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WORKING PLAN

FOR THE

CHANGA MANGA PLANTATION.

1916-17 to 1935-36

Lahore:

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRINTING, PUNJAB.

1917.

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CHANGA MANGA PLANTATION.

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CALIFORNIA

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1917.

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P. 14

WORKING PLAN

FOR THE

CHANGA MANGA PLANTATION

Agric.-Forestry. Main Library

TO THE
MANAGER

No. 6863 (Forests).

FROM

THE HON'BLE MR. H. D. CRAIK, I.C.S.,

Revenue Secretary to Government,

Punjab and its Dependencies,

TO

THE CONSERVATOR OF FORESTS, PUNJAB.

Dated Lahore, 29th March 1917.

SIR,

I AM directed to convey sanction to the adoption of the revised working plan for the Changa Manga plantation for the year 1916-17 to 1935-36 drawn up by Mr. R. N. Parker, which has been received with letter No. 185—14-W.P.-2 dated 13th March 1917 from the Inspector-General of Forests, copy of which is enclosed.

I have the honour to be,

SIR,

Your most obedient Servant,

J. G. BEAZLEY,

UNDER-SECRETARY, REVENUE DEPARTMENT,
for *Revenue Secretary to Government, Punjab.*

No. 6864 (Forests).

COPY forwarded to the—

- (1) Inspector-General of Forests to the Government of India for information, with reference to his letter No. 185—14-W.P.-2, dated 13th March 1917;
- (2) Senior Secretary to the Financial Commissioners, Punjab, for the information of the Financial Commissioner.

By order, &c.,

J. G. BEAZLEY,

Under-Secretary to Government, Punjab,

Revenue Department.

Office of
Conservation

No. 5233 (Forest)

From

The Hon. Mr. H. D. CRAIG, I.C.S.

Revenue Secretary to Government
Forests and its Dependents

To

The CONSERVATOR OF FORESTS, PUNJAB.

Dated Lahore, 23rd March 1917.

I am directed to convey sanction to the adoption of the revised working plan for the Changa Manga plantation for the year 1916-17 to 1925-26 drawn up by Mr. R. N. Parker, which has been received with letter No. 185-14-W.P.-3 dated 13th March 1917 from the Inspector-General of Forests, copy of which is enclosed.

I have the honor to be,

Sir,

Your most obedient servant.

J. G. BHANLEY,

Under-Secretary, Revenue Department,
for Revenue Secretary to Government, Punjab.

No. 5233 (Forest)

Copy forwarded to the—

- (1) Inspector-General of Forests to the Government of India for information, with reference to his letter No. 185-14-W.P.-3 dated 13th March 1917;
- (2) Under-Secretary to the Financial Commissioner, Punjab, for the information of the Financial Commissioner.

By order, &c.,

J. G. BHANLEY,

Under-Secretary to Government, Punjab,
Revenue Department.

No. 185—14-W.P.-2, dated 18th March 1917.

From—The Inspector-General of Forests to the Government of India,
To—The Revenue Secretary to Government, Punjab.

IN accordance with Article 53 (i) of the Forest Department Code, I have the honour to forward herewith, for the orders of Local Government, a revised working plan for the Changa Manga plantation, Lahore Forest Division, drawn up by Mr. R. N. Parker, Deputy Conservator of Forests, and received under cover of letter No. 4108, dated 17th February 1917, from the Conservator of Forests, Punjab (a copy of which is enclosed).

The plan has been prepared on the lines settled by me with the Conservator and the compiler after discussion on the spot, and I recommend it for sanction.

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WORKING PLAN

FOR THE

CHANGA MANGA PLANTATION.

Introduction. The first working plan for the Changa Manga plantation was drawn up by Mr. B. Ribbentrop in 1871-72. At that time the greater portion of the plantation for which the plan was made was not in existence and the plan provided for its formation and working up to 1880-81 from which year regular working was prescribed. This plan was not strictly adhered to and in 1886 a revised working plan was drawn up by Mr. W. E. D'Arcy. The revised plan provided for the completion of the cutting over of the plantation, which had been started in 1881-82 under the old plan, in a period of 15 years, so that the first rotation should have expired in 1895-96. Actually at the end of 1895-96, 538.3 acres were in arrears and a fresh working plan prepared by Mr. H. A. Hoghton provided for the felling of these arrears in 1896-97, the felling of the rest of the plantation being prescribed during the 14 years 1897-98 to 1910-11. The second rotation accordingly should have been completed in 1910-11, but when Mr. Hoghton's plan expired there was an arrear of 2,284.8 acres owing to labour difficulties. No adequate steps having been taken to improve the labour supply these arrears have even by 1915-16 not been cleared off and what remains is prescribed for felling under the present plan together with the area which has been planted up since 1896-97. The plantation may be considered as having passed through one rotation of 16 years from 1881-82 to 1896-97. The second rotation comprises the 22 years 1897-98 to 1918-19. The third rotation should start in 1919-20.

2. It is not proposed to repeat the information available in the previous plans, but only to make such additional remarks as seem necessary. The previous plans should be consulted for details of irrigation and many other matters.

Area.

3. The gross area of the Changa Manga reserve stands at 12,523 acres, made up as follows :—

				Acres.
Changa Manga Plantation	...	...	...	9,605
Maujoki Jand Extension	...	...	...	686
Shahpur Jand Extension	...	...	...	1,223
Rakh Shahpur	...	...	...	1,009
Total				12,523

The wooded area of the plantation is 9,097.2 acres. The blanks shown on the map prepared in 1886 are now mostly stocked and often cannot be recognized as having once been blank. In many cases these blanks have filled up naturally. Patches of low ground if surrounded with an earthen embankment and given only a moderate amount of water instead of being flooded to a depth of several feet readily fill up with mulberry. Patches of high ground have in most cases been stocked by making broader and deeper trenches at wider intervals when reopening trenches in compartments in which such blanks occur. Some work of this nature remains to be done in order to complete the restocking of blanks due to high ground. Of the 93.9 acres within the compartments which is not stocked, 43.7 acres is occupied by the sale depôt, *beldar*

quarters, etc., 11 acres near the Canal Department Rest House was recently cleared at the request of that Department leaving only 39.2 acres of true blanks due mostly to high ground.

4. The outer boundary is marked by a trench with solid stone pillars at the angles. Smaller stones at the corners of compartments show the numbers of the compartments. As a rule one square-topped stone is placed where four compartments meet and indicates by numbers carved on the faces of the stone the numbers of the compartments.

Demarcation.

5. A detailed description of the growing stock compartment by compartment is given in Appendix II and a list of all woody plants found growing naturally in the plantation as well as of plants which have been planted and are still found in the compartments (except when represented by a single specimen) but not including those which have only survived in the rest house garden or along the metalled road from the rest house to the railway station, is given in Appendix III. Excluding the standards which are mostly sissoo, fully 80 per cent. of the growing stock now consists of mulberry (*Morus alba*). This species has spread naturally throughout the plantation being spread mainly by water.

General description of the growing stock.

6. The advent of the mulberry was looked upon as an evil and more or less energetic steps have been taken from time to time to assist the sissoo at the expense of the mulberry. Thus in compartments 1, 2, 121, 122 and 123 in 1898-99 mulberry was cut back over 247 acres when the growth was one year old. There is nothing now to show for this work and the measures taken were evidently quite insufficient to ensure the preservation of the sissoo. The crop in compartments 66, 67 and 68 which were sown with sissoo in 1901-02 and have not yet been felled, is now in many places pure mulberry. In this case it is almost certain that the sissoo has not been suppressed by the more rapidly growing mulberry but that it has been killed over considerable areas by *Fomes lucidus*, and if the mulberry had not appeared the ground would probably be blank.

Competition between mulberry and sissoo.

7. The sissoo undoubtedly yields a better firewood and a more valuable timber than the mulberry and at first sight it would seem advisable to do something to assist the former at the expense of the latter. On the other hand the yield of mulberry per acre is considerably greater and even at present prices with a 20 years rotation there is little difference in value between an acre of mulberry and sissoo. The present average prices of sissoo firewood are based on wood which is largely cut from standards so that if figures were available showing the value of sissoo firewood from crops 20 years old without any thicker pieces obtained from standards, the difference in price of sissoo and mulberry firewood would probably disappear completely. A 20 years old mulberry crop yields a fair amount of timber even under present conditions and if properly thinned would probably yield considerably more, so that it is probable that the mulberry is actually the more profitable of the two.

Relative value of mulberry and sissoo.

8. It is not proposed to make any calculations in support of the above contention as no figures are available showing the value of sissoo firewood cut from crops 20 years old and also owing to the fluctuations of the market the calculation if made might not hold good for any length of time. There are, however, other reasons why the mulberry should be accepted with gratitude and why it would be unwise to try to maintain any considerable proportion of sissoo. Recent experiments have shown that repeated cutting back of mulberry in a compartment during the two years following the felling of the crop at a total cost of Rs. 6 per acre has not been sufficient to ensure the maintenance of the sissoo. Quite apart from any question of expense it would be a mistake to employ labour, the supply of which has hitherto been inadequate on a work of doubtful value. The areas sown up with sissoo about 1900 are now rapidly becoming mulberry crops owing to the sissoo being killed off wholesale by

Fomes lucidus and leaving mulberry which occurred in them as an undergrowth the principal species. Hence it is not advisable to attempt to maintain any large proportion of sissoo in the crop at the expense of other works such as thinnings, to say nothing of the final fellings which for years have been badly in arrears.

9. Mulberry in Changa Manga is a short-lived tree growing rapidly but soon becoming hollow. In the absence of sissoo it has been reserved as standards but is quite unsuitable for a standard, and in future if only mulberry is available for standards no standards at all should be reserved. The mulberry standards tried hitherto suffered greatly from exposure to the sun, those which were not thrown by wind became very branchy and the heavy shade prevented the satisfactory growth of the coppice near them. The rapid growth of isolated trees brings them to early maturity and by the time the coppice is ready for felling the mulberry standards, should any be left, will almost certainly be hollow. Although this working plan prescribes the system of coppice with standards it should be noted that much of the regeneration of the mulberry is from seed, and it would perhaps be more correct to call the system high forest with a short rotation for mulberry and a longer one for sissoo.

10. The sissoo as already stated has been reduced to the second position as regards abundance. Originally the only species sown on a large scale with success, it is now in many compartments difficult to find a specimen other than a standard. Two main causes have been at work to bring this about. In early youth mulberry is more rapid in growth and tends to suppress sissoo. At what age the sissoo can hold its own against mulberry is not known, but many instances have been observed in crops 12 to 16 years old of the sissoo being unable to compete with the mulberry. The root-parasite, *Fomes lucidus*, has spread very considerably in recent years and it can be found in almost every compartment, and, as already mentioned, it has exterminated sissoo in parts of compartments 66, 67 and 68 which have not been felled yet. Which of these causes is chiefly responsible for the disappearance of the sissoo it is impossible to say, but probably each by itself is sufficient to bring about that result. It is clearly useless to cut back mulberry with the object of assisting sissoo if the sissoo is to fall a victim to the fungus. At present the position is that sissoo is rapidly being exterminated. As regards the coppice this is of little importance as it is replaced by mulberry but as regards the standards it is important and they must be replaced either artificially by sissoo or by other species or the plantation will have to be worked as pure coppice and the production of building timber will cease. Now that the proportion of sissoo in the crop has been so greatly reduced it is possible that the severity of the fungus attack may diminish, and that it will be always possible to maintain a proportion of sissoo in the crop, but at present there is no certainty of this.

11. The Persian lilac is the next most important species. Hitherto it has been looked upon as a weed and has been cut back in the young coppice. In spite of this however, there is a fair proportion in some parts of the plantation, and if it were desirable it could easily be increased. This tree has hitherto been much neglected and it is by no means the useless weed it has been considered. There is a demand for the timber at Re. 0-7-0 to Re. 0-8-0 per cubic foot, though probably the demand is not unlimited. A small proportion of Persian lilac should certainly not be discouraged in the plantation and the proportion should be regulated by thinnings rather than by wholesale cutting back of the Persian lilac.

12. The other species most commonly met with are *jand*, *farásh* and *phulái*. None of these is to be encouraged except in dry places as *jand* and *phulái* are slow in growth. The *phulái* yields much sap-wood and billets of *phulái* are very readily attacked by insects. The *farásh* is not valued either as timber or firewood.

13. The injurious factors which have to be considered are drought, wind, fungus and wild animals. Occasionally the irrigation arrangements do not work smoothly and this results in late irrigation for some parts of the plantation. When this happens in a hot dry year such as 1914-15, crops which receive their annual watering late in the season suffer. Some compartments did not get water till late in June 1915 and in them the mulberry particularly suffered. The damage may have been due in part to unusual heat since a few mulberry and many toon trees were seen suffering apparently from drought even though standing near irrigation channels constantly in use. Though perhaps not essential it appears to be advisable to water every part of the plantation once at least by the end of May if possible and to water as large an area as possible a second time, rather than to give a larger quantity of water at the first watering and not to get round the plantation till late in June.

14. Wind causes a good deal of damage, especially in crops which have recently been irrigated. Fallen trees occur in such numbers that it is not possible to collect more than a portion of them and many valuable stems are left to rot on the ground. It is not correct to assume that all the wind-fall is due primarily to wind, as in the case of sissoo standards, it is usual to find that they have first been attacked by fungus and have only fallen after their roots have become rotten. In the case of mulberry much of the wind-fall and wind-break is due to the very dense state of the crop. The trees have been so drawn up by close growth that they cannot stand without the support of their neighbours and consequently once the wind gets into such a crop extensive wind-fall results. At the time of preparing the description of compartments it was noticed in many places in very dense mulberry crops about 12 years old that at least half of the crop had been blown down and many compartments which had been densely stocked were tending to become very open. It is hoped in future by periodic thinning to prevent most of this damage.

15. The sissoo fungus has been referred to already many times, it is *Fomes lucidus*, a fungus which as a saprophyte attacks many kinds of trees including the mulberry, but in the case of sissoo is a dangerous parasite. The symptoms of the attack vary considerably, sometimes a tree will be found to be dead or dying and the sporophores may be found on its stem or much more rarely on a superficial root. Occasionally the sporophores may be noticed on a tree which is apparently quite healthy, and in one instance the writer noticed a tree the lower portion of the stem of which bore dozens of sporophores on all sides and yet the foliage appeared quite healthy. Much more usually sissoo trees are found dead and standing with no external sign of fungus or they will be found fallen and either green or dying or dead and also as a rule with no external sign of fungus. Such trees will be found to have the sapwood of the roots completely rotten though every root may not be attacked up to the time the tree falls. Although probably more often than not, no sporophores are found on the trees attacked, yet in the case of large trees a considerable proportion show them. Whether sporophores are found or not the symptoms are the same, namely, the sap-wood of one or more or all of the roots of the tree is rotten, and as there is no reason to suppose that more than one fungus is responsible for the damage it may be assumed that all sissoo showing these symptoms have been attacked by *Fomes lucidus*. In compartments 66, 67 and 68 in which the sissoo is now 14 years old the trees have been killed off wholesale by the fungus and will be found standing or fallen, with rotten roots, though it is rare to find one bearing a sporophore. Even seedlings 4 years old have been found killed by the fungus and its sporophores have been found on them. The sporophores it may be mentioned occur low down on the stem commonly forming a ring round the stem at ground level. Occasionally they occur a few feet above the ground or still more rarely they appear from a superficial root.

16. Nothing definite is known about the manner in which the fungus spreads though it seems fairly certain that it can spread underground from tree to tree since it is common to see trees in rows such as on the edge of a compartment, showing progressive stages of the attack. For example the trees on either side of a dead tree may be obviously dying and possibly a sporophore may be found on the next tree in the row though otherwise it appears to be healthy. This points to what is probably the only practical remedial measure which is to grow the sissou in mixed crops. *Fomes lucidus* is evidently a wide-spread and natural enemy of sissou, since it is found on planted trees on roadsides and similar places, as well as in unirrigated plantations, such as the Phillaur and Shahdara plantations. In Changa Manga where sissou is grown in large masses under purely artificial conditions the factors are particularly favourable to the fungus and the damage done has consequently been enormous. The question which remains to be answered is, will sissou continue to grow in Changa Manga or is it doomed to be exterminated? This is a very important question as if sissou cannot be relied upon in future another tree for standards must be found. Of one thing the writer is convinced and that is that the fungus attack cannot go on very long at the present rate for there will be no sissou left to kill; the only hope for the sissou is that the damage will probably become much less as the proportion of sissou diminishes and the facilities for the spread of the fungus under ground become less. For the present it will be assumed that it will be possible to grow sissou in mixture with mulberry though at the same time every effort should be made to find other trees which can be grown instead of it, a subject which will be referred to later.

