

# MADRAS RECORD OFFICE.

Government of Madras.

*Revenue* DEPARTMENT.

G.O. No. 633

Press

~~Mis.~~

61-62-55

Dated

11-6-1918

Not to be folded or roughly handled

from #1

*Proceedings of the Madras Government, Revenue Department,  
11th April 1863.*

Read the following letters:—

No. 61. From W. G. McIVOR, Esq., Superintendent Government Chinchona Plantations, to J. D. SIM, Esq., Secretary to Government, Revenue Department, Madras, dated Ootacamund, 18th March 1863, No. 100.

SIR,

1. With reference to paragraph 4 of the Order of Government of the 5th March 1863, No. 471, I have the honor to enclose a brief Manual of instructions with illustrations for the propagation and cultivation of the Chinchonas. I trust this paper will meet the wishes of Government on the subject. It briefly details all that is necessary for the management of the plants in their earlier stages of growth, our experience not enabling us to give further information with that degree of certainty required in the treatment of a plant newly brought into cultivation.

2. Should this Manual be approved and published by Government, I would respectfully solicit the favor of being supplied with 4 or 500 copies for distribution, as I am daily receiving applications for instructions on the treatment of these plants, which under present circumstances it is impossible for me to furnish; as writing such, could not be accomplished even if the whole time of my Office establishment was devoted to that alone.

3. Referring to paragraph 6 of the Order above noted, I have the honor to state, that we cannot safely offer more plants to the public this year, than the applications already registered; I previously brought to the notice of Government, that we originally anticipated being able to supply the public during the present year with 20,000 plants. I now believe that we will be able to supply about 40,000; but of this number 1,619 have already been supplied, and 33,700 bespoken as per lists annexed. The number of plants required by ourselves for planting the land already prepared, or in course of preparation for this season, will be 135,000, which added to those already planted gives a total of 170,000. Although we have now more efficient means for propagation than hitherto, still we cannot with safety rely upon the production of more plants than those above given.

4. In the official year 1864-65 we will only require from 80,000 to 90,000 plants for our plantations, and I therefore think we may safely offer 100,000 plants to the public next year, and should the Government approve of this, I solicit permission to open a register of applicants, supplying the plants as they are ready according to priority of application.

5. I may observe that where a few plants are required for experiment, or for transmission to distant provinces, such can always be supplied without notice further than what is necessary for the preparation of the Wardian cases. What I especially refer to in the preceding part of my letter is the supply of plants in numbers sufficient to stock plantations.

No. 62. From W. G. McIVOR, Esq., Superintendent Government Chinchona Plantations, to J. D. SIM, Esq., Secretary to Government, Revenue Department, dated Ootacamund, 4th April 1863, No. 108.

SIR,

With reference to my letter, No. 100 of the 18th ultimo, submitting for the approval of Government, "Notes on Chinchona cultivation," it seems desirable that we should add to these Notes, a paragraph upon the conveyance of plants in Wardian cases; especially as considerable improvements have been effected in the system of packing. I therefore beg to submit for the approval of Government, the enclosed paper which should the Government consider necessary can be printed on a separate sheet, and attached at the end of the pamphlet.

No. 63. ORDER THEREON, 11th April 1863, No. 633.

The Manual will be printed without delay. Mr. McIvor will open a Register as he proposes in paragraph 4, and it will be notified in the Gazette that 100,000 Chinchona plants will probably be available in 1864-65 at 4 Annas each.

(Signed.) J. D. SIM,  
Secretary to Government.

# Register of Applicants for Cinchona Plants

| Names                 | Station    | N <sup>o</sup> of Plants |
|-----------------------|------------|--------------------------|
| Ed Dawson Esquire     | Potacamund | 1000                     |
| J. Chesson Esquire    | Mahabliwar | 500                      |
| W. Chambers Esquire   | Potacamund | 1000                     |
| A R Lascelles Esquire | Do         | 10000                    |
| J De Facien Esquire   | Hartairy   | 5000                     |
| J. Picrie Esquire     | Calicut    | 2000                     |
| E. B. Thomas Esquire  | England    | 500                      |
| Stambank Esquire      | Hartairy   | 1000                     |
| J H Schuarr Esquire   | Potacamund | 5000                     |
| W. Southey Esquire    | Wallaghat  | 1700                     |
| Major Morgan          | Potacamund | 1000                     |
| C. Vincent Esquire    | Hartairy   | 5000                     |

Total number of plants 33700

Government Gardens  
Potacamund  
18<sup>th</sup> March 1863

# Register of Cinchona Plants distributed

| Names                  | Station     | N <sup>o</sup> of Plants |
|------------------------|-------------|--------------------------|
| Mr. N. Maltby Esquire  | Trevandrum  | 16                       |
| Dr. Junglulu           | Java        | 56                       |
| A R Lascelles Esquire  | Potacamund  | 12                       |
| Mr. Anderson Esquire   | Jamaica     | 2                        |
| Dr. Wiehe              | Bombay      | 10                       |
| Dr. J. Anderson        | Calcutta    | 551                      |
| Dr. Jamieson           | Saharampore | 107                      |
| Professor Lees         | Calcutta    | 61                       |
| Rajah of Travancore    | Trevandrum  | 521                      |
| Major Morgan           | Potacamund  | 19                       |
| Dr. Fitzgerald Esquire | Calcutta    | 201                      |

Total number of plants 1619

1<sup>st</sup> W. G. M. Froo  
Supt. Govt. Chin. Plant.  
(Per copy) M. Lee  
Capt. Cinchona Planting

Register of  
Applicants for  
Climiclonia Plants  
& Register of Climiclonia  
Plants Supplied.

