිල් ප්‍රදේශයේ මුල වටප්‍රමාණය අඩි 16ක් ඇති තේක්ක වාක්ෂයක් බර්ඩ්ලෝන් මහතා ද, දකුණු මලබාර් රටේ එබ්කුවිට් වනාන්තරයේ මුල වට ප්‍රමාණය අඩි 16, අඟල් 8 සහ උස අඩි 192 ක් ඇති තේක්ක වාක්ෂයක් කේ. ආර්. චෙන්කටරාමන් අයියර් මහතා ද සටහන් කර ඇත. අයියර් මහතාගේ වාක්ෂයේ අතු පිහිටා තැන. සෘජු කීද පමණක් අඩි 114 ක් විය. තවද, එච්. වයර්මන් මහතා කුර්ගි රටේ වනාන්තරයක පපුවේ උසින් මනින ලද අඩි 25 අඟල් 2 ක් වට ප්‍රමාණය ඇති වාක්ෂයක් ගැන වාර්තා කර ඇත. මෙම ගසේ කොටන් තුනකින් සහ අඩි 502 ක දැව ලබාගත් බව ද එම වාර්තාවෙන් සැලවේ. තේක්ක ගස අනෙක් කැල ගස්වලින් මුල් තැන ගනී. මුල වට ප්‍රමාණයද, උස ද, ප්‍රයෝජනය සඳහා ලබා ගත හැකි ලීවල සහ ප්‍රමාණය ද සලකා වන පාලකවරු මෙම ගස ලෝකයේ නොයෙක් රටවල ඉතා බහුල ලෙස වගා කරති.

ඇට නවාන් කිරීම.—වසරක් පාසා මාර්තු, අප්‍රියෙල් මාසවල තේක්ක ගසෙහි ගෙඩි හට ගනී. ගෝලාකාර වූ මෙම ගෙඩියක විශ්කම්භය අඟල් 1/2 ක් පමණ වේ. එහි ඉතා සහ කටුවකින් වැසුන කුටා ඇට 3 ක් හෝ 4 ක් හෝ ඇත. කුඩා ඇටය වටකර ඇති සහ කටුව නිසා එය නවාන්කර පැලකර ගැනීම අපහසු කරුණකි. අවුරුදු ගණනා වන අත්දැකීම් ඇති වන පාලකවරු පර්යේෂණ අංශයෙන් ලැබෙන නොමසුරු අවධාද

අනුව මෙම ඇට තවත් කිරීමට පෙර පුරෝහත උපකාර අනු පිළිවෙලක් සකස් කොට ඇත. පැල කිරීම සඳහා හොඳට වැඩුනු මේරු ගස්වලින් කුමානුකූලව තෝරා ගත් ඇට සම්පූර්ණ පැය 12 ක් පිරිසිදු වතුරෙහි බහා, තව සම්පූර්ණ පැය 12 ක් වතුරෙන් ගොඩට ගෙන හෙවනෙහි විසුරුවා නෙතමණය මගහැරෙන්නට ඉඩ හරිති. මේ ක්‍රමය දිනපතා සති 2 ක් මුළුල්ලේ ක්‍රියාවේ යොදවති. ඉන් පසු පිළියෙල කරගත් තවත් වල පැල කරති. එවිට සාර්ථක ලෙස බිජයන් හටගනී. තවත් පිළියෙල කිරීමේ දී ද, පස අඟල් 18 ක් පමණ ගැඹුරට ඉතා සියුම් ලෙස බුරුල් කරති. ඡායා රටෙන් ප්‍රසිද්ධ වූ විද්‍යාත්මක ලිපියක් අනුව පසෙහි ඔක්සිජන් වායුව නිසි ලෙස පිහිටා නොතිබුන හොත් ඉහත අනුසාරයෙන් දින 14 ක කාලයක් පොහවා වේලා ගැනීමෙන් පුරෝහත උපකාර දුන් ඇට සාර්ථක ලෙස පැල නොවන බව ද ස්ථිර ලෙස පවසා තිබේ. එබැවින් තවත් පාත්තිවල පොළොව බුරුල්කර ඔක්සිජන් වායුව නිසි ලෙස පිහිටන සේ සකස් කරති. පළපුරුදු තවත් මෙහෙකරුවෝ පසෙහි වායු මැඩපවත්නා සේ වතුරෙන් පිරි ඉතිරි යෑම වලක්වමින් සුරැබුහුටි ලෙස තවතව වතුර දැමීමේ කාර්ය ඉටු කරති. තවත් සැලැස්ම, ඇට පුරෝහත උපකාර කිරීම, පාත්ති තැනීම, නිසි ලෙස වතුර දැමීම යන කායනීයන් ක්‍රමානුකූලව ඉටු කිරීමට තේක්ක වගා කරන වන පාලක වතුර දැමීම යන කායනීයන් ක්‍රමානුකූලව ඉටු කිරීමට තේක්ක වගා කරන වන පාලක වරු කැප පි හිටිති. වසරක් පාසා වියලි කලාපයේ අක්කර දහස් ගණනක වනාන්තර වල තේක්ක වගා කරන බැවින් ඇට පැල කිරීම සඳහා තවත් ඇති කිරීම සහ තබාගැනීම කිරීම සුළුපටු කාර්යයක් නොවේ.