17. Pigs and nilghai abound in Changa Manga and do considerable damage to the crops of the villagers surrounding the plantation. The only harm done by them in the plantation is to species grown on a small scale. In 1912 *Eucalyptus* and *Terminalia tomentosa* were tried experimentally in compartment 60, the former were browsed down by nilghai in the winter and the latter were rooted up by pigs soon after germination. Shooting of these pests should be encouraged all the year round and permission to hunt and shoot them should be given regardless of close seasons as there is little prospect of ever being able to do more than reduce their numbers to reasonable limits.

18. Appendix IV gives the areas felled year by year from 1896-97 to 1915-16 with the yield. The yield has undoubtedly been rising though, as it varies very greatly from compartment to compartment and as the compartments have never been felled at the same age in the 1st and 2nd rotations a direct comparison is impossible. The following figures however show that the yield has risen considerably :—

Compartment number.	AGE AT FELLING IN YEARS.		YIELD PER ACRE PER ANNUM IN CUBIC FEET STACKED THICK FIREWOOD ONLY.	
	1st rotation.	2nd rotation.	1st rotation.	2nd rotation.
41	15.5	15	101	178
45	15.5	16	99	201
46	16.5	16	142	212
58	17.5	18	116	260

The yield of 518 acres felled at the age of 15 years in 1885-86 amounted to 137 cubic feet stacked per acre per annum. The yield of 464 acres felled in the 2nd rotation at an average age of 15 years amounted to 246 cubic feet stacked per acre per annum. There are probably several causes which account for this rise in the yield. In the first rotation seedling crops were felled as against coppice crops in the second. The plantation to start with was nearly pure sissou whereas now it is principally mulberry. Both the density of the

growing stock and the quality of the soil have improved since the land has been planted up. All these probably contribute to the rise in the yield.

19. The exterior boundary pillars and concrete blocks for numbering compartments have all been replaced by pillars of solid stone on which the numbers are carved.

Special works of improvement.

The exterior boundary stones are $48 \times 16 \times 9$ inches and cost Rs. 4 each exclusive of freight from the Salt Range to Changa Manga. The compartment indicators are $18 \times 8 \times 8$ inches and cost Rs. 2 each exclusive of freight. Annual repairs to boundary pillars are now almost unnecessary and merely consist in resetting pillars which have fallen or started to fall.

20. According to the prescription in paragraph 23 of Mr. Hoghton's working plan a portion of Rakh Gandian was planted up in 1896-97 in order to straighten the boundary of the plantation. The area thus sown amounted to 158 acres and this has been added to compartments 107, 108, 109 and 110. Compartments 66, 67 and 63 were sown in 1901-02, the area being 273 acres. In the same year a portion of the Jand Maujoki extension was sown amounting to 92 acres. Of this area 39 acres was added to compartment 90 and the rest forms part of a new compartment 126, the balance of compartment 126 consisting of a strip adjacent to 125 which had hitherto been included in compartment 90.

21. Efforts have been made from time to time to introduce other valuable trees into the plantation, but except in the case of toon and willow the work has not been very systematic. Neither the toon nor the willow has been very successful. Except when planted near irrigation channels the toon does not get sufficient water. In the summer of 1915 numbers of toon trees, planted along the channel which supplies water to the railway station tank and which is constantly used, died completely or half-down apparently from excessive heat, as in that year many toon trees in the Canal Department Rest House compound also died. The toon in Changa Manga also suffers severely from frost and from the toon shoot borer and further efforts to cultivate it are inadvisable. The willows tried have been *Salix tetrasperma* and *Salix babylonica*. There is no demand for the timber of the former, but there is a small demand for the latter for cricket bats. It has been tried along irrigation channels and although the growth is satisfactory the prices obtained for the timber are low. Moreover the tree is short-lived so that with a rotation of 20 years even with thinnings there would probably be a great waste of timber owing to trees dying before the fellings came round if it were grown on a large scale, as the timber is not durable and a dead tree rapidly becomes rotten.

22. Of more interest than the actual revenue and expenditure of the Changa Manga plantation is the question—Has the plantation proved a profitable undertaking? Any calculation made from actual revenue and expenditure figures is apt to be misleading as many items must be taken into consideration which do not appear in the accounts. As the Forest Department accounts are not kept in such a way as to show the result of an investment which the plantation represents, a better idea can be obtained by making out an account showing what a private person or firm, supposing they were able to borrow money at 4 per cent. could expect to obtain as interest on the capital invested. The first question is—What sum must be borrowed? or in other words—What is the capital which has been spent on the plantation? The value of the land at the time the plantation was started was Rs. 11 per acre. The plantation was started in 1866-67, but as separate money figures for that year are not available it is necessary to consider it as having been started in 1867-68 in which year the revenue and expenditure of 1866-67 have been included. Regular working was started in 1880-81 consequently no return on the capital can be expected during the period 1867-68 to 1880-81 and interest on the sums spent has to be charged to capital. The revenue during the period the plantation was under formation is not expected to pay a percentage on the capital and has consequently been deducted from the expenditure. The following calculation shows that the capital invested

amounts to Rs. 6,73,769 of which Rs. 1,25,499 represents the value of the land:—

YEAR.	CAPITAL AT THE BEGINNING OF THE YEAR.		Expenditure.	Revenue.	Interest charges at 4 per cent. on values in columns 2, 3 and for half column 4.	Capital at close of year excluding value of land (columns 2, 4 and 6 minus 5).
	Excluding land.	Land at Rs. 11 per acre.				
1	2	3	4	5	6	7
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1867-68	Nil.	7,160	8,978	491	466	8,953
1868-69	8,953	11,440	10,563	984	1,027	19,559
1869-70	19,559	6,050	27,854	2,978	1,571	45,506
1870-71	45,506	18,590	40,451	2,512	3,373	86,818
1871-72	86,818	40,150	68,524	18,169	6,449	1,43,622
1872-73	1,43,622	68,750	59,230	7,763	9,679	2,04,763
1873-74	2,04,763	79,876	40,950	5,361	12,185	2,52,542
1874-75	2,52,542	79,332	33,637	2,599	13,948	2,97,528
1875-76	2,97,528	89,392	38,602	15,142	16,269	3,37,257
1876-77	3,37,257	1,00,232	30,615	5,017	18,112	3,80,967
1877-78	3,80,967	1,10,792	34,183	4,422	20,354	4,31,087
1878-79	4,31,087	1,25,499	37,103	7,796	23,006	4,83,405
1879-80	4,83,405	1,25,499	26,062	16,442	24,877	5,17,902
1880-81	5,17,902	1,25,499	18,497	14,235	26,106	5,48,270

23. In 1881-82 when regular working of the plantation was started the capital invested amounted to Rs. 6,73,769 and since that year various works of a capital nature have been carried out. For instance the irrigation channels were remodelled between 1890-91 and 1892-93 at a cost of Rs. 45,457, additional areas were planted up in 1896-97 and 1901-02. These items should certainly be debited to capital, but in doing so the value of the irrigation works replaced by the new ones should be struck off and the capital cost of areas planted up and subsequently lost by transfer to the Irrigation Department or other causes should also be written off. Otherwise, since there is no provision for depreciation of the capital, the capital would steadily rise and in time the returns would not amount to 1 per cent. on the inflated capital. As it is not possible to adjust such items now it is held that no increase to the capital should be allowed unless the area of the plantation is largely increased, of which there is no prospect. In 1880-81 the area of the plantation stood at 11,409 acres whereas the present area is 9,605 acres, so that the comparatively small area planted up in 1896-97 and 1901-02 may be taken against the large areas in the Jand Shahpur and Jand Maujoki extensions which are practically unproductive though the cost of making them was debited to the capital of Changa Manga. The gain in wooded area since 1881 may fairly be considered as being due to re-stocking some of the extensive areas which failed and consequently the cost should be debited to revenue and not to capital, since the original expenditure incurred on areas which have been planted up and have failed is still included in the capital.

24. The following table gives the revenue, expenditure and surplus for the period 1881-82 to 1915-16. The expenditure includes 1-5th of the Lahore Divisional and 9-10ths of the Chunian Range charges:—

YEAR.			Revenue.	Expenditure.	Surplus.	Surplus after deducting 4 % interest on capital (i.e., Rs. 28,951).
1			2	3	4	5
			Rs.	Rs.	Rs.	Rs.
1881-82	...	...	27,445	26,327	1,118	-25,833
1882-83	...	...	69,053	28,296	34,757	+7,806
1883-84	...	...	50,554	38,296	12,258	-14,698
1884-85	...	...	66,132	53,272	12,860	-14,091
1885-86	...	...	34,909	46,264	-11,355	-38,306
1886-87	...	...	52,571	45,510	8,061	-18,890
1887-88	...	...	14,226	36,916	-22,690	-49,641
1888-89	...	...	70,841	38,561	32,280	+5,309
1889-90	...	...	21,243	34,071	-12,828	-39,779
1890-91	...	...	44,252	45,622	-1,370	-28,321
1891-92	...	...	50,507	71,302	-20,795	-47,746
1892-93	...	...	51,640	51,496	144	-26,807
April 1893-June 1893	...	...	3,864	3,134	730	-6,008
1893-94	...	...	90,513	32,743	57,770	+30,819
1894-95	...	...	57,693	45,286	12,412	-14,539
1895-96	...	...	58,639	37,277	21,412	-5,539
1896-97	...	...	55,973	46,863	9,105	-17,846
1897-98	...	...	62,990	45,210	17,780	-9,171
1898-99	...	...	78,595	61,787	16,808	-10,143
1899-1900	...	...	1,14,121	53,688	60,433	+33,482
1900-01	...	...	1,06,841	46,482	60,409	+33,458
1901-02	...	...	1,19,161	58,784	60,427	+33,476
1902-03	...	...	1,08,833	69,774	39,059	+12,108
1903-04	...	...	1,54,818	50,086	1,04,732	+77,781
1904-05	...	...	1,51,073	49,835	1,01,238	+74,287
1905-06	...	...	1,08,104	65,857	42,247	+15,293
1906-07	...	...	87,944	56,490	31,454	+4,503
1907-08	...	...	1,22,834	55,937	66,897	+39,946
1908-09	...	...	1,02,671	63,694	38,977	+12,026
1909-10	...	...	1,21,916	58,484	63,432	+36,481
1910-11	...	...	1,67,201	56,942	1,10,259	+83,308
1911-12	...	...	1,86,155	73,850	62,305	+35,354
1912-13	...	...	1,70,527	65,486	1,05,041	+78,090
1913-14	...	...	2,20,318	69,442	1,50,876	+1,23,925
1914-15	...	...	2,13,551	75,458	1,43,098	+1,16,147
1915-16	...	...	2,04,439	90,908	1,13,531	+86,580

25. It will be seen from the above statement that up to the year 1898-99, taking interest on the capital into account, the working of the plantation resulted in a loss except in a few years, since then there has been a surplus every year. In other words, up to 1899 the plantation was unable to pay 4 per

cent. on the capital invested in it whereas since then it has paid more than 4 per cent. As the plantation is at first unable to pay 4 per cent. interest resulting in a loss if the money invested were borrowed, whereas subsequently it is able to pay more than 4 per cent., the losses may be paid out of subsequent profits by the creation of a separate fund, this fund being a temporary addition to the capital to be paid off as soon as circumstances admit. The following statement shows the accumulation and paying off of these arrears of interest:—

YEAR.	Unpaid interest at the beginning of the year.	Interest at 4 per cent. on the sum in column 2.	Surplus or deficit of the year.	Balance at close of the year.
1	2	3	4	5
	Rs. Nil.	Rs. Nil.	Rs.	Rs.
1881-82 ...			-25,833	25,833
1882-83 ...	25,833	1,033	+7,806	19,060
1883-84 ...	19,060	762	-14,693	34,515
1884-85 ...	34,515	1,381	-14,091	49,987
1885-86 ...	49,987	1,999	-38,306	90,292
1886-87 ...	90,292	3,612	-18,890	1,12,794
1887-88 ...	1,12,794	4,512	-49,641	1,66,947
1888-89 ...	1,66,947	6,678	+5,309	1,68,316
1889-90 ...	1,68,316	6,733	-39,779	2,14,823
1890-91 ...	2,14,823	8,593	-28,321	2,51,742
1891-92 ...	2,51,742	10,070	-47,746	3,09,558
1892-93 ...	3,09,558	12,382	-26,307	3,48,747
1st April 1893—30th June 1893.	3,48,747	3,488	-6,008	3,58,243
1893-94 ...	3,58,243	14,330	+30,819	3,41,754
1894-95 ...	3,41,754	13,670	-14,539	3,69,963
1895-96 ...	3,69,963	14,799	-5,539	3,90,301
1896-97 ...	3,90,301	15,612	-17,346	4,23,759
1897-98 ...	4,23,759	16,950	-9,171	4,49,880
1898-99 ...	4,49,880	17,995	-10,143	4,78,018
1899-1900 ...	4,78,018	19,121	+33,482	4,63,657
1900-01 ...	4,63,657	18,546	+33,458	4,43,745
1901-02 ...	4,43,745	17,950	+33,476	4,33,219
1902-03 ...	4,33,219	17,329	+12,108	4,38,440
1903-04 ...	4,38,440	17,533	+77,781	3,78,197
1904-05 ...	3,78,197	15,128	+74,237	3,19,038
1905-06 ...	3,19,038	12,762	+15,296	3,16,504
1906-07 ...	3,16,504	12,660	+4,503	3,24,661
1907-08 ...	3,24,661	12,986	+39,946	2,97,701
1908-09 ...	2,97,701	11,908	+12,028	2,97,583
1909-10 ...	2,97,583	11,903	+36,481	2,73,005
1910-11 ...	2,73,005	10,920	+83,308	2,00,617
1911-12 ...	2,00,617	8,025	+35,354	1,73,288
1912-13 ...	1,73,288	6,932	+78,090	1,02,130
1913-14 ...	1,02,130	4,085	+1,23,925	+17,710
1914-15 ...	+17,710	+708	+1,16,147	+1,34,565
1915-16 ...	+1,34,565	+5,383	+86,580	+2,26,523

26. From the above statement it will be seen that the financial position was at its worst in 1898-99 when the accumulated arrears of interest amounted to Rs. 4,78,018. It is perhaps not a coincidence that in the year from which the position begins to improve the fellings were in compartments which had all previously been cut over, whereas in 1897-98 some of the compartments were still being felled for the first time. By 1913-14 the whole of the arrears of interest had been paid off and up to that date the plantation had just paid 4 per cent. on all the money invested in it, leaving Rs. 17,710 as profit. Continuing the statement to the year 1915-16 it will be seen that in a very few years at the present rate the plantation could pay off the whole of its capital and there would remain a property the value of which has increased enormously since the plantation was started in 1867.

27. The timber produced in the plantation is the most paying product and it is more readily disposed of than firewood, hence every endeavour should be made to increase the supply of timber at the expense of firewood. The following classes of timber are sold :—

Class.	Size.	Approximate sale price per cubic foot.	Chief uses and markets.
		Rs. A. P.	
Sissoo logs, I Class	Not fixed	1 0 0	Building timber. Lahore, Multan and Sukkur.
Sissoo logs, II Class	Ditto	0 12 0	Ditto.
Sissoo logs, III Class	Ditto	0 8 0	Ditto.
Sissoo selected billets	5 feet long	0 12 0	Furniture. Kartarpur, Sukkur and Bhatinda.
Mulberry logs, 12 feet, I Class	About 12 feet	0 12 0	Carriage shafts. Sporting goods. Lahore and Sialkot.
Mulberry logs, 12 feet, II Class	Ditto	0 8 0	Ditto.
Mulberry logs, 5½ feet, I Class	5½ feet long	0 14 0	Hockey sticks and other sporting goods. Sialkot.
Mulberry logs, 5½ feet, II Class	Ditto	0 8 0	Ditto.
Persian lilac logs	Not fixed	0 8 0	Toys and small building timber. Lahore and Lower Bari Doab Colony.
Persian lilac ballas	About 6 inches diameter	0 5 0	Rough building timber.