Rev-672/13

Transmission of Plants.

In the usual way of packing plants in  
Wardian Cases their transmission to a distance  
was most expensive, and uncertain, to find  
a system which would obviate the risk, and  
reduce the cost of transit has formed a  
subject of recent experiments the issue of  
these, I believe, justifies me in recommending  
to the public the following method of pack-  
ing "Wardian" Cases, by which the cost  
of transit is reduced to less than one  
sixth, while it secures greater safety, in  
consequence, inasmuch as the plants are  
less liable to damp off from an excess of  
moisture, while it secures the great ad-  
vantage of reducing the weight of the  
cases to about one fifth, thus rendering  
the cases more easily handled, and less  
liable to damage in being removed.

The Wardian cases for packing the  
plants can be supplied here at a cost of  
£1.00 each, one case containing from  
170 to 220 plants, according to the species,  
instead of £2.00 or £3.00, plants, as formerly used.

to be packed in cases of the same size.  
In the system of packing which I now  
recommend, the Indian cases are filled  
with moss instead of earth, to a depth  
of about 6 inches, and the *Chinchona*  
plants in the pots in which they were grown  
are firmly packed in the moss, and secured  
with cross battens in order to prevent them  
being dislodged should the cases be upset  
in transit. When the plants are thus  
secured, they receive a moderate amount  
of water; the cases are then secured over,  
the glass being protected by battens, and  
secured from the direct rays of the sun  
by a covering of thin cloth, so as to  
admit a portion of the light; in this  
way, the plants can safely be conveyed  
to Calcutta or Ceylon without the cases  
being opened, but where the journey is  
likely to be prolonged over a month, the  
cases should be opened mornings and  
evenings, so as to admit of the plants  
receiving light and air, water being  
added only when the surface of the earth

in the pots is dry.

5

The cost of the conveyance to Madras  
of a case the weight above described is  
about Rupees 6, and the freight to Calcutta  
or Ceylon about Rupees 16.

Plants can be conveyed to almost  
distances less than 80 miles, with perfect  
safety, packed in open baskets; about  
50 plants forming a cooly load.

J. M. Lee

Super. Govt. Chin. Plantations

Notes on the  
Propagation & Cultivation  
of the Medicinal Chin-  
chenas, or Peruvian  
Rash trees.

18<sup>th</sup> March 1863.

R 672/63

Frederick Ward  
of 21, St. John's St.  
Preston (Lancs.)

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Notes

on the

Propagation and Cultivation  
of the Medicinal Cinchonas  
or Peruvian Bark trees.

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Printed and Published  
By Order of the Government of Madras

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By  
William Graham Mc Ivor  
Superintendent Government  
Cinchona Plantations, Nilgerry.  
MADRAS.

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## Notes

on the

## Propagation and Cultivation of the Medicinal Chinchonas or Peruvian Bark trees.

1. In submitting to the public a brief outline of our experience in the propagation and cultivation of these valuable plants, I would observe that it is not presumed to furnish a perfect guide to their management, as little indeed is yet correctly known of the requirements of the plants under cultivation. Our object is merely to place in the hands of all who are interested in the extension and increase of this valuable product, a knowledge of the management of the plants in their earlier stages, or up to the period to which our experience in their cultivation extends. The Government of Madras have already placed the Chinchonas within the reach of the general public by authorising the distribution of the plants at the moderate rate of 1 anna each, it however has been felt, that the distribution of the plants might in many instances lead to disappointment and failure, if unaccompanied by instructions for their cultivation and management.

2. Selection of Sites for Plantations This is perhaps the most important task which has to be performed, as much of the future success of the plantations will depend on the suitability of the sites selected. In the first instance the Chinchonas require rich forest land, the surface soil consisting of an open black or chocolate colored loam of from 2 to 3 feet in depth, resting upon an open subsoil in order to give efficient drainage, as nothing is so injurious to Chinchonas as stagnant water at the roots; therefore any land with a retentive subsoil is altogether unsuited to their growth. The site must be well sheltered from prevailing winds, the necessity for this, arises from the leaves of the red and grey barks being so large and tender when young, that heavy gales of wind act on them with such force as not only to break and damage the leaves themselves, but to twist and seriously injure the plants; the yellow and crown barks being small leaved species bear the wind better and would grow in more exposed situations, a certain amount of shelter however is desirable for the successful cultivation of all the species.