වගා කිරීම.— දීර්ඝ කාලයක සිටම වන විද්‍යාඥයන්ගේ අනුමැතිය නොලබා, වියලි කලාපයේ වනාන්තරවල ඇති වටිනා දැව වෘක්ෂ කපා බිම හෙලීම සහ කෙටි කාලය කින් සුළු ප්‍රයෝජන තැකා කැලෑ සහමුලින්ම විනාශකර අරඹන්නාවූ හේත් වගාව කරණකොට ගෙන අප වනාන්තරවල වටිනාකම ක්‍රම ක්‍රමයෙන් අඩුවී ගොස් ඇත. මෑත කාලයක සිට, වටිනා දැවයන්ගෙන් විරල රජයේ කැලාවල, පසත්, දේශගුණ යත් මෙම වෘක්ෂයට සතුටුදායක නම් ඒ පළාත්වල සීග්‍ර ලෙස තේක්ක වගා කරති. තෝරා ගත් ප්‍රදේශ, කාලසටහනක අනුව මෑත වෙන්කර, ලදු කැලෑ කපා පුළුස්සා පිළියෙල කරගත් පසු ඔක්තෝබර් මාස කාලයේ ඇතිවන ඊසාන දිග මෝසම් වම්බ වත් සමගම තේක්ක පැල සිටුවති. එවිට වියලි කලාපයෙහි නොවරදින මාර්තු-අගෝස්තු ඉබෝරයට මුහුණ පෑමට හැකිවන සේ සිටුවන ලද පැලය ඔක්තෝබර් මස සිට ජනවාරි මස අන්තය හෝ පෙබරවාරි මස වන තෙක් පැවති මෝසම් වම්බ පතනයෙන් සූර්යකම රෝපනය වේ. මෙලෙස වැඩුණු පැලය සර්වකලාපික වනාන්තර වල පිහිටි තේක්කවලට සීමා වූ විශේෂ ශක්තිය අනුව ඉබෝරයෙන් කිසිදු හානියක් නොලබයි.

වන විද්‍යාවෙහි නවීනතම ක්‍රමය අනුව තේක්ක වගාව ඉතා ලිහිල් ලෙස සකස් වී ඇත. තවත්වල සිටුවන ලද ඇටවලින් ඇතිවන පැල මාස 9 ක් පමණ කාලයක දී අඩි 2 ක් පමණ උසට රෝපනය වේ. කැලෑ වගා කිරීම සඳහා බිම් පෙදෙස් සකස් කර, ඊසාන දිග මෝසම් සුළඟින් ඇතිවන වම්බවත් සමගම තවතේ පැලෑටි උදුරු පැලයේ කදින් අඟල් 1 ක් හෝ අඟල් 1 1/2 ක් සහ මුලෙන් අඟල් 6 ක් හෝ අඟල් 8 ක් ඇතිවන සේ කඳ සහ මුල කපා “කැපු පැල” නමින් පිළියෙල කරති. මේ “කැපු පැල” සකස් කිරීමේදී එයට හානියක් නොවන සේ මුලෙහි ඇති අවශේෂ මුල් කපා හරිනු ලැබේ. අවශේෂ සිහින් මුල් කපා හැරීම කරණකොටගෙන එම මුල් සත්ඨි ස්ථාවර කුඩා සිහින් සිදුරු ඇති වන බැවින් ඒවා ඇතිවීමට පහසුවෙන් සම්පාදනය කරගත හැකි පිළියමක් ද, පර්යේෂණ උපකාරයෙන් අනාවරනය කර ඇත. වේ හුඹයේ ඇති, වැලි ගල් ඇත් වූ මැටිවත් ගොමත්, වතුරෙහි දියකර සාදා ගන්නා වූ මේ පිළියම යෙදීමෙන් “කැපු පැල” වියලීම වලක්වනවත් හැර, මූලාවශේෂයෙහි ඇති සිදුරු තුලට පිංගා ගත හැකි, රෝග උපද්‍රවයන්ට හේතුවන දිලීර, භාකානු, විශානු යනු ජීවින් ඇතුල්වීමද වලක්වා ගත හැක.

තෙක්ක වගාවේ ආරම්භය.—17 වන සියවසේ අග භාගයේදී ඕලන්ද ජාතික, වැන් ඊඩේ මහතා විසින් අප දිවයිනට තේක්ක වාක්ෂය හඳුන්වා දෙන ලද බැව් හි. ඒ. විත්සන් වි මහතා අනාවරනය කර ඇත. තවද, මෙම චක්කවානුවේ හංවැල්ල, අතුරුස්ස යන පෙදෙස්වල තේක්ක වගාවල් ඇති වූ බවද, එම වගාවල් තදබද නීති උනි පද්ධති යක් යටතේ ආරක්ෂා වූ බවද, මොනවට පැහැදිළි වේ. තේක්ක වගාවන් මුහුදුබඩ පෙදෙස්හි සිගු ලෙස පැතුරුණා පමණක් නොව, ඒවායින් එකල රජයේ හාණ්ඩාගාරය තර වූ බවද මුසාවක් නොවේ. සිද දමන ලද තේක්ක ගස්වල ඊකිලිවලින් ඇති වූ වාක්ෂයන් අදත් අතුරුස්ස තානායම, මාතර උසාවිය, හංවැල්ල තානායම සහ මිගමු පාරේ මහබාගය අසලද දකින්නට ලැබේ. එපමණක් නොව ප්‍රථමයෙන්ම වන සංරක්ෂණ දෙපාර්තමේන්තුවේ මෙහෙසීමෙන් ඇති කරන ලද තේක්ක වගාව පිළිබඳ ඇති සිද්ධීන් රස මුසුය.