28. The firewood is cut into billets of 5 feet length and is classified into thick firewood and thin firewood. The former consists of billets over 2 inches diameter at the thin ends and the latter of billets 2 inches or less in diameter at the thick ends. The thick firewood is further classified into thick sissoo and thick mulberry. Both thick sissoo and thick mulberry firewood on being bought by a trader are carefully sorted and all the thicker and straighter pieces are removed and used for timber, mainly in making legs of native bedsteads. The price of the stacks varies enormously according to the amount of thick straight pieces they contain. Of recent years it has been the custom to collect dry and windfall wood of which there are immense quantities, especially in compartments about 12 to 16 years old. The price obtained for this wood varies more than the price for other classes, as a stack containing thick billets from a dry standard is eagerly bought by furniture makers for the thick timber pieces, whereas many of the stacks only contain wood which is more or less rotten and for them the price is low.

29. With the exception of a few dry standing or fallen trees which are sold to local villagers and are cut and extracted by them, the whole of the produce is cut and carried to the sale depôt near the Changa Manga Railway Station. The carriage is done partly by tramway and partly by carts. The tramway is used for the carriage of firewood cut in main fellings, whereas logs and dry windfall wood are mostly carried by carts. The rates paid for carriage from the forest to the sale depôt are :—

- (1) *By tramway.*—Re. 1-0-0 per 1,000 cubic feet for loading and unloading. Re 0-8-0 per 1,000 cubic feet per mile for carriage. For logs half the rate paid for carriage by carts.
- (2) *By carts.*—Logs Re. 1-1-0 per sissoo log over 10 cubic feet and Re. 0-8-6 for logs of 10 cubic feet or less. Mulberry logs Re. 0-8-0 per 12 feet log over 10 cubic feet and Re. 0-7-0 for logs of 10 cubic feet and less, 5½ feet logs Re. 0-2-6 each. Thick firewood Rs. 5 per 1,000 cubic feet for blocks I and III, Rs. 6-0-0 per 1,000 cubic feet for blocks II and IV. Thin firewood rates are Re. 1-0-0 per 1,000 cubic feet less than those for thick firewood.

30. The most important markets for firewood are Lahore and Amritsar. The thin firewood all goes to Lahore, as being a bulky product it does not pay to rail it far. Smaller quantities of firewood are taken to Dhariwal, Ferozepore, Gujranwala and Sialkot. The demand in Sialkot is for thick mulberry for timber and only stacks which contain suitable pieces are bought.

31. The Changa Manga plantation is the only important forest in the Chunian Range and the head-quarters of the Range are situated in the plantation. The staff consists of a Forest Ranger, a Deputy Ranger, 4 Foresters for the 4 blocks and one for the depôt and 20 Forest Guards. There is a permanent staff of labourers (called *beldars*) living in the plantation, the full number for which quarters are available is 100, but at present not more than 80 are actually employed owing to the demand for labour in the Lower Bari Doab Canal Colony. The *beldars* are paid a daily wage of Re. 0-5-0, Re. 0-5-6 and Re. 0-6-0, the increment of Re. 0-0-6 being earned by a year of service. In addition each man obtains a free house, vegetable patch and grazing for 2 cows and 2 calves. After the first year each man is allowed 3 cows and 3 calves. No further concession in the way of grazing should be permitted as it is already difficult to control and often causes damage to the plantation.

32. The labour supply has during the last few years been a great and constant difficulty. The supply of local labour is sufficient for the needs of the plantation if the men were more regular in their habits, but the local men cannot be depended upon to work steadily. Moreover, the system of giving advances which has been long in force, has made the local labour difficult to control. No man will come out to work without an advance of pay and having taken the advance there is no guarantee that he will ever work it off. The only solution appears to be to import outside labour during the felling season, i.e., October to March. This has always been done hitherto, but sufficient labour to do the whole of the fellings has not been imported and consequently a portion of the work has been done by local coolies. In future it will probably be found advisable to import sufficient men to carry out the whole of the final fellings and to use the local labour on thinnings. The latter can be spread more or less over the year as there is not the same importance in getting the thinnings done by the end of March as there is in the case of the coppice fellings. It will of course be necessary to pay imported coolies at a higher rate than local men, but the rates paid for felling hitherto will sooner or later have to be raised as they are far lower than those paid by traders who buy wood standing in the Lahore Division.

PART II.

Proposals for future working.

33. The objects of management will be to obtain the highest annual revenue possible consistent with the supply of timber and firewood to Lahore and other markets in the vicinity. With this object it is necessary to abandon the rotation of 15 years under which the plantation has been nominally worked hitherto, and it is proposed to substitute one of 20 years. Fortunately at the present time owing to the fellings being in arrears the crops now being felled are considerably older than 15 years, so that the change can be made at once without reducing the yield.

34. The following figures show that a rotation of 20 years is more profitable than one of 15 years: An area of 464.3 acres felled at the age of 14, 15 and 16 years, the areas of 14 and 16 years old crop being equal to one another, yielded on the average 2,678 cubic feet stacked of thick and 749 cubic feet stacked of thin firewood per acre. An area of 596 acres felled at the age of 19, 20 and 21 years, the areas of 19 and 21 years old crop being equal to one another, yielded 4,238 cubic feet stacked of thick and 1,323 cubic feet stacked of thin firewood per acre. To obtain a fair and representative figure the areas for which the yields have been taken in the above calculation are situated in 9 compartments in the case of the 14, 15 and 16 years old crops and 11 compartments in the case of the 19, 20 and 21 years old crops. They were all in compartments felled for the second time. The yield of timber from standards does not affect the consideration of the rotation of the coppice as it is of little importance whether standards are to be grown for 3 rotations of 15 years or for 2 rotations of 20 years. The thin wood is also best left out of account as the figures for it represent the amount which was actually extracted and utilized rather than the maximum amount which could be collected. Taking the area of the plantation at 9,000 acres with a 15 years rotation the annual coupe is 600 acres, yielding 2,678 cubic feet stacked of thick wood per acre = 1,606,800 cubic feet stacked. With a 20 years rotation the annual coupe is 450 acres, yielding 4,238 cubic feet stacked of thick wood per acre = 1,907,100 cubic feet stacked. Apart from the fact that 20 years old mulberry wood is worth more than 15 years old mulberry wood (at present about Rs. 8 and Rs. 6 per hundred cubic feet stacked respectively), the actual outturn with a 20 years rotation being greater, the 450 acre coupe is worth more than the 600 acre coupe. Further, if the 15 years rotation were adhered to almost all the mulberry timber which is now produced and which is a very important source of revenue would be lost.

Since a 20 years rotation pays so much better than a 15 years one the obvious question to ask is "why stop at 20 years"? Would not a rotation of 25 or even 30 years pay better still? To answer this question it is necessary to have figures of yields of crops 25—30 years old, which are not available at present. Any one who saw the crops now being felled at 22-23 years old would admit that they should have been felled some time ago as crops of this age tend to open out very much and there is a constant loss of valuable timber from windfalls. It is not uncommon to find a mulberry undergrowth coming up owing to the thinning out of the cover, and it seems probable that if in Changa Manga a rotation of 30 years were adopted the crops would open out very much and regenerate themselves naturally before the fellings came round, so that a 30 years old crop would look more like one 5 years old in which an excessive number of standards had been left.

35. A similar effect to increasing the rotation but probably without the disadvantage of making the crop very open can be produced by periodic thinnings, and these will in future be introduced. The effect of regular thinnings on the rotation is not easy to foresee and it is quite possible that the rotation could profitably be reduced to 18 or 17 years with periodic thinnings. The effect of the thinnings on the crop will be to increase the quantity and improve the quality of the

mulberry timber. In a 20 years old crop which has been repeatedly thinned, almost every stem should yield a log of $5\frac{1}{2}$ feet length and most of them one of 12 feet, whereas at present only one tree out of several gives a $5\frac{1}{2}$ feet log and one out of many a log of 12 feet. As has been remarked already timber pays better than firewood. A good stack of mulberry firewood may be sold for Rs. 9 per hundred cubic feet which is roughly equivalent to Re. 0-2-6 per cubic foot solid. Persian lilac ballas which if cut up into firewood reduce the value of mulberry stacks can be sold (at any rate in small quantities) at annas 5 per cubic foot. Hence timber of the poorest quality is worth twice as much as the best class of mulberry firewood, consequently as much as possible of the outturn should be sold as timber. The thinnings will necessarily yield only firewood and this will in future have to be sold together with the whole of the final yield. Moreover, in a few years other plantations such as Kot Lakhpatt and Chichawatni will be supplying firewood and hence the more the Changa Manga timber outturn can be increased the better it will be both for Changa Manga and for Chichawanti and Kot Lakhpatt which will necessarily be unable to supply any appreciable amount of timber in the first rotation and will compete with Changa Manga in the firewood market. At present a sudden increase in the supply of mulberry or Persian lilac timber would probably be followed by a considerable fall in prices, and it is possible that the plantation can supply more of these timbers than there is a demand for, but it seems much more likely that any fall in prices will be temporary and will be followed by an increase in the demand owing to the timber being put to new uses, and a return to the original prices.

36. Appendix I gives a tabular statement of the fellings. In the first year the areas planted up and not yet felled in compartments 66, 67, 68 and 90 will be felled along with compartments 106 and 107. These areas should have been felled at the time fellings were made in the adjacent compartments and as this has not been done it is desirable to fell them as soon as possible so that the compartments may be taken in their proper sequence when fellings come round again without sacrificing immature growth. It will be noted that these areas are prescribed for felling twice during the working plan period. Thus compartment 66 will be felled once in 1916-17 and again in 1930-31 at 14 years old, and compartments 67 and 68 in the following year at 15 years old. Similarly, the greater part of compartment 90 will be felled a second time in the working plan period at the age of 17 years. Thus the total area of the 20 coupes to be felled comes to 9,479 acres, whereas the total area of the plantation within compartment boundaries amounts to 9,191.1 acres.

37. As far as possible in the past fellings have been made between 1st October and 31st March and this should be continued. There is no silvicultural objection to fellings being made between 1st April and 30th September if it is desired to finish off arrears and labour can be obtained at this season, but as there are other works which require to be done at this time of year it is more convenient to finish the main fellings by 31st March. The wood cut is usually left for 12 months to dry before being carried to depôt, and hitherto it has been usual to carry firewood by tramway and logs by carts as the removal of the logs has generally been in advance of removals of firewood. This leads to waste since for compartments 90-105 the present rates for carriage of logs by cart and by tramway are Re. 1-1-0 and Re. 0-8-6 per log, consequently logs should, as far as possible, be carried by tramway and the removal of the firewood and timber should proceed evenly. It may be noted, however, that the demand for mulberry timber is for green wood and consequently the mulberry timber is removed as soon as possible after felling by carts. When the yield of mulberry timber increases it will be a matter for consideration whether it is better to continue removing the mulberry logs by carts or whether the tramway should be laid as soon as the logs are ready for removal. Having laid the tramway for mulberry logs it will be necessary either to leave it idle for 12 months till the firewood is dry and fit for removal or it can be taken up and relaid for the removal of firewood.

As mulberry and sissoo firewood are stacked separately it is usual to fell the crops in two stages, first the mulberry, with which all other species unsuitable for standards are included, such as *farāsh*, *jand*, *vān*, *phulāi*, etc., is felled and stacked. When this has been done the standards are marked for reservation and the remainder of the crop is felled, finally the excess of standards and any standards broken or damaged are felled and the work is complete. This plan may suitably be continued in future, but as the number of species in the plantation increases it will be more difficult to arrange as it will be necessary to reserve siris, toon, eucalyptus, *Gmelina arborea*, etc., as standards to make up for a deficiency of sissoo, but it is clearly useless to reserve such trees as Persian lilac or tallow and a pure coppice would be preferable to a stored coppice with such trees as standards.

38. Hitherto following European practice it has been customary to dress the stools after felling, but during the last few years this practice has been given up. Nothing can be urged in favour of stool-dressing as even assuming a dressed stool produced more vigorous coppice shoots than an undressed one, which is not the case, seedling reproduction of mulberry is so vigorous that coppice reproduction could be dispensed with altogether and a pure seedling crop will undoubtedly give a better yield of timber at 20 years old than will a coppice crop. Stool-dressing will therefore be given up in future as it has been during the past few years, but low cutting must be insisted on.

39. In very many compartments it will be found quite impossible to find sufficient sissoo stems to leave as standards to replace those felled. In such cases in Mr. Hoghton's working plan (paragraph 22) the reservation of mulberry standards was prescribed. This has proved to be a mistake and in future no mulberry standards should be reserved. Most of the objections to mulberry as a standard apply equally to Persian lilac and this species should also not be reserved. Persian lilac stems grown in dense crops for 20 years and then suddenly opened out and exposed as standards would almost all be thrown or broken by wind. If any survived for another 20 years they would probably become hollow. During the past few years it has been the custom in order to try to make up for a deficiency of standards, in the absence of young sissoo stems, to leave almost all the standards which were found in the crop at the time of felling. This is a great mistake and in many coupes now about 3—7 years old numbers of standards have fallen and rotted on the ground, as a fallen stem is so difficult to extract from a dense young coppice crop that it is usually not attempted. Thus much valuable mature timber has not been cut and has been allowed to rot in the plantation instead. Instances can be found of trees being left in group in order to try and obtain 15 standards per acre on the average, thus in places the standards are so close together that they have prevented the satisfactory growth of the mulberry and elsewhere in the same compartment there may be no standards at all.

40. In 1919-20 when the crop is being cut for the third time it will be necessary to cut almost every standard in the coupe including those on the outer boundary and on road-sides since standards which have already gone through three rotations are fully mature and if left for a fourth rotation of 20 years would run a great risk of dying before the end of the period. Hence such standards should ordinarily be felled and not kept merely to make up for a deficiency in standards of smaller size. In many compartments there is practically nothing but mulberry and Persian lilac in the underwood and as neither of these can be left as standards there will be scarcely any standards left after the felling, consequently the standards will have to be replaced artificially. In replacing standards sufficient should be provided to furnish 15—20 standards per acre as well as a single line along compartment roads and a double line along the outer boundary. The best method of doing this remains to be ascertained, and in offering some suggestions on the subject the choice of the species to be grown will also be considered.

The possibility of it becoming impossible to grow sissoo on a large scale in Changa Manga has already been referred to in paras. 10 and 16 and consequently although it is advisable to continue to try to grow it for the present, the possibility of it becoming absolutely necessary to find a substitute makes it desirable to experiment with other promising trees.

The best method of maintaining sissoo standards will probably be to clear mulberry and weeds in the coupe after felling so as to prevent the sissoo which springs up freely from seed and rootsuckers from suppression by mulberry. The clearing should be done in strips and will also result in maintaining a proportion of sissoo in the coppice and save it from being completely driven out by mulberry. For many reasons an admixture of sissoo is desirable, but as explained in paras. 7 and 8 it is not advisable to attempt to maintain sissoo as the principal species. The clearing of mulberry, &c., will therefore be done primarily to obtain young standards and secondly to preserve an admixture of sissoo in the coppice. The cleared strips will require constant attention for 3 or 4 years to prevent the mulberry obtaining the upper hand, and it is suggested that they be 100 feet apart from centre to centre and 20 feet wide. This will mean preserving 20 per cent. of sissoo in the crop in addition to any found scattered over the rest of the coupe. As regards trees other than sissoo, of those at present found

in Changa Manga *Albizia Lebbek* and *Gmelina arborea* and possibly some species of *Eucalyptus* are likely to prove satisfactory substitutes for sissoo as standards.