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3. Sites, Aspect. The aspect of the plantations should be North, or North west, a North East exposure will also be found suitable where the winds accompanying this Monsoon are not severe. The reason why a Northern exposure in these latitudes is beneficial is from the fact that it is much more moist during the dry season, than a Southern aspect; because the Sun's declination is Southernly during our dry and Cloudless season of the year, and thus on the Northern slope the rays of the Sun do not penetrate and parch the soil. A Northern aspect has also the advantage of preserving a much more uniform temperature than a Southern aspect, because the excessive radiation and evaporation on the Southern slopes greatly reduces the temperature at night, while in the day they are heated to excess by the action of the Sun's rays striking the surface at nearly a right angle. The practical effects of aspect on the plants are so great that they cannot be overlooked with impunity, and in order to impress this upon the minds of all who may have the selection of localities for Chinchona Cultivation, I mention that the difference of

Temperature is almost incredible, for example at this elevation a Thermometer laid on the surface of the Southern face of a hill exposed to the Sun at 3 P.M. will frequently indicate from  $130^{\circ}$  ~~Re.~~ to  $160^{\circ}$  Far: the same Thermometer if left in its position and examined at 6 A.M. will generally be observed to indicate from  $30^{\circ}$  ~~Re.~~ to  $40^{\circ}$  Far: while on a similar slope if selected with a Northern aspect, the Thermometer under the same circumstances at 3 P.M. will generally indicate  $70^{\circ}$  to  $80^{\circ}$  Far: and at 6 A.M. from  $10^{\circ}$  to  $50^{\circ}$  Far: All authors agree that Chinchonas delight in an equable temperature; and this has been unmistakably established by the plants themselves under cultivation: the vital importance of aspect is therefore fully explained. While on this subject it should be observed, that a hollow or land locked valley is also unsuitable to the Cultivation of Chinchonas, because the cold air generated at night on the sides of the neighboring hills, being of greater specific gravity than the warm air, it rolls down and fills the valley, displacing the warm air and reducing the temperature of the valley to a degree injurious to the Chinchonas.

4. Sites. Rainfall. A moderate amount of rain from 60 to 100 inches in the year falling

falling uniformly in showers at not too great intervals, is most beneficial for the growth of Chinchonas; they delight above all things in showers, and sunshine; this has been clearly illustrated by the rapid growth, and fine healthy appearance, which the plants assumed at Neerivittum, during the showery months of October and November. Long continued rain is decidedly injurious to the health of the plants, as also continued drought, but of the two, the latter is to be preferred, as the plants thrive well under artificial irrigation.

5. Elevations The best, range from 4500 to 7500 feet, but different Species require different elevations. Our experience, indicating 4500 to 6000 feet, as best suited for the 'red', 'yellow', and 'grey' barks, and their varieties; while from 5000 to 7500 feet, promises to be most favorable for the varieties of the "brown bark." These elevations are named from our observations on the Neelgherries, where an altitude of 4500 feet in a sheltered locality, gives a mean temperature of about  $66^{\circ}$  Far: 6000 feet giving a mean temperature of  $59^{\circ}$  Far: and 7500 feet giving a mean temperature of about  $53^{\circ}$  Far: It may be mentioned that the temperature of any given

of given locality is a more certain guide  
than elevation.

6. Plants in Wardian Cases. In introducing  
the subject of Cultivation, it is the opportunity  
of impressing upon all who may receive it  
the importance of placing them in the first instance  
under the protection of glass. If this be not  
available, the cases should be placed in a  
shady position, and opened only so much  
at a time as the plants will bear without flag-  
ging, so soon as the leaves of the plants are  
observed to flag, or droop the cases should  
be immediately closed, and great care taken  
not to give the plants too much water at the  
roots, as this is apt to cause them to rot,  
in fact the soil at the roots should always be  
kept rather dry than otherwise, the supply of  
moisture being kept up in the plant by fre-  
quently sprinkling the leaves with water.  
This treatment is only necessary until the  
roots assume a healthy and vigorous action,  
which will take place in from 8 to 20 days,  
according to the length of time, the plants  
have been confined in the Wardian Cases.

7. Propagation. It is of the utmost  
importance that a correct knowledge should  
be disseminated of the principles of propagation

as the increase and multiplication of every  
valuable plant forms an object of the utmost  
utility, as by such means they can only be  
produced in quantities sufficient fairly to  
test their advantages to mankind, and their  
commercial value. The *Chinchona*s are  
propagated by seeds, layers, cuttings, and  
buds.

8. Propagation by seeds. The *Chinchona*  
seeds previous to being sown should be steeped  
in cold water for about 6 or 8 hours, as the  
seeds are very small, when removed from the  
water (which is effected by pouring both seeds  
and water into a muslin strainer) they should  
be mixed with their own bulk of fine dry sand,  
or powdered charcoal. The only difficulty in  
the successful management of *Chinchona* seeds  
is their impatience of any excess of moisture,  
and therefore it has been found necessary to  
take some trouble in the preparation of the  
soil for their reception. The method which we  
have pursued with the greatest advantage being  
as follows, the soil used being composed of leaf  
mould, or the earth produced by rotten leaves  
was sifted and mixed with four times its  
own

given locality is a more certain guide than elevation.

6. Plants in Wardian Cases. In introducing the subject of Cultivation, I take the opportunity of impressing upon all who may receive Cinchona plants in Wardian Cases, the desirableness of placing them in the first instance under the protection of glass. If this be not available, the cases should be placed in a shady position, and opened only so much at a time as the plants will bear without flagging, so soon as the leaves of the plants are observed to flag, or droop. The cases should be immediately closed, and great care taken not to give the plants too much water at the roots, as this is apt to cause them to rot; in fact the soil at the roots should always be kept rather dry than otherwise, the supply of moisture being kept up in the plant by frequently sprinkling the leaves with water.