1873-1875 කාලයේදී සහකාර වන සංරක්ෂක, ස්පෙන්සර් මහතා විසින් ඔහුගේ වාරිකාවල බඩු ගෙන යාම පිණිස පත්වී සිටි මෙහෙකරුවන් ලවා මඩකලපු ප්‍රදේශයේ තුම්පලන්වෝලි වනරොදේ ප්‍රථමවරට තේක්ක වගා කරවන ලදී. තවද, 1880-1883 වර්ෂවල වයඹ පළාතේ පුත්තලමට නුදුරින් පිහිටි අටවිල්ල නම් වූ රජයේ වනාන්තරයෙහි වන පාලක මග්ගලීනි මහතා අවුරුදු 4 ක් තුළ ඔහුගේ ගමන් වියදම් දිමනා ඉතිරිකර ඒ මුදලින් අක්කර 8 ක ප්‍රමාණයේ තේක්ක වගා කරන ලදී. මෙම වගාව සඳහා ප්‍රථමයෙන් කරන ලද කැල කෙටීම සහ පිළිස්සීම පිණිස ඒ යුගයේදීත් අක්කරයකට රු. 30 බැගින් වැය කරන ලදී. මේ අක්කර අවේ තේක්ක සාර්ථක කිරීම සඳහා තවත් වැඩ සහ පාල සිවුවීම ඇතැම්විට මග්ගලීනි මහතා විසින්ම විවේක වේලාවන්හිදී, එසේ නැතහොත් නමැගේ මෙහෙකරුවන් ලවාද, අවකාශ ලත්විට සිරකරුවන් ඇසුරුකොට ද, කරන ලදී. පසුව මෙම වගාවට තව අක්කර 4 ක් එකතු කරන ලදී. එම මහතාගේ උද්යෝගයද, ධෛර්යයද, වෙහෙස මහත් සියද, ඉතිරිකළ ගමන් වියදම් පරිත්‍යාගය, හේතුකොටගෙන උත්පාද කළා වූ ඒ අක්කර 12 ක තේක්ක වගාවේ ජයග්‍රහණය මග්ගලීනි මහතාට උරුමවූවත්, අදට එනම්; අවුරුදු 80 කට පසු කාලයකදී රජයට රු. 75,000 ට වැඩි මුදලින් පමණක් ප්‍රතිඵල අයකරගෙන ඇත. අනාගතයේදී ද එම වගාවෙන් ලබාගත හැකි පල ප්‍රයෝජන ඉමහත් ය.

නුගන යුගයේ වගාව.—තවත්වලින් උපදවන්නා වූ “කැපු පාල” ක්‍රමානුකූලව සකස් කරන ලද බිම් පෙදෙස්වල, පාල සිවුවීමේ ක්‍රම දෙකකි. රජයේ වනාන්තරවල වගාවන් පිහිටුවන බැවින් එහි සම්පූර්ණ අයිතිවාසිකම රජය සතුය. එම නිසා වන වගා කිරීම රජය මගින් සංවිධානය කරයි. පාල සිවුවීමේ ක්‍රම දෙකෙන් පළමු ක්‍රමය නම්, රජය විසින්ම කැලා ශුද්ධ කර, ප්‍රච්චා, කැපු පාල සිවුවා, ඉන් පසු පල නෙලීම වනතෙක් අනෙකුත් කායභියන් ඉටු කිරීම වේ. මේ ක්‍රමය යටතේ රජයට විශාල බරක් පැටවෙනවා පමණක් නොව, වර්තමාන කාලයේදී රජය විසින් පිළිපැදිය යුතු කැලස්ම සාර්ථක කිරීමේදී කම්කරුවාලු රාශියකට මුහුණ පෑමටද සිදුවේ. කෙසේ වෙතත් වගාව දුෂ්කර අවස්ථාවලදී එය සාර්ථක කිරීම සඳහා රජයට මේ ක්‍රමය වැදගත් වේ. අනෙක් ක්‍රමය මීට හාත්පසින්ම වෙනස්ය. එය සමුපකාර වන වගා කිරීමේ ක්‍රමයයි.

සමුපකාර ක්‍රමය.—මෙම ක්‍රමය යටතේ වගා කිරීම කරනු ලබන්නේ කැල අවට ගම්වල පදිංචිව සිටින ගොවි මහතුන්ය. ඔවුන් විසින් කරන මේ බැරැරුම් කාර්යයට රජය විසින් වේතනයක් ගෙවනු නොලැබේ. නමුත් ගොවිමහතුන්ගේ ප්‍රයෝජනය සඳහා ඔවුන් විසින් පාලකරන තේක්ක වගාවේ සීමාව තුළ අවුරුදු 3 ක කාලයක් මුළුල්ලේ ඔවුන්ට ගොවිතැන් කිරීමට අවසර ලැබේ. මෙම ක්‍රමය යටතේ ඉන්දියානු අර්ධද්වීපයේ බෙංගාලය, ඇසාමය, බොම්බාය, මදුරාසිය, ඔරිස්සා, උත්තර ප්‍රදේශය, බිහාර්, මයිසූර්, කේරලය යනාදී රටවල සහ බුරුමයේද විශාල වශයෙන් තේක්ක