Very little can be said on the cultivation of the trees named except *Eucalyptus*. The species of *Eucalyptus* known to do well in Changa Manga as proved by specimens cultivated for a sufficient length of time to show their growth and also to flower and reveal their identity are :—

Eucalyptus tereticornis.—This is the fastest and straightest grower. The wood requires to be sawn up green rejecting the core of the logs, otherwise it splits very badly. Even with these precautions there is likely to be considerable waste.

Eucalyptus rostrata.—Similar in almost all respects to *E. tereticornis*, but not so straight in growth.

Eucalyptus siderophloia, *Eucalyptus crebra* *Eucalyptus paniculata*.—All three are valuable timbers in Australia and grow well in Changa Manga. *Eucalyptus paniculata* is probably the most promising. All three are slow in growth compared with *Eucalyptus rostrata*.

Eucalyptus melanophloia.—Is apt to be straggly for the first year or two but soon straightens and grows well. Nothing is known as to the quality of the timber, but it appears to be hard and durable.

Eucalyptus citriodora.—Grows well in Changa Manga and forms a very straight clean bole. Not a promising tree for cultivation on a large scale as seedlings are more difficult to grow than many other kinds of *Eucalyptus* and the diameter growth is poor.

Very many other kinds of *Eucalyptus* have been tried especially during the last few years, but at present the only one which seems to be as good as most of the species mentioned is *Eucalyptus saligna*. Of the species tried this is the only one which approaches *Eucalyptus tereticornis* and *Eucalyptus rostrata* in rapidity of growth. Many other species doubtless can be grown, but under Changa Manga conditions rapidity of growth is the first consideration and provided the timber produced is fairly good the fastest grower will probably pay best.

One experiment has been tried with the object of introducing *Eucalyptus* standards in compartment 60. In the autumn of 1912 *Eucalyptus* seed was sown as soon as the monsoon was over, that is about the middle of

September. The seedlings were potted off into 4-inch pots as soon as possible in order to get plants big enough to plant out early in the irrigation season. In May 1913 the plants then about 8—12 inches high were planted out in compartment 60. Several species were tried including *Eucalyptus rostrata*, *Eucalyptus tereticornis* and *Eucalyptus siderophloia*. The growth of the first two was excellent and by November it was evident that they could hold their own against mulberry coppice without further attention. During the cold weather almost every plant was browsed down by *nilghai* and many were broken off. In spite of this, however, many recovered in the spring and at present there are a considerable number left about 20—30 feet high which promise to make excellent standards though *nilghai* still damage them by gnawing the bark. The kinds left are mostly *Eucalyptus tereticornis* and *rostrata*.

It seems evident that *Eucalyptus tereticornis* and *rostrata* can be grown as standards without any great difficulty. Whether in the event of sissoo failing it is advisable to grow these species is another matter. As already noted the timber should be sawn up green and hence a saw mill will be necessary and the trees must be grown on a scale sufficient to justify the mill. *Eucalyptus paniculata* and *crebra* produce more valuable timbers than *Eucalyptus tereticornis* and *rostrata*, and although not so rapid in growth it is possible that they could be grown with a little more assistance in the way of cutting back mulberry and consequently before selecting *Eucalyptus tereticornis* and *rostrata* experiments should be made with *Eucalyptus crebra* and *paniculata*. With no species of *Eucalyptus* can natural reproduction by seed be expected in Changa Manga, and as they are wanted as standards coppice reproduction is of no use, consequently it will be necessary to plant standards at each felling. If trees of 6-7 feet girth can be got in two rotations or 40 years as seems probable with *Eucalyptus* the money spent on planting will probably be well invested.

41. Hitherto with the main fellings getting more and more into arrears, thinnings have not been attempted except on a small scale as an experiment. With a 15 years rotation and an outturn consisting almost entirely of firewood thinnings were not very important, but now that the rotation has been raised to 20 years in order to increase the yield and the proportion of timber produced, thinnings which have the same object are most important, and it is necessary to get them done. The thinnings would be worth doing for the benefit of the final yield even if it were necessary to raise the rates for cutting and stacking considerably to attract labour and get them done so that they in themselves were not profitable. No such rise in the rates, however, is called for at present though, if double the present rates were paid, the thinnings would still more than cover expenses.

Thinnings made hitherto in 6—12 years old crops have yielded roughly 1,000 cubic feet stacked per acre in each case, but it cannot be said that a crop thinned at 6 years old will, if thinned again at 12 years, give another 1,000 cubic feet stacked per acre. If the final yield of a thinned area is affected in any way it should be increased rather than diminished if a suitable interval has elapsed since the last thinning, but it cannot now be said that this will be the case. In a few years a good deal more about thinnings in Changa Manga will be known than now and consequently it is proposed to prescribe the thinnings tentatively for a period of 6 years at the end of which a fresh scheme should be drawn up.

42. The objects sought to be attained by the thinnings are (1) to increase the quantity of the outturn by recovering material which at present falls to the ground and rots, (2) to increase the yield of timber by assisting promising stems and cutting out badly grown coppice shoots, and (3) to regulate the mixture and save as far as possible promising stems of sissoo, siris, etc., from suppression by mulberry. The first of these objects necessitates thinnings repeated at frequent intervals and the last two make it desirable to carry out the first thinning as early as possible. The mulberry crops in Changa Manga are so dense and so sensitive to any great interruption of the cover that it is

Thinnings.

Age of the crops to be thinned.

impossible to open them out sufficiently in one operation to prevent them becoming congested again in a few years without cutting so many stems that those left are unable to stand upright. Hence it is considered that 3 thinnings will be required. Two thinnings would have advantages over 3, in that they would be easier to carry out, but it is doubtful if in 2 thinnings the immense number of stems which have to disappear between the ages of 5 and 20 years, can be removed without the risk of the stems left being too isolated to stand. The first thinning should take place at 6 years. A thinning earlier than this would have advantages, but the crops until they have been opened to grazing are so dense that it is difficult to enter them and consequently thinnings in 5 years old coupes would be very difficult to carry out. During the 20 years, 1916-17 to 1935-36, the average age of the crops to be felled will be about 22 years, hence if 3 thinnings are to be made starting at 6 years, the second and third thinning should be at 11 and 16 years respectively. The following thinnings are therefore prescribed:—

I.—Thinnings (6 years old crops).

Years.					Compartment.	Area.
1916-17	...	...	...	...	59, 100	177
1917-18	...	...	...	...	61—64	359
1918-19	...	...	...	...	60, 65, 69	337
1919-20	...	...	...	...	78—86, 90—91	329
1920-21	...	...	...	...	87—89, 92—94	258
1921-22	...	...	...	...	95—105	764

II.—Thinnings (11 years old crops).

1916-17	...	...	...	...	52—56	570
1917-18	...	...	...	...	73—76	492
1918-19	...	...	...	...	71—72	188
1919-20	...	...	...	...	58, 77	116
1920-21	...	...	...	...	57	107
1921-22	...	...	...	...	59, 100	177

III.—Thinnings (16 years old crops).

1916-17	...	...	...	...	12 (part), 13—16	468.6
1917-18	...	...	...	...	17—24	479.0
1918-19	...	...	...	...	25—31	447.2
1919-20	...	...	...	...	32—40	515.5
1920-21	...	...	...	...	41—48	487.5
1921-22	...	...	...	...	49—52	494.0

43. The method of carrying out the thinnings found most successful

The execution of the thinnings.

hitherto is first to have all dead and fallen stems including standards cut and collected. An untrained guard can then with very little practice have all the suppressed stems marked and cut. After this has been done a light thinning is marked by a skilled officer. This method gives satisfactory results in crops 10—16 years old which have not previously been thinned. In crops 6 years old there is very little dead wood and unless a skilled officer has plenty of time to spare for the work it will be necessary to use an untrained guard to mark all suppressed stems which should be cut before the skilled officer marks the thinnings.

From a silvicultural point of view the first thinning is probably the most important, but from the revenue side the second and third will be found more profitable. When work gets into arrears it will be advisable to do the thinnings prescribed for the year before trying to clear off arrears. If it is impossible to carry out the whole scheme it will be better to leave the second thinning entirely and finish I and III rather than to have arrears in all three.

44. The first thinning should be made as heavy as possible without damage to the crop. As far as possible all crooked shoots should be removed, seedlings being straighter than coppice shoots and less liable to decay at the base should be favoured. If it is not advisable to remove all the shoots in a coppice clump they should be reduced to 3 or 4 or even fewer.

In the second thinning at 11 years there is far less scope for choice and consequently less opportunity for improving the crop. Suppressed trees which will soon die if left should be cut and removed together with dead stems which are not rotten. The crop left can then be thinned. Again a fairly heavy thinning would be desirable if it were not for the stems which have been accustomed to be supported by their neighbours being unable to do without some support.

The third thinning at 16 years should aim mainly at opening out promising stems so that they may put on a good girth increment during the remaining 6 years of their life.

The intensity to which it is safe to thin is at present unknown and can only be found out practically. If the thinnings are over-done they may do harm rather than good though it must be remembered that unthinned crops at present often suffer very severely from wind. On the other hand, if done properly they will increase the yield probably by 40 per cent. or even more, viz. :—

- I—Thinning, say, 800 cubic feet stacked per acre.
- II—Thinning, say, 400 cubic feet stacked per acre.
- III—Thinning, say, 400 cubic feet stacked per acre.

Total 1,600 cubic feet stacked per acre.

45. The cutting back of mulberry in strips has already been referred to as necessary if it is decided to grow sissoo standards. In the past it has also been customary, at least once during the first year and often more frequently and occasionally again in the second and rarely also even in the third year, to go over the coppice coupe cutting back weeds, with which hitherto Persian lilac has been included. Although it is not proposed to cut back Persian lilac wholesale as a weed in future there are weeds particularly *Saccharum Munja* "*kana*" and *Chenopodium album* "*báthu*" which are apt to overrun the coupe and suppress all other growth. These must be kept down by weeding as hitherto and it is suggested that mulberry coppice shoots be cut back at the same time whenever mulberry seedling regeneration is sufficient to enable coppice to be dispensed with entirely. If pure seeding crops can be grown the timber yield will be improved and there will be less loss from windfalls. Windfall is very often due to the rotting of a big mulberry stump surrounded by coppice shoots, the shoots under these conditions are easily blown over in a direction radially away from stump and if one shoot goes the rest frequently follow and cause a big hole in the canopy.

46. After the fellings have been made and the wood has been removed it used to be the custom to burn the brushwood and refuse, but it has been found cheaper to heap it up between the irrigation trenches and leave it to rot on the ground which it

does in 3-4 years. Apart from questions of expense the giving up of the burning of the brushwood is of advantage in that the work was frequently carelessly done and caused much damage to standards and also at times to fuel stacks. In plots where *kána* is very dense and standards are few it may be advisable to burn the felling area to facilitate the removal of *kána*, but ordinarily the brushwood should merely be piled between the irrigation trenches. The trenches should then be re-opened the earth being thrown in the middle between the trenches unless seed is to be sown when the earth from the trench must be piled in a ridge on one side. The object of re-opening the trenches is to facilitate irrigation and ensure the even distribution of the water. Without the trenches under the present system of irrigation pieces of high ground would get very little water whereas the ground around at the normal level would be given far more than necessary as it would be taking up water as fast as it could percolate away (*vide* D'Arcy paragraph 31) until it had been flooded to a depth sufficient to moisten the high ground. Patches of high ground are usually not very absorbent so that if the water supply were stopped as soon as the high pieces were moistened, the water might not have sunk into the soil at the high level more than a few inches, whereas normally in Changa Manga after irrigation the soil is saturated to a depth of several feet.

47. Blanks in Changa Manga capable of being stocked amount to an estimated area of 39.2 acres only. These are mostly due to high ground and although a good deal has been done towards restocking patches of high ground some work of this nature still remains. A little extra expense is all that is required in digging deeper trenches through the high ground when the trenches in the compartment are being re-opened. When the difference in level amounts to more than 3 feet which is seldom the case, every second or third trench should be dug 2 feet wide and deep enough to carry water through the mound. It is not expected that this work will prove profitable owing to the gain in area, but it is justifiable as a great deal has already been done and comparatively little remains to complete the work. Blanks due to *kána* or similar causes other than level, should be re-sown after the fellings. Sissoo or siris might be sown in case sufficient mulberry does not come up naturally. The outer edge of the plantation is distinctly worse stocked than the interior and it is usually possible when walking towards the boundary through the plantation to tell by the nature of the growth that the end is approaching before it is possible to see the light ahead through the trees. The time has come not to reserve mature trees merely because they are on the outer boundary; consequently after the next felling it will be advisable to create a wind-break round the outer edge. If Eucalyptus plants are available they might be planted in a double row and a line of *Acacia Farnesiana* sown between them along the outer boundary. If hot dry winds could be kept out of the plantation the growth inside would be improved.

48. All the forest roads in Changa Manga were originally made 16 feet wide except for 2 main roads of 32 feet, one on either side of the canal running through the plantation approximately parallel to the canal. In course of years owing to the constant repairing of passels, roads which were originally straight have become crooked and the width in many places has been greatly reduced. At the time of starting the fellings in any compartment the roads round it should be straightened and brought to their original full width before any stacking of wood is commenced. The roads bounding compartments 90-126 are those which require most attention as they were seldom quite straight in the first instance. In the rest of the plantation very little beyond slight widening here and there is required.

49. Appendix V shows the areas irrigated each year from 1896-97 to 1915-16. Mr. D'Arcy in paragraph 24 of his working plan for Changa Manga says "The adequate irrigation of the plantation is the most important circumstance affecting its management." This fact cannot be too strongly emphasised and all work must give way to irrigation whenever water is available. Occasionally

the Forest Department has been asked to take water by the Canal Department and the local Forest Officer has refused to accept it on the grounds that the *beldars* were employed on other works than irrigation. As the plantation now gets so much less water than formerly and the water supply is likely to get worse rather than to improve, all works must give way to irrigation until the whole area has been watered twice, which since the total area within compartment boundaries amounts to 9,191 acres means until at least 18,382 acres has been watered. An area of this size has only twice been exceeded, *viz.*, in 1896-97 and 1899-1900 and it is unlikely to be approached again.

Mr. D'Arcy in paragraph 25 gives an abstract of the correspondence between the Canal and Forest Departments which ended in a contract being drawn up for a period of 10 years from 1st April 1884. This contract worked well up to 31st March 1894 when it was proposed by the Forest Department to renew it on the same terms for a further period of 10 years. The Canal Department pointed out that as the areas irrigated during the past two years (1892-93 and 1893-94, the years immediately following the remodelling of the irrigation works) had been so much larger than the average of the previous 8 years, the fixed sum of Rs. 13,800 paid annually by the Forest Department for water should be increased. A sum of Rs. 2-4-0 per acre per annum was asked for or Rs. 18,000 in all, assuming the area irrigated to be 8,000 acres, which was approximately the average of the "first waterings" during the past decade. Under this arrangement any second or third waterings were not to be charged for. The Forest Department pointed out that during 1892-93 and 1893-94 an exceptionally large area had been irrigated because of unusually heavy rains in consequence of which water was not required in large quantity by agriculturists and was given to the plantation rather than let it escape back into the river. The figures of watering during April, May and June in those years showed no great difference from the average. It was feared that owing to the great increase in the demands of cultivators for water, in a dry year the plantation might not get sufficient water during April, May and June. (Mr. Elliot, Conservator of Forests, remarked "unless water is given at this time (April-June) the plantation suffers irretrievably and no amount of irrigation at other times will repair the damage done.") The Forest Department agreed to the enhanced rate, but asked in return that sufficient water to irrigate 8,687 acres once thoroughly during the dry months of April, May and June be guaranteed by the Canal Department. This raised an old question on which the two departments had always differed, namely, the amount of water really necessary to irrigate a forest plantation. The Superintending Engineer, Bari Doab Canal, from figures showing the total quantity of water supplied and the area irrigated for the 8 years 1886-87 to 1893-94, found that on the average 3.06 feet of water were required all over the area irrigated between 1st April and 30th June. He remarked "there is no reason why the Forest Department like all other users of canal water should not be urged to practice economical distribution," and to induce them to do so undertook to guarantee only a depth of 2.5 feet. The agreement now in force was accordingly drawn up guaranteeing as a *minimum* the supply of 946×10^6 cubic feet of water between 1st April and 30th June annually (*i.e.*, sufficient to flood 8,687 acres to a depth of 2.5 feet).