This treatment is only necessary until the roots assume a healthy and vigorous action, which will take place in from 8 to 20 days, according to the length of time, the plants have been confined in the Wardian Cases.

7. Propagation. It is of the utmost importance that a correct knowledge should be disseminated of the principles of propagation as

as the increase and multiplication of every valuable plant forms an object of the utmost utility, as by such means they can only be produced in quantities sufficient, fairly to test their advantages to mankind, and their commercial value. The Cinchonas are propagated by seeds, layers, cuttings, and buds.

8. Propagation by seeds. The Cinchona seeds previous to being sown should be steeped in cold water for about 6 or 8 hours, as the seeds are very small, when removed from the water (which is effected by pouring both seeds and water into a muslin strainer) they should be mixed with their own bulk of fine dry sand, or powdered charcoal. The only difficulty in the successful management of Cinchona seeds is their impatience of any excess of moisture, and therefore it has been found necessary to take some trouble in the preparation of the soil for their reception. The method which we have pursued with the greatest advantage being as follows, the soil used being composed of leaf mould, or the earth produced by rotten leaves was sifted and mixed with four times its own

own volume of sand. The leaf mould was in the first instance exposed to the sun for two or three days and thoroughly dried, it was then heated to about  $212^{\circ}$  Far. in order to destroy all grubs or larva of insects: after being allowed to cool, it was brought into the potting shed and watered sufficiently to make it moist, but only to that degree of moisture that the particles of soil would not adhere together when pressed firmly with the hand, that is, the earth on being laid down was sufficiently dry to break and fall into its usual form. The leaf mould and sand in this state of moisture were mixed together and the pots filled, the surface lightly pressed down, and the seeds sown thereon being covered with a sprinkling of sand. The pots were then plunged into beds of moist sand on a bottom heat of about  $75^{\circ}$  Far: these were never watered in the strict sense of the word; when the surface became dry they were merely sprinkled with a fine syringe, just sufficient water being given to damp the surface, but never to penetrate or consolidate the soil; under this treatment the seeds began to germinate very strongly on the 16<sup>th</sup> day after sowing. The principal

art.

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art appears to be to keep the soil in a uniform state of moisture, but never wet. The least excess of moisture causes the seeds to mould and damp off in thousands, while as a matter of course if kept too dry they become parched up. As soon as the seeds germinate they are carefully pricked out into fresh earth (prepared as above described) this operation is a very delicate one, the radicle being carefully raised with a small pointed stick out of the original seed-pot, is removed to the new pot, and covered with soil, while the seed lobes are kept well above the surface, in this way from twenty five to fifty seedlings are transplanted into a five inch pot; and then treated in every respect the same as the seeds, that is, they are never watered, the surface being merely sprinkled and the pots plunged in beds of damp sand, as before stated, to keep the soil in that medium state of moisture in which it was when first placed in the pots, the necessity for this care is to prevent the seedling from damping off, to which they are very liable when treated otherwise, it also greatly facilitates their growth and the formation of roots, the earth in which they are placed being so perfectly open that it is readily affected by the action of the atmosphere, and thus kept in the most favorable condition for promoting vegetation. When treated in this way our seedlings have made an average

growth

growth in one year of over thirty inches, while many of our seedlings which were raised and grown on a retentive soil have not attained the height of three inches in the same period.

9. Propagation by Layers.—As soon as the plants have attained a height of from 10 to 15 inches they are propagated by being layered as illustrated at Plate I. in this way they were found to root readily in about six weeks, or two months at the latest, and the plants by being bent down, break or throw out shoots from every bud along the whole length of the stem, and not only this, but many latent buds are developed and a fine growth of young wood produced for succeeding layers and cuttings, in this way each branch or shoot is treated as it gains sufficient size. The principle of layering we have adopted is somewhat different from that usually practiced, as we found when cut, the juice of the *Chinchona* flows so freely from the wound that if merely placed into the soil, it was apt to cause mildew and rot. To remedy this a piece of perfectly dry brick is placed into the cut as soon as it is made, this absorbs the juice and effectually prevents the ill effects it produces. The layers when well rooted are removed from the parent plant, potted off, and kept in a close atmosphere for a few days until they become established. In removing the layers, great care must be taken, for if they are cut off before the shoots shown in Figure 2 at A and B have attained a good size, <sup>leaves</sup> their ~~leaves~~ fairly developed, the stock

or

14 8  
or parent plant is almost certain to die off. The reason of this is, the sap flows into the plant with equal vigor, but cannot be elaborated because of the removal of the leaves attached to the layer and consequently it ferments and causes rot in the parent plant.