වනාන්තර පිහිටුවා ඇත. මෙයට බුරුම වැසියන් “ටොංගියා” ක්‍රමයයිද, ඉන්දියානුන් “කෘෂිකම් සම්බන්ධතා වන වර්ධනය” යි ද ව්‍යවහාර කරනු ලැබේ. මෙම රටවල මෙන් හෙලදිවෙහිද දිලිඳු ගොවි ජනයාට දිනපතා මුහුන පාමට සිදුවන දරුණු ඉඩම් අවශ්‍යතාවය මෙම ක්‍රමයෙන් සංසිද්දෙන බැවින් ගොවි මහතාගේ එක එල්ලේ මෙයට එකඟ වෙති. ඉඩම් බහුල ප්‍රදේශවල වුවත් මෙම ක්‍රමය යටතේ ගොවිතැන් කිරීමට ලැබෙන සහනයෙන් ගොවිමහතාගේ මුදල් රාශියක් උපයා ගන්නා බැවින්, එම පෙදෙස්වල ද මෙම ක්‍රමය ප්‍රතික්ෂේප නොකෙරේ. කැලා බිදහෙලා පිළිස්සීමෙන් ඇතිවන්නා වූ පොහොර පසෙහි මෙම ගස සිගු ලෙස වැඩෙන්නාක් මෙන්ම, එම පැල සහිත හේන් වල ගොවිතැන් කරන්නාවූ වගාවන්ගෙන්ද ප්‍රතිඵල රාශියක් ගෙන දෙන බව කැලා බිද ගම්වල වසන ගොවියාට රහස්‍යක් නොවේ. මෙම ක්‍රමය ගොවිජනයාගේ ප්‍රසාදයට ලක්වීමෙන් ලංකාවේ වයඹ, උතුරු මැද සහ නැගෙනහිර පළාත්වල වනාන්තරයන්හි වගා කිරීමට ප්‍රිය නමුත්, බටහිර පළාත, මධ්‍යම පළාත සහ දකුණු පළාතේ සමහර පෙදෙස්වල වසන ගොවියෝ මෙම ක්‍රමයට එතරම් සතුටක් නොදක්වති.

සමුපකාර තේක්ක වගාවන් ඇතිකිරීම සඳහා ප්‍රථමයෙන් ඊට සුදුසු වනාන්තර තෝරා කලට වේලාවට ඒවා මැන වෙන් කරති. ඉන් පසු ඒ ඒ පළාත්වල වසන ජනයාගේ වගා කිරීමේ හැකියාව අනුව අක්කර දෙකක් හෝ පහේ හෝ සමහර විට, ඉන් විශාලවද කවි වෙන් කරති. එක එක ගොවි මහතෙකුට එක කවිටිය බැගින් පැවරෙන අවයෙන් රජයන් ගොවියාගේ අතර ගිවිසුම් නීත්‍යානුකූලව නිසි ලෙස ඉෂා කරවීම පිණිස පළාත්වල දුෂ්කරතාවයන් අනුව අක්කරයකට රුපියල හෝ රුපියල් පහක ඈප මුදලක් රජයෙහි තැන්පත් කරයි. ගිවිසුමේ කොන්දේසි අනුව, ගොවියාට පැවරුණු ඉඩමේ වල් දව දඩු සුළු මුදලක් රජයට ගෙවා ඔවුන්ගේ ප්‍රයෝජනය පිණිස ඉවත් කර ගැනීමට පහසුකමද සලස්වනු ඇත. දැව දඩු කපා ඉවත් කිරීමෙන් පසු ඉතිරිවන දව ද, දව දඩු රිකිලි යනාදිය ද, මනාලෙස වේලුනායින් පසු ගොවි යාගේ විසදමෙන් ඒවා පිළිස්සීම ඔවුන් සතු කාර්යයකි. ඉන් පසු රජය නියම කරන දුර ප්‍රමාණය අනුව සාමාන්‍යයෙන් අඩි 10 න් 10 ට කුඤ්ඤ ගැහිමද ඉන් පසු ඒ කුඤ්ඤ ඇති තැන්වල පැල සිටුවීමද ගොවියාම කළ යුතුයි. මේ කායභියන් සියල්ලම ඊසාන දිග මෝසම් සුළං වැස්ස ආරම්භ වෙනවාත් සමගම නිසි ලෙස ඉටු කර පැල සිටුවීම සාර්ථක ලෙස අවසන් කිරීම කොන්දේසිවල පරමාර්ථය වේ.

තේක්ක පැල කිරීමත් සමගම ගොවියාගේ වගාවන් එම ඉඩමෙහි යෙදවීමටත්, ඒවා අරක්ෂා කිරීමටත්, පැලක් තනා ගැනීමට පහසුකම් ලැබේ. ගොවියාට මෙම ඉඩමෙහි අවුරුදු 3 ක කලයක් නතරවී වගාවන් ඇති කිරීමට ගිවිසුම් අනුව අවකාශ ඇතත්, තේක්ක පැලයට සම්පව එනම් අඩි 1½ ක අර්ධ විෂ්කම්භයක් ඇතුළත මේ වගාවන් ඇති කිරීම තහනම් බව කොන්දේසිවල සඳහන් වේ. මේ ක්‍රමය අනුව වගා කිරීමට පෙළඹෙන ගෙවියෝ අමු කැලා කොටා පිළිස්සීමෙන් පසුව ඇතිවන පොහොර බහුල පසෙහි ගොවිතැන් කර හොඳ අස්වැන්නක් පළමු අවුරුද්දෙහිම ලබා ගනිති. මෙම ජයග්‍රහණයෙන් තෘප්තියට පත්වූ සමහරු දෙවන තුන්වන අවුරුදුවල ගොවිතැන් කිරීමට පසුබට වෙති. මෙවැනි අවස්ථා වැලැක්වීම පිණිස රජයද ඔවුන්ගේ ගිවිසුමෙහි ගොවීන්ට පවරා ඇති ඉඩම් වල් පැලැව්වින් තොරව තබා ගැනීම සහ වරින් වර ඒවා ක්‍රමානුකූලව නෙලීමද අත්‍යවශ්‍ය බව කොන්දේසි වල සඳහන් කර ඇත. තේක්ක පැලය අවට එලවළු වගාවට ඉඩ නොතැබුවත්, ඒ වෙනුවට වල් පැලැටි ඇති වුවහොත් තේක්ක සිහින්තාව සෙවන ඇති කරයි. මේ සිහින්තා සෙවන තුරුස්සන බැවින් එය මනාසේ නොවැඩේ. එබැවින් වල් නෙලීම වැනි සුළු කාර්යයක් ඉටු නොකිරීමෙන් තේක්ක වගාව සහමුලින්ම කඩා කප්පල් කලා යන අවලංගු හිමිවෙනවා පමණක් නොව, ගිවිසුමද අවලංගු කිරීමට තරම් දඩුවමකට මුහුණ පාන්නට ඉඩ තිබේ.