From the point of view of the Forest Department the present agreement drawn up originally for the period 1st April 1894 to 31st March 1904, and subsequently extended to 31st March 1914 and again to 31st March 1924, has been satisfactory.

50. The area permitted to be irrigated under the agreement is the whole Changa Manga Reserve and not merely the 8,687 acres for which a depth of 2.5 feet is guaranteed. Additions and extensions have brought the irrigated area up to 9,191 acres, but owing to increased demand for water by agriculturists the Canal Department has declined to increase the minimum supply guaranteed. Twenty years ago considerably more than the minimum supply contracted for was given by the Canal Department, but of recent years surplus water has decreased owing to extension of cultivation and the minimum supply has been more and more nearly worked down to. In the 12 months, April to March

Extension of the area irrigated.

considerably more than 943×10^6 cubic feet of water, the guaranteed minimum, is supplied, *but the size of the plantation is limited to the area which can be irrigated during April, May and June.* Consequently to increase the size of the plantation it is necessary to give less than 2.5 feet so that a larger area than 8,657 acres may be watered. Under the present system of irrigating large blocks it is not possible to give much less than 2.5 feet at the first watering. In May 1916 the plantation was watered using the water economically, and it was found that the 3,300 acres irrigated during the month had received a depth of 2.375 feet. If this figure is taken as the minimum depth of water required and assuming that in a dry year 946×10^6 cubic feet of water will be supplied during April—June, it will be enough to irrigate 9,144 acres. The area within compartment boundaries now stands at 9,191 acres so that no increase should be made unless it is found that economies can be effected by a change in the method of irrigation.

The only change in method of irrigation which need be considered is one which has already been urged by Canal Officers and is mentioned by Mr. D'Arcy in para. 31 of his working plan, namely, "to sub-divide the compartments and to water each sub-division as quickly as possible." Arrangements have been made to try this method of irrigating and if by it water can be economised the Maujoki Jand Extension should be sown up and added to the irrigated area. Since 2 acres watered once a year will give a bigger yield than 1 acre watered twice as much or twice as often, every endeavour should be made to make the water go as far as possible. It must, however, be remembered that if the amount of water given is cut down below a certain point, in a dry year a second watering would be necessary to keep the trees alive, and it is quite possible that if less than 2.37 feet of water is given to the plantation one irrigation in a dry year will be insufficient. If this proves to be the case it is obvious the area of the plantation cannot be extended without more water however economically it may be used.

51. The *beldars* or permanent labour staff employed in Changa Manga are occupied as follows :—

Work of the "*Beldars*."

July	}	Stubbing out <i>kána</i> and other weeding work. Opening trenches.
August		
September		
October	}	Clearing roads and repairing quarters.
November		
December	}	Clearing silt, repairing channels and passels. Opening trenches.
January		
February		
March		
April	}	Irrigation, opening trenches, stubbing out <i>kána</i> .
May		
June		

52. The following works will of course be carried out annually if required as hitherto :—

Miscellaneous.

Repairs to roads.

Repairs to buildings.

Up-keep of rest-house compound and wells.

Clearing silt from *kháls* and channels.

52. On the average the following annual revenue, expenditure and surplus may be expected from Changa Manga :—

Forecast of the financial results of working.

Revenue.

	Ra.
Sale of timber from 470 acres at 80 cubic feet sissoo and 50 cubic feet mulberry per acre at Re. 0-12-0 and Re. 0-10-0, respectively, say Rs. 90 per acre	42,300
Sale of firewood from 470 acres at 4,000 cubic feet stacked per acre of thick wood and 750 cubic feet stacked per acre of thin wood at Rs. 8 per C cubic foot and Rs. 16 per M cubic foot stacked respectively, Rs. 332 per acre	1,56,040
Sale of firewood from three thinnings each over 470 acres at Rs. 1,600 cubic feet stacked per acre at Rs. 5 per C cubic foot	37,600
Local sales of timber and firewood	1,000
Grazing in the unplanted area	2,500
Miscellaneous (compensation, rent of shops, etc.)	560
Total revenue	2,40,000

Expenditure.

Cost of cutting and carrying to depôt 61,100 cubic feet of timber at Re. 0-1-6 per cubic foot, say	5,750
Cost of cutting and carrying to and restacking in depôt of 2,984,500 cubic feet stacked firewood at Rs. 12 + 2-8-0 + 0-12-0 per M cubic foot, say	45,500
Cost of laying and repairing tramline	2,000
Cost of 4 watchers in the depôt and other depôt expenses	700
Cost of upkeep of roads	850
Cost of up-keep of buildings	700
Cost of up-keep of compounds including irrigation charges	500
Water rate for the plantation	18,000
Up-keep charges of the plantation (labour on watering, clearing silt, etc.)	6,000
Establishment (average of the last 19 years, excluding divisional office charges), say	6,000
Total expenditure	86,000
Surplus	1,54,000

Abstract of Prescriptions.	Para. of the Working Plan.
Fellings, coppice with standards	36
Thinnings	42
Replacement of standards	40
Cleaning and weeding	45
Reopening irrigation trenches	46
Restocking blanks	47
Straightening roads	48
Upkeep of roads, buildings, wells, etc.	52
Clearing silt from irrigation channels	id.

Countersigned.

H. P. TOLLINTON,

Deputy Commissioner, Lahore.

15th September 1916,

R. N. PARKER,

Deputy Conservator of Forests.

Approved.

H. A. CASSON,

Commissioner, Lahore.

20th September 1916.

Approved.

By order,
MILES IRVING,
Senior Secy. to the Finl. Commr.
Punjab
8th January 1917.

APPENDIX I.

**STATEMENT OF FINAL FELLINGS PRESCRIBED FROM
1916-17 to 1935-36.**

APPENDIX I.

Statement of final fellings prescribed from 1916-17 to 1935-36.

Year.	No. of compartment.	Area acres.	Total acres.	REMARKS.
1	2	3	4	5
1916-17	{ 86 87 88 90 (part) 106 107 }	{ 92.0 89.3 57.7 38.9 71.8 59.6 }	419.3	In compartment 90 only the area planted in 1901-02 is to be felled.
1917-18	{ 108 109 110 111 112 113 114 }	{ 75.3 120.3 96.8 46.6 58.0 47.0 61.4 }	495.4	The following areas recently felled will be thinned only:— 112 ... 15 acres 113 ... 20 „ 114 ... 17.8 „
1918-19	{ 115 116 117 118 119 120 121 122 123 }	{ 48.2 53.6 59.8 40.0 32.7 54.2 32.9 53.4 64.2 }	489.0	
1919-20	{ 124 125 126 1 2 3 4 (half) }	{ 53.2 58.0 56.6 35.8 74.0 79.0 67.6 }	484.2	
1920-21	{ 4 (half) 5 6 7 8 }	{ 67.6 82.0 68.4 74.8 148.2 }	436.0	In compartment 8 the 22.5 acres occupied by the sale deposit will yield nothing.
1921-22	{ 9 10 11 12 (part) }	{ 91.8 110.6 156.4 100.0 }	458.6	
1922-23	{ 12 (part) 13 14 15 16 }	{ 157.8 114.0 85.6 57.6 53.6 }	468.6	
1923-24	{ 17 18 19 20 21 22 23 24 }	{ 55.9 58.9 58.4 53.0 61.6 50.0 57.0 74.2 }	479.0	
1924-25	{ 25 26 27 28 29 30 31 }	{ 58.8 68.4 59.4 77.2 75.0 46.4 62.0 }	447.2	
1925-26	{ 32 33 34 35 36 37 38 39 40 }	{ 85.2 50.8 53.4 56.6 53.5 55.6 49.6 52.2 58.6 }	515.5	Arrangements should be made to vacate the quarters in compartment 36 for 5 years, transferring the <i>beldars</i> to other blocks, owing to the damage done by their cattle.

Statement of final fellings prescribed from 1916-17 to 1935-36—concluded.

Year.	No. of compart- ment.	Area acres.	Total acres.	REMARKS.
1	2	3	4	5
1926-27	{ 41 42 43 44 45 46 47 48 }	{ 48.8 46.5 50.8 51.2 54.4 53.8 79.6 102.4 }	437.5	
1927-28	{ 49 50 51 52 }	{ 97.2 148.0 108.8 140.0 }	494.0	
1928-29	{ 53 54 55 56 57 }	{ 142.4 121.4 93.6 72.4 106.8 }	536.6	
1929-30	{ 58 59 60 61 62 }	{ 88.0 101.2 103.2 84.4 42.4 }	419.2	
1930-31	{ 63 64 65 66 }	{ 106.6 125.6 132.0 92.0 }	456.2	
1931-32	{ 67 68 69 70 71 72 }	{ 89.3 67.7 101.4 76.0 104.4 83.2 }	523.0	
1932-33	{ 73 74 75 76 }	{ 134.4 143.6 150.4 63.6 }	492.0	
1933-34	{ 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 }	{ 28.0 24.8 23.8 22.4 22.6 20.4 20.2 18.4 22.4 19.0 20.4 20.6 19.8 71.2 65.7 66.4 }	484.1	
1934-35	{ 93 94 95 96 97 98 }	{ 70.4 60.4 72.2 72.4 73.6 68.6 }	417.6	
1935-36	{ 99 100 101 102 103 104 105 }	{ 70.0 76.0 59.6 72.4 65.2 74.0 59.8 }	477.0	
Total	...	...	9479.0	

APPENDIX II.

Description of compartments.

Number of compartment.	AREA.			Description of the growing stock.
	Wooded.	Blank.	Total.	
1	84'8	1'2	85'8	Standards; largely attacked by fungus. Coppice; mulberry with a good deal of <i>Acacia Farnesiana</i> , some Persian lilac and other species. Growth poor in a strip along the eastern edge of the compartment, good elsewhere. Mulberry was cut back for two years after felling in 1897-98 to favour sissoo but there is now insufficient sissoo to replace the standards.
2	74'0	...	74'0	Standards; better than in compartment 1 and fungus not conspicuous. Coppice; as for compartment 1 but without <i>Acacia Farnesiana</i> .
3	79'0	...	79'0	Standards; good, little signs of fungus. Coppice; good, mulberry with some Persian lilac and very little sissoo. Mulberry was cut back to favour sissoo for two years following felling in 1897-98.
4	135'2	...	135'2	Standards; as for compartment 4. Coppice; good in the east and centre more open towards the west. Nearly as much Persian lilac as mulberry, sissoo rather more than in compartments 1-3. Mulberry was cut back for two years after fellings in 1898-99.
5	82'0	...	82'0	Standards; rather poor and many attacked by fungus. Coppice; rather open in places, towards the east the growth has recently suffered from want of water, the western end is largely stocked with <i>phulai</i> . More Persian lilac than mulberry with a good deal of sissoo in places. Mulberry was cut back for two years after felling in 1898-99.
6	68'4	...	68'4	Standards; as for compartment 5. Coppice; fairly good, mulberry with a good deal of Persian lilac and sissoo. Open towards the north and here largely sissoo.
7	72'0	2'8	74'8	Standards; poor, some attacked by fungus. Coppice; fairly complete except towards the north, but the growth is rather poor. A fair amount of sissoo and only a little Persian lilac. The blank is due mostly to low ground and can be stocked by <i>bunding</i> off excess water.
8	118'7	24'5	143'2	Standards; few in number and very poor. Many have been damaged by fire. Coppice good on the whole but rather open at the north and south ends. A fair amount of sissoo and some Persian lilac. 22'5 acres is occupied by the sale dépôt, etc.
9	91'6	...	91'6	Standards; very few and poor at the western end where many are dead or dying of fungus; fairly good in the centre and east. Coppice; nearly fully stocked but growth very poor towards the west. Some Persian lilac and a little sissoo and <i>phulai</i> .
10	110'8	...	110'8	Standards; short and branchy. Coppice; good on the whole. A fair proportion of sissoo and a little Persian lilac. In the western end the growth is very open and sissoo and mulberry are both dying off leaving a few <i>phulai</i> and <i>jand</i> .
11	153'4	3'0	156'4	Standards; rather poor, several attacked by fungus. Coppice; very open at the western end, good in the centre and east. Sissoo scanty, some Persian lilac and towards the west <i>phulai</i> and <i>jand</i> . The blank was formerly a dépôt site. It should be planted up when the compartment is felled or kept for sites for shops, etc.
12	257'8	...	257'8	Standards; good, a few attacked by fungus. Coppice; good but somewhat open towards the north-west boundary. Sissoo quite insufficient to replace standards.
13	114'0	...	114'0	Standards; as for compartment 12. Coppice; practically pure mulberry fully stocked but backward in diameter growth.
14	85'8	...	85'8	Standards; as for compartment 12. Coppice; good, a good proportion of sissoo, but fungus is killing off many well grown coppice shoots.
15	57'6	...	57'6	Standards; rather short and branchy, many attacked by fungus. Coppice; good, mulberry with very little sissoo.
16	53'8	...	53'8	Standards; fair, many have been killed by fungus. Coppice; poor and open but a good proportion of sissoo in places.
17	55'9	...	55'9	Standards; as for 16. Coppice; open towards the railway, good elsewhere, nearly pure mulberry.
1	58'9	...	58'9	Standards; good but many are being killed by fungus. Coppice; as for 17.

Description of compartments—continued.

Number of compartment.	Area.			Description of the growing stock.
	Wooded.	Blank.	Total.	
19	58.4	...	58.4	Standards; good. Coppice; rather open towards the railway. A fair proportion of sissoo with some <i>phulai</i> and a little Persian lilac.
20	53.0	...	53.0	Standards; rather short and branchy. Coppice; well stocked except towards the railway line but in places the crop is tending to become open owing to windfalls. Only a little sissoo and Persian lilac, the former though now 15 years old is still being suppressed by mulberry and many stams have recently been killed by mulberry.
21	61.6	...	61.6	Standards; as for 20. Coppice; good, a fair proportion of sissoo in the north-west half, a little sissoo and some Persian lilac in the south-east half.
22	50.0	...	50.0	Standards; as for 19. Coppice; good, a little Persian lilac, some sissoo and <i>farash</i> . Suffering somewhat from wind-break.
23	67.0	...	67.0	Standards; as for 19. Coppice; almost pure mulberry. Has been well stocked but has recently suffered a good deal from wind-break.
24	73.2	1.0	74.2	Standards; good. Coppice; good, nearly pure mulberry.
25	56.8	2.0	58.8	Standards; as for 24. Coppice; good except near the blanks. A fair proportion of sissoo.
26	68.4	...	68.4	Standards; not very good. Coppice; good, a good proportion of sissoo in the half near the railway, very little in the other half.
27	59.4	...	59.4	Standards; rather few. Coppice; good, a fair proportion of sissoo and some tamarisk.
28	77.2	...	77.2	Standards; as for 10. Coppice; good, a fair proportion of sissoo and some Persian lilac.
29	75.0	...	75.0	Standards; very few and bad. Coppice; good except along the north-west boundary where it is rather open. Sissoo rather scanty except towards the north-west.
30	46.4	...	46.4	Standards; bad, mostly damaged by fire. Coppice; good, a fair proportion of well-grown sissoo.
31	62.0	...	62.0	Standards; as for 30. Coppice; good on the whole but worse towards the western end, a fair proportion of sissoo but in several places pure mulberry.
32	85.2	...	85.2	Standards; good. Coppice; good, a fair proportion of sissoo, very little Persian lilac, some too along the eastern end. Growth falls off slightly near the eastern end.
33	50.8	...	50.8	Standards; as for 20. Coppice; as for 30.
34	53.4	...	53.4	Standards; as for 24. Coppice; as for 24.
	56.6	...	56.6	Standards; fair, some attacked by fungus. Coppice; a little open in places owing to windfall. Mulberry with a little sissoo and Persian lilac.
36	53.5	...	53.5	Standards; as for 35. Coppice; almost pure mulberry and fully stocked but growth a little backward.
37	55.6	...	55.6	Standards; very many have been destroyed by fungus. Coppice; as for 24.
38	49.6	...	49.6	Standards; many badly injured by fire. Coppice; has been open but is now fully stocked. A fair proportion of sissoo but it is rapidly being suppressed.
39	52.2	...	52.2	Standards; as for 37. Coppice; has recently suffered badly from wind-break, in many places at least half the crop has fallen. Pure mulberry and formerly very dense.
40	58.6	...	58.6	Standards; as for 37. Coppice; pure mulberry and very dense but wind-break has started badly.
41	48.8	...	48.8	Standards; fairly good. Coppice; pure mulberry and dense. Wind is beginning to damage the crop.
42	46.5	...	46.5	Standards; as for 21. Coppice; good, a fair proportion of sissoo and some Persian lilac. Some patches of pure sissoo coppice have been killed recently by fungus.