10. Propagation by Cuttings.—Cuttings of from 3 to 5 inches in length if planted in beds in the open air and partially shaded will form roots in from 3 to 5 months, and when a rapid increase of the plants is not an object, this is perhaps the safest and cheapest plan of propagation, but where the object is to increase the plants rapidly a propagating house as at Plate II, is indispensable. The cost of a structure of the description and size given being from Rs 800 to Rupees 1000. where labour and material can be procured at a reasonable price. The plate above referred to gives full particulars of the construction and application of this structure; the fuel used by us being wood, the furnace is however equally well suited for the consumption of peat or coal. With the aid of a propagating house the youngest wood that can be procured is the best adapted for making cuttings; as young tender shoots a fortnight or three weeks old—  
from

from roots in a very short space of time; the majority of these cuttings being invariably rooted within a month; it is however difficult to deal with this description of wood, and to secure success requires a great amount of care; the earth in which these cuttings are placed is prepared as before described for the seeds; it is however kept a little drier; the cuttings on being made are placed around the sides of the pots, the cut end of each being pressed firmly on a piece of dry brick, as shown in the illustration at Plate III. fig 3.

Each pot contains from 20 to 25 cuttings, and as they are filled they are immediately removed to the propagation frames, and plunged into beds of damp sand on a bottom heat of about  $75^{\circ}$  Far.

11. The cuttings are now carefully watched, the surface and the leaves moistened by a fine syringe when the atmosphere in the cases appears dry; they are however never watered, it being very necessary to ensure success to avoid this, as we have invariably found that when the earth is once watered that it causes the cuttings to damp off and seriously retards their rooting. The Cause of this appears to be that the cuttings not only suffer from excess of damp, but the soil

soil when watered in the usual way<sup>15</sup> after the cuttings are placed in the pots, by its expansion and adhesion from the action of the water the particles of soil are forced far too close together to be beneficial for the development of roots. With young wood our losses with cuttings has recently not averaged 3 per Cent. In removing the cuttings from the stock plants one or two pairs of leaves and buds should, if possible, be left between the plant and the part cut; this is done in order not to decrease the succeeding supplies of young wood, which would be the case if the cut was made close to the parent stem.

Another circumstance very necessary to be attended to in order to ensure success is to be careful to place each cutting as it is made into the pot with the cut end on a piece of dry brick, this must be attended to because where the cut is made the juice begins to flow, and this juice if not immediately absorbed by the dry brick causes mildew and rot. When the cuttings are placed in the <sup>frames</sup> cases they are exposed to as much light as they can bear without flagging.

12. Propagation by Buds. — In December last it occurred to me that the plants could be successfully propagated by leaves with the

the bud attached; and as this method offered very considerable advantages in producing a large number of plants from a limited supply of wood, we resolved to attempt the experiment, which has been carried out most satisfactorily.

Plate III. fig 1, illustrates the method by which this is accomplished, the whole secret of success depends entirely on the amount of moisture given, if this is supplied in excess, they rot immediately, even in a day; but if sufficient care is exercised the losses will not exceed 3 or 4 per Cent, and this percentage has not been exceeded <sup>in</sup> by many thousands we have propagated in this way; by this method fine plants are obtained in every respect resembling strong healthy seedlings. The period required to form roots is nearly the same in all the species, varying from three to 6 weeks. In the figure above given the pot on the left represents six *Chenopodium* buds put in on the 30 January 1862, which were all rooted in 11 days after, being the date on which the drawing was made by Mr. Balcorn. This drawing on the right represents a rooted bud of the red bark, put in at the same time. It may be observed that it is not indispensable that a leaf be attached to the bud; this no doubt a great advantage, altho' we have struck many buds without any leaf attached.

The

13. The usual way in which we prepare the buds is to remove the point of the shoots for a cutting; the stem is then divided near the middle of each internode, split down the centre, and immediately placed upon the brick in the pot: the bud itself being covered with about  $\frac{1}{4}$  inch of soil, while the leaf of course projects above the surface. The pots are then plunged in damp sand and treated in every respect the same as the cuttings.

14. Nurseries. Formation of in the open air. Terraces nearly horizontal (having only sufficient fall on one side to carry off the water) 80 to 100 yards in length, and 7 feet in width, being cut <sup>along</sup> the face of a hill in a succession of steps, as illustrated at Plate IV. until the number of beds required to form the nursery be obtained. The surfaces of the beds are then covered with rich vegetable soil from the forest, and dug over to the depth of 18 inches leaving 15 inches nearest the bank not dug, this undug portion being slightly hollowed out forms a pathway, and drain, so as to draw off the rain water, and prevent it from running over the beds. This being com-  
-pleted forked sticks 3 feet in height

above the surface, and 1 1/2 feet apart are placed along the front of the beds or terraces; the same description of sticks (but 5 feet in height above the surface) are placed along the back of the beds, or on the outer edge of the pathway, or drain above described. Upon these perpendicular forked sticks horizontal ones are placed for the support of the thatched hurdles, which are used in covering the beds, while the young plants are being transplanted, and until such time as they have become established; when the hurdles are removed by degrees, by raising them more and more daily, according as the plants indicate their ability to bear the effects of light and sunshine.

15. The terraces are now again dug over their entire width, with the exception of the pathway and formed into small beds 5 feet 9 inches in length and 1 foot wide with a pathway, of 1 foot between each bed; these beds are now ready for the reception of the young plants which are planted in rows across the bed, 6 inches apart, the plants being 1 1/2 inches apart in the row, which gives 110 plants to each small bed, or 10 rows with 11 plants in each, this allows for the spaces

5. spaces lost, at the ends and sides of the beds, of course the plants in the nurseries require watering, when the weather is dry and even if showery; so long as they are covered with the grass hurdles. In mild showers it will be found beneficial to the young plants even if not well established to remove the grass hurdles, while the rain is falling, but they should again be covered immediately the rain ceases.