ගොවියාට, සමුපකාර ක්‍රමයෙන් තව අනිෂ්ඨ විපාකවලට පංගුකාර විය හැකි කරුණු බොහෝ ඇත. පුද්ගලික ගොවිතැනට පමණක් දිළි දී කලට වේලාවට පැල කිරීමේ බිම් පෙදෙස් සකස් නොකිරීමත්, ඉඩමෙන් පිටතට ගෙන ගිය යුතු දැව දඩු එම ඉඩමෙහි නුපුළුස්සා රඳවා ගැනීමෙන් කාලය ඉක්ම යත්ම ඒවායේ ඇතිවන දිලීර රෝගත්, ඒවා මගින් ඇතිවන කෘමි සංඛ්‍යාව අධිකවීමත් ගොවියාගේ අපේක්‍ෂාවට කරුණු විය හැක. එපමණක් නොව, සමහර අවස්ථාවල බලාපොරොත්තු නොවූ අධික වණිවෙන් පස සේදී යාම වැලැක්වීම පිණිස කැණු කැපීම වැනි අමතර කායඝයන් කිරීමට ද සිදුවන අවස්ථා බොහෝ ඇත. කැලෑ අවට ගම්බද ජනයාට මෙවැනි බාධක හුරු පුරුදු නිසා මෙම ක්‍රමය යටතේ තේක්ක වගාව දියුණු කළ හැකිය. බාධක උග්‍රවීමෙන් හෝ ගොවියාගේ අපහසුකම්වලින් හෝ ගිවිසුමේ උපදෙස් නොපිළිපැදී නම් ඊට දඩුවම්වලටද ඔව්හු උරුමක්කාරයන් වෙති.

ප්‍රයෝජන හා තැගි.—තේක්ක පැල සිටුවා ඇති බිම් පෙදෙස් සරුසාර බැව් මින් ඉහත ප්‍රකාශකර ඇත. එපමණක් නොව, සුළු මහන්සියකින් එහි රෝපනය කරන්නාවූ බීජයන්ගෙන් වැඩි අස්වැන්නක් ලබාගත හැක. ගොවියාගේ ප්‍රයෝජනය සඳහා ඔවුන්ට පවරා ඇති කට්ටිවල වගා කිරීමට අවසර ඇති බෝගයන් අප්‍රමාණය. ඉන් සමහරක් නම්—

- (i) ගොයම් සහ කුරක්කන්.
- (ii) මිරිස්, ලුනු, අඹ, රටකපු, මුං ඉරිඟු, තල.
- (iii) බණ්ඩක්කා, බඩු, කොමඩු, තක්කාලි, වට්ටක්කා, පුහුල්, පිපිඤ්ඤ, කරවිල.
- (iv) දුම්කොල, කපු.
- (v) මයිගොක්කා, ගස්ලඩු, කෙසෙල් අඩි 20×20 ට

දිළිඳු ගොවීන්ට රුකුල් දෙන ලෙස සමුපකාර ක්‍රමය යටතේ තේක්ක වගාවෙන් සම්පූර්ණ අස්වැන්න ගොවියා සතුවන ලෙසටත්, රජයට ඉන් කිසිදු ආදායම් බද්දක් අය නොකරන ලෙසටත්, විධිවිධාන සකස් කර තිබේ. වගාවේ ආදායම පමණක් නොව පළමුවන අවුරුද්ද තුළ (සැප්තැම්බර් මස 30 දා අවසන් වන රජයේ මුදල් අවුරුද්ද) භාර්ථක ලෙස බිම් පෙදෙස් තේක්ක වගාව සඳහා පුළුස්සා සකස් කිරීමෙන් පසුව ඒ බව සුදුසු යයි හැඟී ගියේ නම් ගොවි මහතාට අක්කරයකට රු. 25 බැගින් ඔහුගේ ඉඩම් කට්ටියේ ප්‍රමාණය අනුව තැගි මුදලක් ලැබේ. එමෙන්ම දෙවන අවුරුද්ද තුළ තේක්ක සිටුවා ඒවා සියයට 80 කට වැඩියෙන් පැලවී ඇත්නම් අක්කරයකට රු. 15 බැගින් පවරා ඇති කට්ටි ප්‍රමාණය අනුව තැගි මුදලක්ද පිරිනමනු ලැබේ. තුන්වන අවුරුද්දේ, ඉඩම් කට්ටිය වල් පැලැට්ටලින් තොරව සියයට 80 ක් තේක්ක පැල වැඩි ඇත්නම් අක්කරයකට රු. 10 බැගින් බිම් කට්ටියේ ප්‍රමාණය අනුව තැගි මුදලක්ද අයිතිවෙතවා ඇත. පිළිවෙලින් සළකා බලන විට, ගොවි මහතෙක් තේක්ක පැල කිරීම භාර්ථක ලෙස ඉටුකළ විට ඔහු ඉඩමේ සිටි අවුරුදු 3ක කාලය තුළදී ගොවිතැනින් ලැබෙන ප්‍රයෝජනයට අමතරව අක්කරයකට රු. 50 ක තැගි මුදලක් හිමිවේ.