Description of compartments—continued.

Number of compartment.	AREA.			Description of the growing stock.
	Wooded.	Blank.	Total.	
43	50.8	...	50.8	Standards; poor, many have died and fallen. Coppice; good but very dense. A little sissoo and some Persian lilac.
44	50.2	1.0	51.2	Standards; as for 24. Coppice; good, growth very vigorous. A little wind-break starting.
45	54.4	...	54.4	Standards; very good, a few have been destroyed by fungus. Coppice nearly pure mulberry, suffering badly from wind-break.
46	52.8	1.0	53.8	Standards; as for 37. Coppice; good but wind-break is starting. Some sissoo in places but mostly pure mulberry.
47	79.6	...	79.6	Standards; very good except towards the 32 feet road where the growth is poor, many attacked by fungus. Coppice; good but far too dense.
48	92.5	9.9	102.4	Standards; as for 41. Coppice; good, nearly pure mulberry, very dense. The blanks due mostly to high ground have been about half stocked with tamarisk and mulberry by deep trenches at 25 feet intervals.
49	92.2	5.0	97.2	Standards; rather few and poor. Coppice; backward in growth, dense in places, open and with much <i>kāna</i> elsewhere.
50	138.0	10.0	148.0	Standards; as for 37. Coppice; very irregular, many new blanks have been created by <i>kāna</i> having been allowed to overrun the compartment after felling.
51	108.8	...	108.8	Standards; as for 35. Coppice; pure mulberry, good on the whole but open in places owing to <i>kāna</i> and also near the 32 feet road.
52	140	...	140	Standards; as for 35. Coppice; pure mulberry, good on the whole but a little open in places owing to <i>kāna</i> .
53	141.4	1.0	142.4	Standards; as for 35. Coppice; pure mulberry, good except near the 32 feet road where it is open.
54	116.4	5.0	121.4	Standards; very irregular, in some places for want of sissoo, mulberry standards were reserved, these have nearly all been blown down or broken by wind. Coppice; shows signs of having been browsed when young. Wind-break is just beginning in places. Five acres occupied by <i>beldars'</i> quarters.
55	98.6	...	98.6	Standards; several mulberry standards have been left for want of sissoo. Coppice; good on the whole, a few places rather open owing to grazing.
56	66.4	6.0	72.4	Standards; as for 1. Coppice; very bad owing to grazing. Before felling this was one of the best compartments, now it is the worst in the whole plantation. Mulberry mixed with sissoo, some <i>Acacia Farnesiana</i> and <i>Prosopis glandulosa</i> . Six acres occupied by quarters.
57	106.8	...	106.8	Standards; few to start with and many more have recently died. Coppice good, pure mulberry.
58	85.0	3.0	88.0	Standards; rather few and almost all of large size. Coppice; good, nearly pure mulberry, very dense. Three acres occupied by <i>beldars'</i> quarters.
59	101.2	...	101.2	Standards; as for 58. Coppice as for 58.
60	103.2	...	103.2	Standards; as for 58. Coppice; over 22 acres mulberry was cut back for 3 years to favour sissoo. After felling, 6,533 <i>Eucalyptus</i> plants were planted as follows:— <i>E. hemiphloia</i> 959; <i>E. hemiphloia</i> var. <i>albena</i> 2,646; <i>E. hemiphloia</i> var. <i>microcarpa</i> 459; <i>E. siderophloia</i> 572; <i>E. tereticornis</i> 598; <i>E. rostrata</i> 614; <i>E. melliodora</i> 583; miscellaneous 105. The plants were mostly destroyed by <i>nilghai</i> .
61	84.4	...	84.4	Standards; all of large size. Coppice; irregular and rather open in places, probably owing to the cutting back of <i>bāthū</i> having been neglected after felling. Some sissoo and a good deal of Persian lilac.
62	42.4	...	42.4	Standards; as for 57. Coppice; as for 61.
63	106.6	...	106.6	Standards; poor, many have recently died. Coppice; poor, very open towards the south. <i>Bāthū</i> was not cut and trenches were not reopened in this compartment which probably accounts for the bad growth as the growth is good along <i>khals</i> and <i>passels</i> .
64	125.6	...	125.6	Standards; as for 59. Coppice; as for 61.

Description of compartments—continued.

Number of compartment.	AREA.			Description of the growing stock.
	Wooded.	Blank.	Total.	
65	132.0	...	132.0	Standards; as for 58. Coppice; a little open in places owing to <i>batku</i> not having been cut. <i>Kana</i> has given much trouble. It has been stubbled out for 3 years in succession, but there is still some left.
66	92.0	...	92.0	Standards; <i>nil</i> . Sown with sissoo in 1901-02 and not yet filled. The northern end is nearly pure mulberry, the southern end still <i>sissoo</i> . Fungus has been very bad in this compartment, and many <i>seena</i> are still being killed.
67	89.3	...	89.3	Standards; <i>nil</i> . As for 66 but more open, less <i>sissoo</i> and a good deal of <i>kana</i> .
68	67.7	...	67.7	Standards; <i>nil</i> . As for 67 but rather better stocked.
69	101.4	...	101.4	Standards; as for 57. Coppice; nearly pure mulberry rather open on the west.
70	76.0	...	76.0	Standards; very irregularly distributed. Coppice; nearly pure mulberry.
71	104.4	...	104.4	Standards; as for 58. Coppice; very dense, mulberry with a considerable proportion of Persian lilac.
72	83.2	...	83.2	Standards; many have recently died. Coppice; a considerable proportion of Persian lilac.
73	123.4	11.0	134.4	Standards; very few, in part of the area none were left. Coppice; very dense, mulberry with some <i>sissoo</i> and Persian lilac in places. The 11 acres shown as blank is near the Canal Rest House and was cleared at the request of the Canal Department.
74	143.6	...	143.6	Standards; as for 72. Coppice; as for 71.
75	150.4	...	150.4	Standards; many mulberry have been reserved for want of <i>sissoo</i> . Coppice as for 71.
76	63.6	...	63.6	Standards; as for 55. Coppice; mulberry with a little Persian lilac.
77	28.0	...	28.0	Standards; as for 61. Coppice; mulberry with a good deal of Persian lilac and some <i>sissoo</i> .
78	24.8	...	24.8	Standards; rather few. Coppice; at present pure <i>sissoo</i> and very open in places. After felling mulberry was cut back 3 times in the first year and once in the second.
79	23.3	...	23.3	Standards; as for 78. Coppice; as for 78.
80	22.4	...	22.4	Standards; as for 78. Coppice; at present pure <i>sissoo</i> . After felling mulberry was cut back 3 times in the first year.
81	22.6	...	22.6	Standards; as for 78. Coppice; mulberry was cut back after felling along the trenches (<i>i.e.</i> , at 10 feet intervals) 3 times in the first year and twice in the second.
82	20.4	...	20.4	Standards; as for 41. Coppice; mulberry was cut back after felling twice in the first year and twice in the second.
83	20.2	...	20.2	Standards; as for 41. Coppice; as for 82.
84	16.4	...	16.4	Standards; as for 41. Coppice; as for 82.
85	22.4	...	22.4	Standards; as for 78. Coppice; as for 78.
86	19.0	...	19.0	Standards; as for 41. Coppice; <i>batku</i> was not cut back after felling.
87	20.4	...	20.4	Standards; as for 78. Coppice; mulberry was cut back once after felling.
88	20.6	...	20.6	Standards; as for 78. Coppice; as for 87.
89	19.8	...	19.8	Standards; as for 78. Coppice; as for 87.
90	71.2	...	71.2	Standards; as for 78. Coppice; 32.3 acres as for 78, 38.9 acres was sown in 1901-02 with <i>sissoo</i> , it is now nearly pure mulberry and well stocked. This area has not been felled as yet.

Description of compartments—continued.

Number of compartment.	AREA.			Description of the growing stock.
	Wooded	Blank.	Total.	
91	65.7	...	65.7	Standards; as for 78. Coppice; mulberry was cut back after felling twice in the first year and once in the second.
92	66.4	...	66.4	Standards; as for 41. Coppice; mulberry was cut back twice in the first year.
93	70.4	...	70.4	Standards; as for 41. Coppice; as for 92.
94	60.4	...	60.4	Standards; as for 41. Coppice; as for 92.
95	72.2	...	72.2	Being felled.
96	72.4	...	72.4	As for 95.
97	73.6	...	73.6	As for 95.
98	68.6	...	68.6	As for 95.
99	70.0	...	70.0	As for 95.
100	76.0	...	76.0	Standards; many have fallen and several have died. Coppice; very good, some sissoo towards the 32 feet road.
101	59.6	...	59.6	As for 95.
102	72.4	...	72.4	As for 95.
103	65.2	...	65.2	As for 95.
104	74.0	...	74.0	As for 95.
105	59.8	...	59.8	As for 95.
106	71.8	...	71.8	Standards; will probably be satisfactory after felling. Coppice; mostly sissoo with some mulberry. A great deal of dead wood lying on the ground.
107	59.6	...	59.6	Standards; as for 106. Coppice; except on 10.4 acres sown in 1896-97 as for 106. The seedling crop is still mostly sissoo.
108	75.3	...	75.3	Standards; as for 106. Coppice; on 34.6 acres as for 106. The rest sown in 1896-97 and not yet felled. The seedling crop is getting very open as many sissoo have died and not much mulberry has come in.
109	120.3	...	120.3	Standards; as for 106. Coppice; 33.8 acres as for 106, but contains much more mulberry. Area sown in 1896-97 still carries a good growth of sissoo but the crop is getting open in places, and there is much dead wood on the ground.
110	96.8	...	96.8	Standards; mostly attacked by fungus and dead or dying. Coppice; 52.4 acres very irregular, in places pure sissoo, in places pure mulberry, good as regards density but in many places this is due to recent mulberry regeneration. There is much dead wood on the ground. The area sown in 1896-97 carries a good growth of sissoo with a mulberry under-story except on about 10 acres towards the south where all sissoo have died recently.
111	46.6	...	46.6	Standards; as for 1. Coppice; as for 110 but more open.
112	58.0	...	58.0	Standards; as for 1. Coppice; in places pure sissoo, elsewhere largely mulberry, rather open and a good deal of dead wood on the ground.
113	47.0	...	47.0	Standards; as for 1. Coppice; pure mulberry and fully stocked in the 20 acres felled in 1910-11. Mixed sissoo and mulberry and fairly stocked in the center. Very open in the south, full of kana and dead wood.
114	51.4	...	51.4	Standards; as for 1. Coppice; pure mulberry and fully stocked in the 17.8 acres felled in 1908-09, fairly good in the centre, very open and full of kana and dead wood in the south.
115	48.2	...	48.2	Standards; as for 1. Coppice; rather open except the 9.5 acres felled in 1908-09.

Description of compartments—concluded.

Number of compartment.	Area.			Description of the growing stock.
	Wooded.	Blank.	Total.	
116	47.6	8.0	55.6	Standards; as for 1. Coppice; bad, especially in the south, full of <i>kana</i> and dead wood. This compartment was probably damaged by <i>beldar</i> cattle when young. 6 acres occupied by <i>beldar</i> settlement.
117	59.8	...	59.8	Standards; as for 1. Coppice; in places pure mulberry and fully stocked, elsewhere very open with heavy growth of <i>kana</i> . Fungus seems to have killed most of the <i>sissoo</i> in the coppice. Much dead wood on the ground.
118	40.0	...	40.0	Standards; as for 1. Coppice; nearly pure mulberry, good on the whole but becoming open in places. The south end is very open.
119	82.2	0.5	82.7	Standards; as for 1. Coppice; good at the north end, open at the south. A good deal of <i>sissoo</i> but it is rapidly being killed out by fungus.
120	54.2	...	54.2	Standards; some attacked by fungus, but not so much so as in 117 to 119. Coppice; mostly mulberry and good on the whole.
121	32.9	...	32.9	Standards; mostly dead and removed. Coppice; nearly pure mulberry well stocked.
122	53.4	...	53.4	Standards; many have died and been removed. Coppice; nearly pure, mulberry, open in places with heavy growth of <i>kana</i> especially towards the south.
123	64.2	...	64.2	Standards; as for 122. Coppice; nearly pure mulberry, good in the northern half, rather open in the southern half.
124	53.2	...	53.2	Standards; as for 78. Coppice; nearly pure mulberry, very dense.
125	68.0	...	68.0	Standards; fair. Coppice; as for 124, but open at the southern end.
126	55.6	...	55.6	Standards; as for 78. Coppice; as for 90, but rather more <i>sissoo</i> in the area sown in 1901-02.
Total	9,097.2	93.9	9,191.1	

APPENDIX III.

List of species found growing wild or planted in the Changa Manga plantation.

T=tree; S=shrub; C=climber U=undershrub.

<i>Menispermaceæ.</i>			
C.	Cocculus Lamæba, DC.	... ..	Common in dry places.
<i>Capparidaceæ.</i>			
C.	Mærua arenaria, Hk. f. and Th.	... ..	In dry places.
C.	Cadaba indica, Lamk.	... ..	Litto.
S.	Capparis aphylla, Roth.	... ..	Ditto.
<i>Tamaricaceæ.</i>			
T.	Tamarix articulata, Vahl	... ..	Planted.
<i>Malvaceæ.</i>			
T.	Bombax malabaricum, DC.	... ..	Self-sown in the plantation.
U.	Abutilon bidentatum, Hochst.	... ..	Common fibre used for ropes. Vern pathaka.
U.	Abutilon ramosum, Guil. and Perr.	... ..	Scarce.
U.	Sida spinosa, Linn.	... ..	Very common.
U.	Urena lobata, Linn.	... ..	In moist shady places.
U.	Malvastrum tricuspidatum, Gray	... ..	An American plant, abundant in shady places.
<i>Tiliaceæ.</i>			
S.	Grewia populifolia, Vahl.	... ..	In dry places, not common.
<i>Mel'aceæ.</i>			
T.	Melia Azedarach, Linn.	... ..	Regenerates freely from seed. The Per- sian lilac.
T.	Cedrela Toona, Roxb.	... ..	Does not do well as it suffers from heat, cold and drought.
<i>Rhamnaceæ.</i>			
T.	Zizyphus Jujuba, Lamk.	... ..	Takes up much room and is slow in growth.
S.	Zizyphus nummularia, W. and A.	... ..	Very common in dry places.
<i>Ampelidaceæ.</i>			
C.	Vitis trifolia, Linn.	... ..	Common.
<i>Leguminosæ.</i>			
T.	Dalbergia Sissoo, Roxb.		
T.	Robinia Pseud-acacia, Linn.	... ..	Does badly, a very few specimens now left.
S.	Butea frondosa, Roxb.	... ..	Does badly and remains a shrub.
U.	Desmodium gangeticum, DC.		
T.	Cassia Fistula, Linn.	... ..	Grows slowly and suffers much from frost.
U.	Cassia occidentalis, Linn.	... ..	Abundant and usually an annual.

List of species found growing wild or planted in the Changa Manga Plantation—contd.