16. In placing the plants in the nursery beds, it is desirable that a small clump of moss be placed in the rows a few inches under the roots of each plant. The object of the moss being placed under the plants, is to prevent them from suffering when transplanted; as the roots grow into the clump of moss, which enables us to remove the plants with a ball of earth when permanently transplanted into the plantation.

17. Cultivation. — The question as to the way in which the land should be prepared for the cultivation of *C. quinquefolia*, is one that has been much discussed since the beginning of this experiment; we have advocated that the land should be entirely cleared of forest, at least so much of it as may be planted with

*C. quinquefolia*

Chinchonas. In very exposed situations or such as are subject to occasional storms and high winds perhaps it might be well to clear small patches of a few acres in extent here and there throughout the forest, in order to ensure shelter. The only objection to this system, exists in the liability of the trees left standing on the borders of the patches to be blown down, and damaging the plants within their reach. The system of cultivating the Chinchonas in partially cleared land is liable to the same objection for the forest trees when deprived of a portion of the support upon which they were accustomed to lean, are also liable to be blown down; and moreover this system has the further and more serious objections of shading the plants too much from the sun, while they are subjected to the damaging effects of the drip, during the rains, while ~~increases~~ the roots of the forest trees, immediately fill up and choke the holes into which the Chinchona plants are placed; thus depriving the young plants of all nourishment. In our experiments here we have planted a considerable extent of land in this way, but I fear with such bad results as will ultimately render it necessary to clear away the remaining forest trees. In the greater part of our

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operations the whole of the forest has been felled, and on that which is planted, the growth of the plants has been much more satisfactory, than those placed under any degree of living shade. I therefore feel convinced that the open system of planting, will be the only successful one especially on the Neilgherries, it is true, that while the plants are young, this system has also disadvantages, which should not be overlooked. I refer to the excessive evaporation and radiation during the bright and cloudless season, when our dry and cold weather prevails. We have hitherto combated this difficulty, by sheltering the plants, with a temporary shading of bamboo, or fern as illustrated at Plate V. Many hundreds of our plants however have passed through this dry season without any protection whatever; and, although their growth has not been so rapid, their health is quite equal if not superior, to any of those protected by artificial shade; and it is probable, that during the spring and rainy season, the growth will be more rapid in the plants without shade than in those which have been shaded; should this prove to be the case, the system of artificial shading will be abandoned altogether, except when the plants are newly transplanted. With these remarks

remarks, which are intended to enable the public to draw their own conclusion; I now proceed to detail the system of cultivation I would recommend.

18. Cultivation. Preparation of sites. — The sites being selected, the operation of felling is begun at the lowest portion of the land, and proceeding with the work upwards, until the whole is completed, belts of forest may be left upon the ridges, to give shelter, but these must be pretty wide, otherwise they will be destroyed by the fire in burning the fallen forest. After the forest has lain for a sufficient time, to become dry and fit for burning, the afternoon of a dry day with a brisk wind is selected for this operation, a row of coolies being placed about 20 or 30 yards apart across the entire length of forest at its lowest extremity, each provided with a fire stick, and a large bundle of dry grass, the grass being carefully placed among the leaves of the fallen trees, opposite to each man, <sup>at a given signal the whole is set on fire at once.</sup> thus immediately generating a force of fire which consumes nearly the whole of the trees, and saves an immense deal of after labor in topping and burning. By thus firing the forest ~~is~~ a good burn (as planters term it) is almost certain, whereas if the forest is only set on fire in one or two places, it travels comparatively weakly through the trees; consuming only the leaves and the small

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small branches. The burning being finished the next operation is to top and burn such portions as are entangled by the stems of the trees.

19. — This operation finished the lines of road are then marked in such positions, as to render the different parts of the plantation easily recognizable. The next operation, is that of lining or marking off the distances at which the plants are to stand apart. For *C. Speciosa*, *C. Calisaya*, and the varieties of Grey bark, the lines should be placed 10 feet apart, and for the varieties of the Brown barks, 8 feet apart, this being done, the land is trenched over 3 feet wide, and 2 feet deep, along the lines, and the plants planted in the trenches at 10 feet apart. In placing the plants in the trenches they should stand alternately, that is, the plants of the second row should be in the centre of the vacancies of the first row. When binding is considered too expensive, pits may be dug, for the reception of the plants, 3 feet square, 2 feet deep, and 10 or 8 feet from centre to centre, according to the species intended to be planted. When filling in the holes, the soil surface soil mixed with charcoal and the burned earth is to be selected.

20. — Planting. — The best season for planting is the early part of the year, or after the ground is well soaked by the first showers, this gives the plants time to be well established before the setting in of the dry weather. Damp, cloudy,

or foggy weather, without rain is the best  
for planting, and when the soil is comparatively  
dry, that is, in a state that it will not clump  
and adhere together, which is the case with  
all soils, when worked during heavy rains.