තේක්කයෙහි විශේෂයන්.—ලංකාවේ වගා කරන ලද තේක්ක වෘක්‍ෂයට සීමාවූ ගති ගුණ කාලාන්තරයක් තිස්සේ ඇතිවූ පර්යේෂණවලින් වන විද්‍යාවාරීන් පැහැදිලි ලෙස සොයාගත ඇත. එම පර්යේෂණවල ප්‍රතිඵල, කෘත්‍රිම වනාන්තර පිහිටු විමට උපකාරීවී ඇත. මෙම ගස අන්‍ය වෘක්‍ෂලතාදියෙන් ආවරනයවීම, කුඩාකල සිටම අභිනකරය. තේක්ක ගසට ඉහලින් සහ පැතිවලින්ද සම්පූර්ණ ආලෝකය

අත්‍යවශ්‍යය. එබැවින් සන කැලවල අත්‍ය ගස් සෙවනේ එය නොවැඩේ. කෘත්‍රිම වගාවෙහිද, මෙම කරුණු සවහැවික ලෙස පිහිටීම සඳහා තේක්ක ගස අවට හෝ උඩින් ඇති ගස් විනාශ කිරීමෙන් තේක්කය වැඩීමට නියම පරිසරයක් ඇති කෙරේ. මෙම ගසෙහි මුල් පද්ධතිය ඉතා විශාල නමුත්, එතරම් ගැඹුරු නැත. අවශේෂ මුල් ඉතා ශක්තිමත් ලෙස පසෙහි රඳා තිබේ. මුල්වලින් වෘක්ෂයට ලබා දෙන ශක්තිය කොපමණද යන්න, මෙම විශාල වෘක්ෂය වණ්ඩ මාරුතවලදී පෙරලීමක් නොමැතිව සෘජුව රඳා පවත්වන එඩිතර ගතියෙන් එය හොඳාකාර පැහැදිලි වේ. වියලි කලාපික වනාන්තරවල ඇති අත්‍ය වෘක්ෂයන්ටත්, තේක්ක පරිසරයෙහි ඇතිවන්නාවූ අත්‍ය වෘක්ෂයන්ටත් වඩා මෙම වර්ගයට වණ්ඩ සුලභව ඔරොත්තු දෙන විශේෂ බලයක් තිබේ. පසෙහි දිය රඳා සිටීමද, පස අභ්‍යන්තරයේ ජලවහනය නැති වීමද, තේක්ක ගස වැඩීමට බාධා කරන සාධකයෝ වෙති. වගා කිරීම පිණිස බිම් පෙදෙස් පරික්ෂා කිරීමේදී මෙම සාධකයන් විශේෂ තැන් ගනී. තේක්ක ගස පිහිටන පරිසරයෙහි වම්සක් පාසා වියලි සෘතු වේ පොළොව මත ඇතිවෙන්නාවූ ගින්නද, දැවීමෙන් හට ගන්නාවූ උපද්‍රවද, මෙම වෘක්ෂයට කිසිදු හානියක් නොකෙරේ. නමුත් තේක්ක ගස අවට වගා පිලිස්සෙන තෘණභූමි මධ්‍යයෙහි ගින්නක් ඇතිවුවහොත් එයින් ඇතිවෙන උෂ්ණත්වය අනුව සමහර අවස්ථාවලදී තේක්කය මරාමුවට පැමිණෙන්නට පුළුවන. වියලි වනාන්තරවල හැසිරෙන සතුන් මෙම ගසෙහි කොළ, දළු, මුල්, පොතු යනාදිය බුද්ධිමත් රුවියක් නොපෙන්වන ප්‍රථමය. එය ද ගසෙහි වැඩීමට වාසියෙකි. තවද, අං කුර, දල, සහිත සතුන්ගෙන් ඇතිවන්නාවූ පැහිම, අං ඇතිල්ලීම යනාදියෙන් ඇතිවෙන්නාවූ තුවාල අසාධ්‍ය නොවී ඒවාට ඔරොත්තු දීමේ අපූරු ශක්තියද මෙම වර්ගයට තිබේ.