Leguminosæ—concl'd.		
T.	<i>Parkinsonia aculeata</i> , Linn.	... Planted mainly on the canal bank.
T.	<i>Albizzia Lebbeck</i> , Benth.	... Suffers from frost when young.
T.	<i>Acacia modesta</i> , Wall.	... Growth very slow.
T.	<i>Acacia leucophloea</i> , Willd.	... In dry places.
T.	<i>Acacia arabica</i> , Willd.	... Suffers greatly from frost and is difficult to grow.
S.	<i>Acacia Farnesiana</i> , Willd.	
T.	<i>Prosopis spicigera</i> , Linn.	... In dry places.
S.	<i>Prosopis glandulosa</i> , Torr.	... Mainly on the canal bank, planted and self-sown.
S.	<i>Mimosa rubicaulis</i> , Lamk.	... Introduced by water.
Compositæ.		
S.	<i>Pluchea lanceolata</i> , Oliv.	... In dry places, common. Vern. <i>resham</i> .
Plumbaginaceæ.		
U.	<i>Plumbago zeylanica</i> , Linn.	... Common in shady places.
Salvadoraceæ.		
T.	<i>Salvadora oleoides</i> , Dene.	... In dry places only.
Asclepiadaceæ.		
S.	<i>Calotropis procera</i> , R. Fr.	... Gets frozen to the ground each winter.
C.	<i>Dæmia extensa</i> , R. Br.	... Very common.
C.	<i>Pentatropis spiralis</i> , Dene.	... Common in dry places.
Boraginaceæ.		
T.	<i>Cordia Myxa</i> , Linn.	... A few seedlings in the plantation. Suffers badly from frost.
S.	<i>Ehretia aspera</i> , Roxb.	... In dry places.
Convolvulaceæ.		
C.	<i>Rivea hypocrateriformis</i> , Chois.	... Common in dry places.
C.	<i>Ipomœa sinnata</i> , Ortega.	... A South American plant. Not common.
Solanaceæ.		
S.	<i>Solanum verbascifolium</i> , Linn.	... Introduced by canal water.
S.	<i>Lycium europæum</i> , Linn.	... Common in dry places.
U.	<i>Withania somnifera</i> , Dunal.	
Bignoniaceæ.		
S.	<i>Tecoma undulata</i> , G. Don	... A very few plants left. Small and shrubby.
Verbenaceæ.		
T.	<i>Gmelina arborea</i> , Linn.	... A few specimens only.
S.	<i>Callicarpa macrophylla</i> , Vahl.	... Self-sown.
S.	<i>Clerodendron phlomidis</i> , Linn. f.	... Fairly common in rather dry places.

List of species found growing wild or planted in the Ohanga Manga Plantation—concl.

<i>Chenopodiaceæ.</i>		
	<i>Salsola foetida</i> , Delile.	... In dry places only.
<i>Euphorbiaceæ.</i>		
T.	<i>Sapium sebiferum</i> , Roxb.	... Does well only near water.
S.	<i>Ricinus communis</i> , Linn.	... Found mainly near water-courses.
<i>Urticaceæ.</i>		
T.	<i>Morus alba</i> , Linn.	
T.	<i>Celtis australis</i> , Linn.	... A few self-sown seedlings only.
S.	<i>Ficus hispida</i> , Linn. f.	... Introduced by canal, suffers much from frost.
S.	<i>Ficus palmata</i> , Forsk.	... Common.
T.	<i>Ficus glomerata</i> , Roxb.	... Mainly found near water,
T.	<i>Ficus religiosa</i> , Linn.	... A few specimens only.
S.	<i>Debregeasia hypoleuca</i> , Wedd.	... Introduced by water.
<i>Salicaceæ.</i>		
T.	<i>Salix tetrasperma</i> , Roxb.	... Planted.
T.	<i>Salix babylonica</i> , Linn.	... Planted.
<i>Liliaceæ.</i>		
S.	<i>Asparagus gracilis</i> , Baker	... In dry places.
<i>Palmeæ.</i>		
T.	<i>Phoenix</i> sp.	... A few small self-sown plants.
<i>Gnetaceæ.</i>		
C.	<i>Ephedra foliata</i> , Boiss.	... Common in dry places.

APPENDIX IV.

Statement showing the actual yield of the plantation per compartment from 1896-97 to 1915-16 according to the figures recorded in the Plantation Journal.

Year.	Compartment No.	Average age.	Wooded area in acres.	FELLINGS.			PREVIOUS THINNINGS AND DEAD AND WIND FALLEN TREES			TOTAL.			AVERAGE PRODUCTION PER ACRE.			AVERAGE PRODUCTION PER ACRE PER ANNUM.			REMARKS.		
				Thick fuel.	Thin fuel.	Timber.	Thick fuel.	Thin fuel.	Timber.	Thick fuel.	Thin fuel.	Solid cubic feet.	Stacked cubic feet.			Solid cubic feet of all classes.					
													Thick fuel.	Thin fuel.	Total.	Thick fuel.	Thin fuel.	Total.		Thick fuel.	Thin fuel.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1896-97.	115	19	45.9	76,900	23,940	...	3,780	80	...	80,680	24,020	37,575	1,757	523	2,280	819	92	23	120	43	
	116	19	36.3	59,560	17,160	...	3,980	...	...	63,490	17,160	29,360	1,749	472	2,321	809	92	25	117	44	
	117	19	57.6	86,840	27,760	...	10,410	560	...	97,250	28,320	45,216	1,658	492	2,180	785	89	26	115	41	
	118	19	32	63,940	20,740	...	2,530	160	...	66,470	20,900	31,090	2,077	653	2,730	972	109	34	143	51	
	119	20	56.7	100,520	30,740	...	4,460	120	...	104,980	30,860	48,845	1,851	544	2,395	861	93	27	120	43	
	120	20	44.1	99,900	25,040	...	10,160	...	...	110,060	25,040	50,330	2,496	568	3,064	1,141	125	28	153	57	
1897-98.	121	21	31.9	62,320	27,220	...	5,640	180	...	67,960	27,400	32,511	2,150	859	2,989	1,019	101	41	142	49	
	122	21	53.4	100,010	39,660	...	5,880	...	...	105,890	39,660	60,292	1,983	743	2,726	942	94	35	129	45	
	123	21	62.2	149,660	54,800	...	7,810	...	...	157,300	54,800	74,215	2,529	881	3,410	1,193	120	42	162	57	
	1	14.8	84.6	226,520	119,100	399	50,280	...	155	276,740	119,100	133,814	3,271	1,408	4,679	1,582	221	95	316	107	
	2	14.4	74.0	232,290	74,380	19	19,200	...	...	251,490	74,380	117,085	3,399	1,005	4,404	1,582	236	70	406	109	
	3	14.8	79.0	242,180	63,100	21	33,060	...	...	275,240	63,100	125,949	3,434	799	4,283	1,591	235	54	289	108	

Year.	Compartment No.	Average age.	FELLINGS.			PREVIOUS THINNINGS AND DEAD AND WINDFALLEN TREES.			TOTAL.			AVERAGE PRODUCTION PER ACRE.				AVERAGE PRODUCTION PER ACRE PER ANNUM.				REMARKS.	
			Thick fuel.	Thin fuel.	Timber.	Thick fuel.	Thin fuel.	Timber.	Thick fuel.	Thin fuel.	All classes of fuel including timber.	Thick fuel.	Thin fuel.	Total.	Thick fuel.	Thin fuel.	Total.	Solid cubic feet of all classes.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1898-99.	4	17	135.2	332,780	82,980	734	84,286	...	3	457,066	82,980	211,533	3,454	614	4,068	1,565	203	36	239	92	Crop mostly sissoo. A few trees were dead at time of felling. Crop mostly sissoo. Large blanks covered with kane.
	5	15.9	82.0	235,340	49,820	97	33,520	...	36	263,860	49,820	119,571	3,218	608	3,826	1,458	202	38	240	93	
	6	16	68.4	107,340	47,880	26	13,325	...	...	180,865	47,880	83,457	2,041	700	3,341	1,220	165	44	209	76	
	7	16	72.0	200,100	63,500	479	19,100	...	14	219,500	63,560	102,376	3,044	833	3,927	1,422	190	55	245	89	
	8	16	118.6	373,780	154,300	386	4,614	...	126	421,394	154,300	230,227	3,553	1,301	4,854	1,688	222	81	303	105	
	9	16	83.4	169,300	48,200	...	18,100	320	...	187,400	48,520	86,404	2,247	582	2,829	1,036	140	36	176	65	
	10	16	106.7	153,500	48,100	...	7,549	...	...	161,040	48,100	75,019	1,509	451	1,960	703	94	28	122	44	
	11	16	150.0	213,880	66,069	...	39,930	...	...	253,880	66,060	117,087	1,692	440	2,132	780	106	28	134	49	
	12	16	253.6	472,260	166,160	...	116,920	14,720	...	589,180	180,880	275,053	2,323	713	3,036	1,085	145	44	159	68	
	13	13	110.5	194,372	68,347	...	20,607	3,860	...	...	214,979	72,207	101,106	1,945	653	2,598	915	150	50	200		70
1899-1900	14	13.3	82.0	133,831	64,439	...	8,900	1,520	...	162,731	63,959	77,890	1,985	804	2,789	950	149	60	209	71	
	15	13.4	57.6	103,084	41,642	...	6,040	1,620	...	109,124	43,262	52,115	1,894	751	2,645	905	141	56	197	68	
	16	13	53.6	47,450	21,022	...	16,760	4,720	...	64,210	25,742	30,699	1,198	480	1,678	573	92	37	129	44	
	17 (part)	13	46.8	74,783	27,718	...	21,680	2,320	...	96,463	30,086	45,063	2,061	642	2,703	963	159	49	208	74	

Statement showing the actual yield of the plantation per compartment from 1896-97 to 1915-16 according to the figures recorded in the *Plantation Journal*—continued.

Year.	Compartment No.	Average age.	Wooded area in acres.	FELLINGS.			PREVIOUS THINNINGS AND DEAD AND WIND FALLEN TREES.			TOTAL.			AVERAGE PRODUCTION PER ACRE.				AVERAGE PRODUCTION PER ACRE PER ANNUM.				REMARKS.
				Thick fuel.	Thin fuel.	Timber.	Thick fuel.	Thin fuel.	Timber.	Thick fuel.	Thin fuel.	All classes of fuel including timber.	Stack d cubic feet.			Stacked cubic feet.					
													Thick fuel.	Thin fuel.	Total.	Thick fuel.	Thin fuel.	Total.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1903-04.	43	20	49.6	137,414	19,481	552	38,660	747	129	176,074	20,238	78,820	3,550	408	3,958	1,539	178	20	198	79	
	44	20	46.6	143,105	18,592	645	33,061	1,917	120	176,163	19,699	78,869	3,780	421	4,201	1,692	189	21	210	85	
	45	16	54.4	140,264	28,786	623	34,877	2,799	110	175,141	31,535	79,834	3,220	581	3,801	1,467	201	36	237	92	
	46	16	47.6	124,183	23,147	622	37,251	1,720	195	161,434	21,867	73,228	3,391	522	3,913	1,538	212	33	245	96	
	47	18	77.6	210,219	39,943	982	63,911	8,947	24	279,130	48,890	126,393	3,597	630	4,227	1,635	200	35	235	91	
	48 (part)	16	57.0	150,816	25,602	1,586	45,761	5,847	127	196,577	31,449	90,015	3,443	551	4,001	1,579	191	31	222	88	
1904-05.	48 (part)	19	25.6	80,852	8,431	339	22,580	2,923	99	103,732	11,354	46,405	4,052	443	4,495	1,813	213	23	236	95	
	49	18	63.4	232,384	33,259	1,328	68,382	4,483	401	300,766	37,747	135,538	4,744	595	5,339	2,159	261	33	297	119	
	50	18	140.8	347,037	63,551	1,931	63,982	1,561	743	411,019	65,112	187,279	2,919	462	3,381	1,330	162	26	183	74	
	51	19	108.8	233,238	41,401	667	69,807	492	807	302,745	41,593	136,596	2,781	335	3,166	1,255	146	20	166	66	
	(pt)	19	47.0	122,001	15,413	1,351	33,214	546	272	155,215	15,961	70,291	3,880	399	4,279	1,757	204	21	225	92	
	52 (part)	20	100.0	162,308	22,759	838	83,037	1,366	679	245,345	24,125	109,910	2,453	241	2,694	1,099	123	12	135	55	
1905-06.	53	19	136.6	365,137	56,562	4,573	99,070	2,874	1,136	464,207	59,893	212,492	3,398	438	3,836	1,556	179	23	202	82	
	54	21	121.2	361,121	49,462	6,632	159,896	3,080	2,471	520,717	52,542	239,316	4,296	431	4,730	1,975	205	21	226	94	
	55	21	93.6	319,720	62,487	10,052	89,820	4,540	2,904	409,546	67,027	197,131	4,375	7.6	5,091	2,106	208	34	242	100	
	56	19	72.4	222,605	46,854	3,593	37,400	5,200	2,079	230,005	52,084	123,724	3,591	719	4,310	1,709	189	38	227	90	

* Figures estimated.