In placing the plants in the holes, the roots  
must not be pressed with the hand, as  
this invariably causes decay, 6 to 8 plants  
being taken from the Nursery at a time, are  
placed in a basket, and conveyed to the  
planter; who raising the plant from the basket  
between the thumb and forefinger of the left  
hand, while with the right hand he supports  
the ball of earth, at the same time conveying  
the plant to the hole made for its reception;  
where being deposited, the loose earth is  
filled in lightly around the roots, and the  
plant shaded by a few palm or fern leaves.  
If the weather continue dry, the plants should  
be watered in the mornings or evenings, until  
they become established. It may here be  
observed that no plant should ever be  
watered while the sun is shining upon it,  
as every globule of water, forms a lens,  
which burns up the portion of the leaf on  
which it rests; neither should any plant be  
buried <sup>deeper</sup> in the ground, than the collar, or

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or union of the stem and roots. When a  
portion of the stem is buried in transplanting,  
the growth of the plant is much retarded, and  
it does not as some suppose, give it a firm  
hold of the ground, but the reverse. When  
manure can be obtained its application will  
be found to be highly beneficial, as *Chinchona*  
plants like the Coffee, delight in a good soil  
well enriched by manure. If used too fresh, the  
application of manure might prove injurious;  
it is therefore, always safest to apply such ma-  
nure only as is well decomposed. When the  
planting is finished, the young plants must  
be carefully attended to, until such time, as  
they become established; should the weather prove  
wet with high gales of wind, the fern or date  
leaves used for shading should be removed  
to such a distance, as not to touch or ~~rest~~  
upon the plant, when moved by the action of  
the wind. When it is necessary to stake young  
plants in order to give them support, two  
stakes should be used being driven into  
the ground, opposite to each other at from  
a foot to 18 inches from the stem of the  
plant, then around these stakes and passing  
from the one to other a piece of coir rope  
is stretched in a double line enclosing the  
plant.

plant; the point where the ropes pass the stem of the plant being secured against rubbing by a clump of soft moss being wrapped round it. The plants being once fairly established, the plantations like those of Coffee will merely require to be occasionally weeded, and the surface turned over from time to time in order to permit of the action of the atmosphere upon the soil.

2<sup>d</sup>. — It may be expected of us to answer the very natural, and probably the first question which will arise in the mind of every planter, namely, "How will *Cinchona* cultivation pay?" Although we have not yet practically answered this question, feel called upon to contradict a very erroneous notion which has been extensively propagated that "*Cinchona* trees will not produce bark under 40 or 50 years." It is not desirable to be over sanguine as to the produce to be obtained from any new cultivation, but still the advantages which the *Cinchonas* offer should be taken fairly into consideration. In the early part of this experiment, it occurred to me that a small produce might be obtained in the sixth or seventh year after planting; but since that time, I have reason to believe that

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7. that a small harvest of bark will be procured even earlier, and that *Cinchonas* will not be far behind Coffee trees in the period which must elapse between the time of planting, and that of reaping the first harvest. This opinion has been considerably strengthened by the analysis of Mr. Howard noted at foot\* of a small portion of young

\* "The piece of bark you sent me from India is (so far) a very promising earnest of much that is to follow, (as we hope) in good time. I have examined it both chemically and microscopically, as far as so small a piece would enable me so to do, and I am happy to say the result is so far satisfactory. The test of sublimation, shows abundance of the distinctive carmine color, indicating Alkaloid; and the section shows under the microscope the commencement of the chief tissues; the suberous tissues well developed, as in Red Bark, generally the cellular tissues, cortical fibre, medullary rays &c."

Signed/ J. E. Howard.

bark grown on the *Neitcheriss*, this bark was forwarded in July last, or 15 months after the receipt of the first *Cinchona* plant in India, a portion of the bark being from wood of only 8 months growth. Another serious objection urged against the profitable cultivation of *Cinchona*, ~~is~~ the supposed necessity of felling the trees in order to procure the produce because this has been usually done on the *Andes*. There can however be no doubt that such a system can never be put into operation with plants under cultivation; as the opinion which we at first advanced has already been well confirmed, namely, that constant and uniform yearly supplies of bark can be obtained by simply topping, and pruning the trees; and as this operation if conducted with skill will benefit rather than injure the plants, there can be no doubt that it will be uniformly adopted. Plate VI gives a general idea of the principle of <sup>topping and</sup> pruning recommended. The plants should be induced to branch as near the ground as possible, and on the fifth year, the two branches are removed at the line AA, the branches below marked BB, would immediately take their place, preserving the uniform

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uniform growth and appearance of the trees. On the sixth year the branches at the line CC would be cut off in like manner, the small branches marked DD, being left to take their place; and this operation should be continued on successive branches, until the eighth or ninth year, by which time the branches marked BB, could again be removed and so on for any number of years. Judging from the growth the plants have attained here, it would not be too much to estimate 1 lb of bark from each tree as the produce of the first pruning; or 500 lbs per acre; but, reducing this estimate to one half, or 250 lbs of bark per acre, as the average produce from the fourth to the eighth year; after this date, a rapidly increasing supply would be obtained as the trees gain size; and with this yearly produce, an amount of bark will be annually stored up in the trunk to be made available at a future date; perhaps 40 or 50 years, when the entire tree might be felled; but a year prior to the operation of felling a triangular incision of 2 inches each way should be made entirely through the bark, and the juice

piece of bark removed as illustrated at Plate VI Fig. 3, this would cause the development of buds at E, and a number of young shoots would immediately spring from the base of the triangular incision as illustrated at Fig. 2. F. when these shoots have attained a height of 3 to 4 feet or more, the trunk may be felled immediately above them, one of the finest shoots on each side being selected to take its place, and the small shoots removed. The average yield of large trees of the *C. Succirubra* is estimated at 500 lbs of dry Bark.