වනාන්තරවල ජීවත්වන නා නා සතුන්ගෙන් තේක්ක ගසට කරදර ඇති කරන්නෝද නැත්තෝ නොවේ. මිශේ ඔවුන්ගේ තියුණු දත්වලින් මෙම ගසේ මුල් සූරා කපා හරිති. මෙම උපද්‍රවයන්ගෙන් කුඩා තේක්ක පැලය විනාශවන අවස්ථාද බොහෝ වේ. වල් උරන් කුඩා පැලවල මුල් හැරීමෙන් ඒවා සම්පූර්ණයෙන්ම උදුරා පොළොවෙන් ඉවත් කරති. ඉත්තාවෝ, ගෝත්තු, මුවෝ පමණක් නොව වල් අලිද වැඩුණු ගසට නොයෙක් අන්දමින් වින කරන්නෝය. තේක්ක කොළය විශාල වුවද, එය සම්පූර්ණයෙන්ම කා දමන දලමුවන් නිසා ගසෙහි භාමාත්‍ය වැඩීමට බාධා ඇතිවේ. කොළ කා දැමීම කරනු ලබන්නේ දළඹු අවස්ථාවේ සිටින “ගිබිලියා පුයෙරා”, “හැපලියා මැකරාලි” යන සමනලයන්ය. “පග්ලියා දමස්තසාලිය” යන සමනල වර්ගයාගේ දළඹුවා තේක්ක කොළ හකුළුවා කෝෂ හැදීම කරනකොට ගෙන තේක්ක ගසට බාධා පමුණුවයි. “පැසස් මලබරිකස්” සහ “සයිලියුටස් සෙරම්බිකා” යන කෘමීන් තේක්ක කඳ විදීමෙන් දැවෙහි වටිනාකම අල්ප කරයි. දිලීර වර්ග රාශියක්ම දැවෙහි ශක්තිය සහ කල් පැවැත්ම බාල කරයි. නමුත් මනා ලෙස වැඩුන වෘක්ෂයකින් ලබා ගත් දැව මෙම දිලීරයන්ගේ හපන්කම් මැඩ පවත්වන ගතියක් ඇති බැවින් අත්‍ය දැව වඩා කල් පවතී. පිලිල වර්ග සහ ලතාවන් වෘක්ෂ කඳෙහි පිහිටීම අවලක්ෂණ කරති. තේක්ක වෘක්ෂයට ඉහත සඳහන් හිරිහැර බාධක ඇති වුවත්, වනාන්තරවල ගැවසෙන පක්ෂි සමූහයා දිනපතා කෘමි දළඹු විශාල සංඛ්‍යාවක් අනුභව කරන බැවින් පක්ෂීන්ගේ නොමසුරු හැසිරීමට රුකුල් දීමෙන්ද, වන විද්‍යාඥයන්ගේ උපදෙස් පිට රසායන ද්‍රව්‍ය ඉසීමෙන් හා තැවරීමෙන්ද, පිලිල වර්ග හා ලතාවන් කපා විනාශ කර දැමීමෙන්ද, මෙම බාධකයන්ගෙන් සහනය ලබා දී ජය ගත හැක.

තේක්ක දැවයෙන් ඇති ප්‍රයෝජන.—ගස කුඩා අවදියෙහිදී වගාවෙන් ඉවත් කරන රිපි කණු යනාදියටද, මධ්‍යම වයසේ ගස්වලින් සවි ශක්තිය ඇති ගෙවල්, වැලිපෝත් සහ විදුලි කම්බි කණු යනාදියටද, පාවිච්චි කළ හැක. මනා ලෙස වැඩුණු ගසෙහි දැව දඩුවලින් ප්‍රයෝජන රාශියක් ලබාගත හැක. මෙම දැවෙහි ඇති අගනා වෛරම සහ

ඇසට ප්‍රිය වර්ණය නිසා ඉස්තරම් ගෘහ භාණ්ඩ තැනීමට ඉතා කදිම වේ. දැවෙහි ඇති ශක්තිය, කල් පැවැත්ම, බර සහ තද ගතිය ගැන විශේෂ සැලකිල්ලක් දරන බැවින් නැව් තැනීම, දුම්පිය සිල්පර, ගොඩනැගිලි තැනීම (ජනේල, දොරවල්, උළුවනු, බාල්ක, පරාල, කණු, කුළුණු, තරප්පු), දුම්පිය සහ වෙනත් වාහන මැදිරි තැනීමටද භෞතික දැවය උපයෝගී කරගනී. එපමණක් නොව, කරදියට හා මිරිදියට ඔරොත්තු දෙන බැවින් පාලම් කුළුණු, ඔරු පාරු ආදියෙහි අමතර වැඩවලටද සුදුසු වේ. සුළු කම්කර්තයන් සඳහා අමු ද්‍රව්‍ය වශයෙන්ද, සෙල්ලම්බඩු, සංගීත භාණ්ඩවන පියානෝ, හාර්මෝනියම්, ඔර්ගන්වල තව්ටු රාමු, පනා කාටයම් වැඩ සහ වෛරම් ඇති තුනී ලෑලි පිණිසද යෝග්‍ය වේ. තවද දැවෙහි ඇති ගැට, දුම් පානය කරන්නාට පසිඳුප සෑදීමට ගනු ලැබේ. සාමාන්‍ය වශයෙන් දැව උපයෝගී කරන සෑම දෙයකටම තේක්ක විශේෂ තැනක් නොගනිනත්, එය සුදුසු ලෙස පාවිච්චි කළ හැකි බැවින් මේ දැව අන්‍ය දැවවලට වඩා ජනප්‍රියය.

තේක්ක දැවයෙන් අමතරව එම ගසෙහි පොත්තෙන් ලබාගන්නා කහවෙන් ලණු පැදුරු පාට කර ගත හැකිය. සෙලබ්ස් දුපත්වල මෙම පාට කිරීම ඉතා ජනප්‍රියය. පේෂකම් ආයතන, තේක්ක කොලයෙහි ඇති සංයමෙන්, කපු සහ සිල්ක් රෙදි පාට කිරීමට යොදා ගනු ලැබේ. සමහර රටවල තේක්ක දැවයෙන් තෙල් සිඳිති. මෙම තෙල් ලී ඔප දැමීමට වාර්තීස් වශයෙන්ද, තිත්ත දියාරු කිරීමට ගන්නා “ලින්සිඩ්” තෙල් වෙනුවටද භාවිත කරති.