	1906-07	1907-08	1908-09	1909-10	1910-11
73 (part)	17	17	17	17	17
74	16	16	16	16	16
75 (part)	17	17	17	17	17
72 (part)	17	17	17	17	17
75 (")	18	18	18	18	18
76	18	18	18	18	18
70 (part)	17	17	17	17	17
71	18	18	18	18	18
72 (part)	18	18	18	18	18
73 (")	18	18	18	18	18
7 (part)	10	10	10	10	10
57 (")	17	17	17	17	17
58	18	18	18	18	18
69 (part)	18	18	18	18	18
73 (")	19	19	19	19	19
77	16	16	16	16	16
95 (part)	15	15	15	15	15
114 (")	13	13	13	13	13
115 (")	12	12	12	12	12
2 (part)	12	12	12	12	12
57 (")	18	18	18	18	18
59 (")	19	19	19	19	19
70 (")	19	19	19	19	19
104 (")	15	15	15	15	15
112 (")	14	14	14	14	14
59 (part)	20	20	20	20	20
61 (")	19	19	19	19	19
62	20	20	20	20	20
100	16	16	16	16	16
113 (part)	15	15	15	15	15
37,024	184,672	37,024	4,523	17,585	2,550
286,064	435,103	7,216	43,880	43,880	1,930
4,894	17,885	286	4,830	4,830	70
3,352	18,653	*537	...	...	...
698,104	698,104	*10,117	53,887	53,887	1,016
243,000	243,000	*4,696	42,944	42,944	3,040
32,855	32,855	1,278	...	...	...
436,039	436,039	1,449	51,3-5	51,3-5	...
300,592	300,592	2,798	13,382	13,382	...
342,703	342,703	3,730	24,590	24,590	3,570
101,820	101,820	1,085	2,234	2,234	273
89,290	89,290	44,589	4,862	4,862	...
339,761	339,761	13,177	18,076	18,076	...
130,172	130,172	53,206	36,091	36,091	7,442
10,960	10,960	4,480	...	...	...
107,387	107,387	71,812	2,995	6,890	180
141,061	141,061	87,854	6,549	7,995	...
37,796	37,796	12,254	949	80	...
22,880	22,880	9,546	522	28	...
50,938	50,938	25,360	995	3,948	...
311,379	311,379	135,893	29,995	15,318	...
175,417	175,417	69,700	21,195	25,247	510
44,318	44,318	18,309	5,607	...	...
83,418	83,418	14,538	1,730	...	...
38,588	38,588	15,861	1,723	530	...
303,108	303,108	119,724	15,470	34,640	730
47,717	47,717	19,702	2,951	...	...
180,381	180,381	73,624	8,321	14,352	...
222,329	222,329	67,787	7,926	2,785	...
53,214	53,214	11,799	3,833	157	...
182,287	182,287	182,287	182,287	182,287	182,287
478,933	478,933	478,933	478,933	478,933	478,933
22,765	22,765	22,765	22,765	22,765	22,765
18,653	18,653	18,653	18,653	18,653	18,653
746,791	746,791	746,791	746,791	746,791	746,791
28,594	28,594	28,594	28,594	28,594	28,594
32,855	32,855	32,855	32,855	32,855	32,855
437,424	437,424	437,424	437,424	437,424	437,424
813,954	813,954	813,954	813,954	813,954	813,954
367,243	367,243	367,243	367,243	367,243	367,243
57,903	57,903	57,903	57,903	57,903	57,903
215,243	215,243	215,243	215,243	215,243	215,243
114,121	114,121	114,121	114,121	114,121	114,121
153,570	153,570	153,570	153,570	153,570	153,570
17,862	17,862	17,862	17,862	17,862	17,862
248,693	248,693	248,693	248,693	248,693	248,693
162,528	162,528	162,528	162,528	162,528	162,528
182,132	182,132	182,132	182,132	182,132	182,132
4,428	4,428	4,428	4,428	4,428	4,428
49,6-6	49,6-6	49,6-6	49,6-6	49,6-6	49,6-6
229,302	229,302	229,302	229,302	229,302	229,302
84,429	84,429	84,429	84,429	84,429	84,429
5,508	5,508	5,508	5,508	5,508	5,508
60,922	60,922	60,922	60,922	60,922	60,922
81,228	81,228	81,228	81,228	81,228	81,228
18,706	18,706	18,706	18,706	18,706	18,706
2,128	2,128	2,128	2,128	2,128	2,128
2,411	2,411	2,411	2,411	2,411	2,411
2,858	2,858	2,858	2,858	2,858	2,858
3,994	3,994	3,994	3,994	3,994	3,994
188,526	188,526	188,526	188,526	188,526	188,526
116,996	116,996	116,996	116,996	116,996	116,996
26,861	26,861	26,861	26,861	26,861	26,861
17,846	17,846	17,846	17,846	17,846	17,846
15,831	15,831	15,831	15,831	15,831	15,831
170,599	170,599	170,599	170,599	170,599	170,599
25,834	25,834	25,834	25,834	25,834	25,834
19,702	19,702	19,702	19,702	19,702	19,702
73,624	73,624	73,624	73,624	73,624	73,624
112,395	112,395	112,395	112,395	112,395	112,395
27,778	27,778	27,778	27,778	27,778	27,778
52,371	52,371	52,371	52,371	52,371	52,371
5,657	5,657	5,657	5,657	5,657	5,657
4,771	4,771	4,771	4,771	4,771	4,771
1,970	1,970	1,970	1,970	1,970	1,970
1,736	1,736	1,736	1,736	1,736	1,736
892	892	892	892	892	892
590	590	590	590	590	590
2,619	2,619	2,619	2,619	2,619	2,619
3,209	3,209	3,209	3,209	3,209	3,209
1,889	1,889	1,889	1,889	1,889	1,889
176	176	176	176	176	176
39	39	39	39	39	39
214	214	214	214	214	214
261	261	261	261	261	261
75	75	75	75	75	75
186	186	186	186	186	186
283	283	283	283	283	283
101	101	101	101	101	101
384	384	384	384	384	384
355	355	355	355	355	355
104	104	104	104	104	104
251	251	251	251	251	251
283	283	283	283	283	283
233	233	233	233	233	233
96	96	96	96	96	96
329	329	329	329	329	329
321	321	321	321	321	321
223	223	223	223	223	223
98	98	98	98	98	98
1785	1,785	1,785	1,785	1,785	1,785
1,933	1,933	1,933	1,933	1,933	1,933
186	186	186	186	186	186
261	261	261	261	261	261
97	97	97	97	97	97
148	148	148	148	148	148
136	136	136	136	136	136
120	120	120	120	120	120
98	98	98	98	98	98
241	241	241	241	241	241
214	214	214	214	214	214
39	39	39	39	39	39
214	214	214	214	214	214
236	236	236	236	236	236
94	94	94	94	94	94
308	308	308	308	308	308
134	134	134	134	134	134
162	162	162	162	162	162
362	362	362	362	362	362
292	292	292	292	292	292
118	118	118	118	118	118
393	393	393	393	393	393
131	131	131	131	131	131
374	374	374	374	374	374
132	132	132	132	132	132
308	308	308	308	308	308
110	110	110	110	110	110
375	375	375	375	375	375
225	225	225	225	225	225
117	117	117	117	117	117
146	146	146	146	146	146
174	174	174	174	174	174
97	97	97	97	97	97
136	136	136	136	136	136
221	221	221	221	221	221
81	81	81	81	81	81
101	101	101	101	101	101
285	285	285	285	285	285
120	120	120	120	120	120
128	128	128	128	128	128
148	148	148	148	148	148
141	141	141	141	141	141
119	119	119	119	119	119
97	97	97	97	97	97
148	148	148	148	148	148
136	136	136	136	136	136
120	120	120	120	120	120
98	98	98	98	98	98
241	241	241	241	241	241
214	214	214	214	214	214
39	39	39	39	39	39
214	214	214	214	214	214
236	236	236	236	236	236
94	94	94	94	94	94
308	308	308	308	308	308
134	134	134	134	134	134
162	162	162	162	162	162
362	362	362	362	362	362
292	292	292	292	292	292
118	118	118	118	118	118
393	393	393	393	393	393
131	131	131	131	131	131
374	374	374	374	374	374
132	132	132	132	132	132
308	308	308	308	308	308
110	110	110	110	110	110
375	375	375	375	375	375
225	225	225	225	225	225
117	117	117	117	117	117
146	146	146	146	146	146
174	174	174	174	174	174
97	97	97	97	97	97
136	136	136	136	136	136
221	221	221	221	221	221
81	81	81	81	81	81
101	101	101	101	101	101
285	285	285	285	285	

Statement showing the actual yield of the plantation per compartment from 1898-97 to 1915-16 according to the figures recorded in the Plantation Journal—concluded.

Year.	Compartment No.	Average age.	Wooded area in acres.	FELLINGS.			PREVIOUS THINNINGS AND DEAD AND WIND FALLEN TREES.			TOTAL.			AVERAGE PRODUCTION PER ACRE.			AVERAGE PRODUCTION PER ACRE PER ANNUM.			REMARKS.		
				Thick fuel.	Thin fuel.	Timber.	Thick fuel.	Thin fuel.	Timber.	Thick fuel.	Thin fuel.	All classes of fuel included- ing timber.	Stacked cubic feet.			Solid cubic feet of all classes.					
													Thick fuel.	Thin fuel.	Total.	Thick fuel.	Thin fuel.	Total.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1911-12.	61 (part)	20	74.4	337,750	99,000	27,022	43,915	340	1,038	331,665	99,340	204,085	5,130	1,335	6,465	2,743	256	67	323	197	
	63	20	106.6	428,625	129,875	13,837	18,300	4,700	520	447,225	134,575	222,813	4,195	1,232	5,457	2,090	210	63	273	105	
	64	20	125.6	530,135	190,375	24,457	114,341	21,975	514	644,366	215,350	327,890	5,130	1,715	6,845	2,611	257	86	343	131	
1912-13.	60	21	101.6	374,750	97,625	17,323	29,972	445	726	494,722	97,970	202,836	3,933	964	4,947	1,993	190	46	236	95	
	65	21	132	432,825	102,325	19,328	6,787	...	908	439,612	102,323	22,548	3,330	775	4,105	1,678	159	37	196	80	
	69 (part)	22	16	49,000	5,875	2,84	23,210	4,579	253	71,210	10,454	34,771	4,431	653	5,104	2,173	202	30	232	99	
1913-14.	70 (")	22	53	246,750	40,425	11,383	99,443	...	713	345,193	40,425	185,330	5,952	697	6,649	2,851	271	32	303	120	
	69 (part)	23	58.4	189,275	27,075	5,457	80,510	16,304	915	239,785	43,679	127,821	4,620	748	5,368	2,185	201	33	234	95	
	78	21	24.8	103,000	19,250	2,783	17,537	5,238	32	120,537	24,478	57,583	4,860	937	5,847	2,322	231	47	278	111	
1913-14.	79	21	23.8	94,225	17,375	3,327	19,573	2,887	152	113,799	20,562	54,880	4,781	864	5,645	2,306	228	41	269	110	
	80	21	22.4	93,000	17,575	4,025	16,131	3,015	127	115,131	20,590	56,129	5,140	919	6,059	2,506	245	44	289	119	
	81	21	22.6	98,550	21,850	4,172	21,297	8,364	332	122,847	30,714	61,014	5,436	1,359	6,795	2,700	259	65	324	124	
1913-14.	82	21	20.4	84,500	20,400	3,443	18,173	11,765	285	102,673	32,163	51,738	5,033	1,577	6,610	2,536	240	75	315	121	
	83	21	20.2	84,860	19,600	3,149	17,548	10,781	175	102,408	30,381	51,003	5,070	1,504	6,574	2,525	241	72	313	120	
	84	21	16.4	75,725	19,150	3,403	21,319	12,690	311	97,044	31,840	49,264	5,917	1,941	7,858	3,004	282	92	374	143	
1913-14.	85	21	22.4	79,775	20,925	3,776	4,348	944	258	84,423	21,869	42,960	3,769	973	4,745	1,918	179	46	225	91	

86	21	19°0	55,100	17,025	2,975	27,790	12,138	198	92,820	29,163	48,586	4,855	1,535	6,420	2,452	298	78	306	117
90	21	50°0	197,000	19,205	6,151	25,999	14,282	478	229,999	38,487	108,532	4,450	870	5,130	2,131	212	32	244	101
91	21	60°1	235,700	27,475	11,027	129,612	44,875	958	389,312	72,350	178,191	6,095	1,204	7,299	2,955	300	57	347	141
87	22	20°4	64,770	11,775	2,491	19,333	7,063	399	84,703	19,838	41,573	4,152	928	5,075	2,038	189	42	231	93
88	22	20°4	62,500	15,675	1,747	14,504	8,183	268	77,004	22,338	37,977	3,775	1,169	4,944	1,862	172	53	225	85
89	22	20°8	69,075	18,300	3,692	19,750	7,494	185	83,325	25,794	45,167	4,270	1,240	5,510	2,172	194	56	250	99
92	22	63°2	283,025	73,775	16,582	197,149	42,125	950	420,174	115,900	212,115	6,848	1,834	8,482	3,355	302	83	395	153
93	22	70°4	335,750	82,000	11,604	28,645	...	1,239	364,395	82,000	179,373	6,176	1,165	6,341	2,548	285	53	238	115
94	22	60°0	316,450	73,525	10,162	40,930	...	1,004	357,380	73,525	173,662	6,956	1,225	7,131	2,894	271	56	327	132
96 (part)	22	44°5	167,300	29,300	5,039	16,997	...	874	183,297	29,350	88,253	4,119	560	4,779	1,938	187	30	217	90
96	22	72°4	277,080	55,300	14,765	14,687	...	434	291,747	55,300	147,405	4,030	778	4,808	2,036	183	35	218	92
97	23	73°0	289,395	63,375	13,325	14,724	...	397	304,119	63,375	152,099	4,160	868	5,034	2,034	189	39	228	95
98	22	68°4	254,475	62,575	11,382	14,305	...	478	268,780	62,575	133,744	3,930	769	4,699	1,955	179	35	214	89
99 (part)	21	55°0	154,275	39,500	6,790	2,360	...	385	156,635	39,500	79,268	2,843	718	3,556	1,441	136	34	170	69
101	21	59°6	179,165	41,455	5,202	540	...	59	179,706	41,455	87,509	3,015	698	3,711	1,458	144	33	177	70
102	21	72°4	231,000	25,700	9,948	800	...	56	231,800	29,700	113,155	3,199	410	3,609	1,553	152	20	172	74
103 (part)	21	60°2	197,275	23,350	8,510	...	...	27	197,305	23,350	96,767	3,277	471	3,748	1,507	155	22	178	77
104 (,,)	21	64°0	211,025	27,825	8,735	81,375	6,675	95	242,400	34,500	117,303	3,787	539	4,325	1,831	180	28	206	87
105	21	69°8	265,100	47,625	8,297	600	...	317	265,700	47,625	128,580	4,443	796	5,239	2,150	212	38	250	102

APPENDIX V.

Statement showing the areas irrigated in Changa Manga during the years 1896-97 to 1915-16.

Year.			Area irrigated in acres.	Average acres.	Rainfall inside the plantation in inches.
1896-97	...	...	20,608	16,236	13.21
1897-98	...	...	12,709		9.68
1898-99	...	...	17,158		7.40
1899-1900	...	...	20,046		5.12
1900-01	...	...	15,301		22.46
1901-02	...	...	14,558		11.65
1902-03	...	...	15,233		7.90
1903-04	...	...	15,086		17.80
1904-05	...	...	16,390		4.50
1905-06	...	...	15,272	11,930	17.30
1906-07	...	...	13,369		14.95
1907-08	...	...	9,732		8.45
1908-09	...	...	11,041		24.30
1909-10	...	...	11,867		14.90
1910-11	...	...	14,294		17.45
1911-12	...	...	8,496		7.80
1912-13	...	...	13,757		16.24
1913-14	...	...	15,317		15.73
1914-15	...	...	10,664		21.24
1915-16	...	...	10,767		3.76

NOTE.—Average rainfall for the period 13.09 inches. Figures up to 1911-12 taken from the Canal Department Station at Van. Since then from the Forest Department Station.

APPENDIX VI.

Statement showing the quantity and prices of timber and firewood sold at the Sale Depot in 1896-97—1915-16. (Units: Rupees ; cubic foot solid for timber ; cubic foot stack d and price per 100 cubic feet stacked for firewood.)

Description of produce.	1896-97.		1897-98.		1898-99.		1899-1900.		1900-01.		1901-02.		1902-03.		1903-04.		1904-05.		1905-06.	
	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.
Sisoo logs	48	0 37	8,113	0 41	1,353	0 42	2,343	0 40	1,112	0 43	10,735	0 50	9,637	0 50	6,440	0 54	12,030	0 55	1,553	0 98
Mulberry logs	...	...	1,214	0 31	1,606	0 31	2,677	0 37	72	0 35	5,775	0 37	4,825	0 48	1,281	0 49	607	0 46	13,607	0 62
Thick firewood	777,343	5 93	951,331	4 89	1,221,937	5 99	1,497,981	5 28	1,764,065	5 52	1,359,225	7 37	1,329,000	6 90	1,638,000	6 25	1,735,500	7 55	1,025,480	6 76
Thin firewood	161,560	1 34	328,700	0 98	488,895	1 17	340,240	1 18	740,400	1 21	590,000	1 49	265,000	1 96	265,000	2 52	610,000	2 39	225,000	2 00

APPENDIX VI—concluded.

Statement showing the quantity and prices of timber and firewood sold at the Sale Depot in 1896-97—1915-16. (Units: Rupees; cubic foot solid for timber; cubic foot stacked and prices per 100 cubic feet stacked for firewood)—concluded.

Description of produce.	1906-07.		1907-08.		1908-09.		1909-10.		1910-11.		1911-12.		1912-13.		1913-14.		1914-15.		1915-16.	
	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.	Quantity sold.	Average price.
Sirsoo logs, I Class	...	...	...	...	8,241	0.84	2,752	0.85	8,062	0.86	8,204	0.89	18,802	0.91	14,490	0.96	20,905	1.03	21,430	1.21
" " II	...	8,886	6,300	0.74	7,598	0.59	12,056	0.69	20,287	0.67	27,521	0.78	26,508	0.61	13,351	0.71	10,650	0.73	14,732	0.86
" " III	...	...	...	...	61	0.16	...	...	...	...	1,028	0.58	4,581	0.46	2,589	0.43	583	0.53	1,272	0.61
" billets (selected)	...	...	...	...	...	...	3,382	0.37	18,713	0.41	11,382	0.50	3,182	0.57	4,299	0.70	7,037	0.67	5,415	0.78
Malberry logs, I Class	...	7,265	9,974	0.52	10,190	0.57	12,604	0.95	23,882	0.54	24,121	0.81	17,801	0.60	15,370	0.85	14,467	0.64	16,527	0.98
" " II	...	...	...	...	...	...	...	...	...	...	3,185	0.46	8,743	0.38	3,751	0.49	4,319	0.44	6,729	0.54
Thick sissoo, firewood	...	789,016	1,215,000	7.14	156,000	13.02	156,000	10.69	221,888	10.34	259,000	8.32	447,000	8.37	237,125	10.86	334,000	11.49	336,600	10.69
" mulberry, firewood	...	...	...	...	831,000	6.09	985,000	6.47	895,429	8.03	508,000	6.57	901,000	6.16	1,469,000	6.71	988,800	8.29	662,175	8.67
Tbin firewood	...	225,000	320,000	2.10	127,524	2.17	279,791	2.00	693,000	2.28	233,400	2.20	367,000	1.62	424,875	2.51	241,875	2.77	211,700	2.42