සිංහල තේක්කවලත්, බුරුම තේක්කවලත්, ශක්තිය, තද ගතිය, කල් පැවැත්ම, වර්ණය, වෛරම යන දිය සමාන වුවත් බොහෝ අය බුරුම තේක්කවලට විශේෂ කැමැත්තක් දක්වති. බුරුම රටෙන් මෙරටට දැව ගෙන්වීමටත්, ඒවා ක්‍රමාණුකූලව ගබඩා කිරීමටත්, ගතවන කාලය නිසා ඒ දැව අප හ විනයට ගන්නා විට නිසි ලෙස පදම් වී ඇත. නමුත් සිංහල තේක්ක, වගාවෙන් බිඳ හෙලා, දින කිපයකින්ම උපයෝගී කරන බැවින් දැව වැඩ කිරීමේදී යම් යම් වෙනස්කම් දැව කම්කර්තයෙහි නිපුණ අයට දැනගන්නට හැකි වෙනවා ඇත. මෙය නිසි ලෙස මේරූ, පදම්වූ, අප තේක්ක දැව සමග සංසන්දනය කරතොත්, එහි අසමානකමක් නැති බැවින්, දැවෙහි බාලකම එය වගා කරන දේශගුණය අනුව ඇතිවන දෙයක් බවත් වටහාගත හැක. මෙය හැරෙන්නට, වගා කරන රටෙහි විශේෂ ප්‍රවණතාවයක් නැති බවත් අගේට පෙනී යයි. තවද, සිංහල තේක්ක, බුරුම තේක්ක මෙන් හෝ ඊට වැඩියෙන් හෝ ජනප්‍රිය බැව් දැව ගබඩාවල ලේඛණවලින් මෙ තවට පැහැදිලිවේ. සිංහල තේක්ක නිපදවීමෙන් අප රටෙහි දැව වුවමනාවෙන් පිරිමැසෙනවා පමණක් නොව පිටරට ගලායන මුදල් රාශියක්ද ඉතිරිවන බැවින් අප ජාතියට මහඟු සේවයක් මෙයින් ඉටුවේ.

CEYLON FORESTER (NEW SERIES)

SUBJECT INDEX FOR VOLUME VI (1963-1964)

Prepared by :—A. W. SENEVIRATNE

	Vol.	No.	Page
C			
Contribution of Improved Forest Utilization to Productivity in Developing Countries	VI	1 & 2	18
E			
Economics of Forestry in Developing Countries	VI	3 & 4	81
Editorial Notes	VI	1 & 2	1
Editorial Notes	VI	3 & 4	69
I			
Investigation of the Relation between the Quantity of Seed sown and the Out-turn of Stumps in Teak Nursery Work	VI	1 & 2	31
Investigation of the Nature and Extent of Insect attack on Sixteen Species of Ceylon Timbers	VI	3 & 4	126
N			
Notes on a Reconnaissance Survey for the Integrated Development of the Walawe Basin of Ceylon	VI	3 & 4	121
P			
Potentialities of Beedi Leaf Production in Ceylon	VI	1 & 2	12
Preliminary Study of the Distribution, Growth and Propagation of Weniwelgeta (<i>Coscinium fenestratum</i>)	VI	3 & 4	113
Pre-sowing Treatment Trials on Teak	VI	1 & 2	4
R			
Report on the Regional Training Course in Forestry Techniques, January-February, 1962	VI	1 & 2	87
Report on Afforestation with Eucalyptus in Ceylon	VI	3 & 4	95
S			
Some Observations in Raising <i>Dendrocalamus strictus</i> in the Nursery	VI	3 & 4	134
Study of the Fibre Lengths of Eucalyptus Grown in Ceylon	VI	3 & 4	101
T			
Tannins from our Wattles (<i>Acacia</i> Spp.) for the Leather products..	VI	3 & 4	73
Timber Grading in Singapore	VI	3 & 4	138

CEYLON FORESTER (NEW SERIES)

AUTHORS INDEX FOR VOLUME VI

(1963-1964)

Prepared by :—A. W. SENEVIRATNE

		Vol.	No.	Page
F				
Fernando, S. N. U.	.. Some Observations on Raising <i>Dendrocalamus strictus</i> in the Nursery	VI	3 & 4	134
M				
Muttiah, S.	.. A Preliminary Study on the Distribution, Growth and Propagation of <i>Weniwelgeta</i> (<i>Coccoloba fenestrata</i>)	VI	3 & 4	113
P				
Pryor, L. D.	.. Report on Afforestation with <i>Eucalyptus</i> in Ceylon	VI	3 & 4	95
R				
Ranatunga, M. S.	.. A Study of the Fibre Lengths of <i>Eucalyptus grandis</i> Grown in Ceylon	VI	3 & 4	101
Ratnarajah, A. D. R.	.. Report on the Regional Training Course in Forestry Techniques, January-February, 1962	VI	1 & 2	37
Abeynaike, L.				
Herat, S. B.				
Wijeratnam, C.				
S				
Sridas, S.	.. Notes on a Reconnaissance Survey for the Integrated Development of the Walawe Basin of Ceylon	VI	3 & 4	121
T				
Tisseverasinghe, A. E. K.	.. The Contribution of Improved Forest Utilization to Productivity in Developing Countries	VI	1 & 2	18
Tisseverasinghe, A. E. K.	.. The Economics of Forestry in Developing Countries	VI	3 & 4	81
V				
Vivekanandan, K.	.. An Investigation of the Nature and Extent of Insect Attack on Sixteen Species of Ceylon Timbers	VI	3 & 4	126
W				
Warnakula, D. A. L.	.. Timber Grading in Singapore	VI	3 & 4	138
Weeraratne, W. G.	.. Potentialities of Boedi Leaf Production in Ceylon	VI	1 & 2	12
Weeraratne, W. G.	.. Tannins from Our Wattles (<i>Acacia</i> Spp.) the Leather Industry	VI	3 & 4	73
Wijesinghe, L. C. A.	.. An Investigation of the Relation between the Quantity of Seed and the out-turn of Stumps in teak Nursery Work	VI	1 & 2	31
Wijesinghe, L. C. A.	.. Pre-sowing Treatment Trials on Teak	VI	1 & 2	4