22. There is another advantage possessed by *Chinchonas* over every other cultivation, that is, the great difference between the market value of the produce, and the cost of production, this state of the market has been brought about by the supplies of bark from the South American forests yearly decreasing, while the demand for this inestimable medicine is increasing, and its application in diseases extending. The average market price of Peruvian bark produced by the best species may at present be estimated at from 5 to 6 shillings per lb of dry bark, while judging from the progress our plants have made here, the cost of production

8.

production of this quantity of bark cannot possibly exceed 3 pence.

23. The following brief notice of the different species of *Chinchonas* introduced, will enable intending purchasers to select such as may be best suited to their localities.

*Chinchona yildini* Quinine.

*Chinchona succirubra* the "Cascarilla colorada" or "Genuine Red Bark" of commerce. This species grows to a lofty tree, and is the most valuable known, being the richest in alkaloids which generally amount to as much as 3 to 4 per cent, and thus fair average samples are valued in the market at more than twice the price of Calceoga "Bark." The present price of Red Bark varies from 2s. 6d. to 3s. 9d. per lb of dry bark. This sort is also hardy, its range of growth extending from 2000 to 8000 feet; the plant, according to Mr Spruce, prefers open ground with "plenty of air, light, and room, wherein to develop its proportions, the bark is thin in proportion to the diameter of the tree when growing at low elevations and thick in proportion when growing at high elevations." The amount of alkaloids are also much affected by situation. Mr Spruce informs us that Señor Cordovez who has analysed the

Red Bark collected at various altitudes, found that the greater the height at which the tree grows, the larger is the proportion of alkaloids contained in the bark.

*Cinchona Calisaya* or "Yellow Bark of Bolivia." This species grows to the height of a large forest tree, and was long considered the most valuable of all the medicinal barks; and certainly it was so, until the discovery of the Red Bark; the present price of Calisaya or Yellow Bark, varies from £1. 10 d. to 1s. per lb. of this species we have evidently two varieties very distinctly marked even when growing under the same conditions. According to Mr. Markham and Dr. Sedell, the tree Calisaya grows on "shelving and steep rugged places of the mountains 5000 to 6000 feet above the sea, in the hottest forest of Carabaya and Bolivia." Subsequently Mr. Markham in writing of this species states "There can be no doubt that the correct method of cultivating the *Cinchonas* is planting them out, in the open, with plenty of light and air. They may require shade from the direct rays of the sun at first. The only really fine well grown plant of *Cinchona Calisaya* that I saw in Carabaya was one that had been planted in a small clearing entirely exposed, those in the forest

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forest were poor staggling things in comparison. *Cinchona Brittingia*, the "Cascarilla fina" or "Original Lima Bark." <sup>introduced by J. B. Howard Esq.</sup> This species, which in the days of La Condamina was a noble and lofty forest tree, is now almost extinct, the trees of a large size having entirely disappeared from the Andes; it is rich in alkaloids, good specimens giving a total of 3.8 per cent, and in this respect it equals the Calisaya bark of Bolivia, it was common on the mountains of Brittinga, and grows at elevations from 5000 to 8000 feet, a general opinion prevails among the Cascarilleros that the bark of this species "differs in quality according as it is exposed to the morning or evening sun."

*Cinchona Condamina*, the "Cascarilla Colorado del Pay" or "Cascarilla amarilla" or "Pachy brown Bark" of English commerce, and of equal value to the preceding species to which it is nearly allied, imitating the same qualities, but perhaps growing at greater elevations, in the days of Paredon it was a stouter tree a little more than 25 feet in height, and is considered to be the species that produced the bark which cured the Acute of Chiriqui. At the present time Mr. Sedell informs us "but few trees are to be seen of these denominations. One plant from which the bark of commerce is now

"taken are in number not more than 8 to 10 in height. When the plants are cut down there are four young shoots, or suckers in general spring up, but this does not always happen, as some of the more industrious Cascauileros frequently pull up the roots, and bark them also. The bark is taken from the smallest twigs, thus the annual growths are sometimes taken, especially if they are strong. Mr. Cogg also observes that the alluvial deposit in the ravines where this species is found growing, is shallow and in many places not more than 6 inches in depth."

*Chinchona Cuscutilla* (*C. Crispata* Tagalla), or "fine Brown Bark". This species is a small shrub and contains a smaller quantity of alkaloids than the preceding; still it brings a high price in the market, being a "very fragrant and pretty looking bark." It grows at great elevations from 7000 to 10,000 feet, in a deposit of peat, and where the temperature sometimes falls to 27° Fahr.

*Chinchona Lancifolia* from Java or "Pataya Bark". This is a valuable species it is also hardy and easily cultivated; inhabiting the moist and cold regions of the Andes. — Dr. Karsten observes that "it descends only to a height of 2,000 metres (6,700 feet), above the

the sea, from the cold summits of the mostly snow-capped mountains, where it sometimes reaches the upper limits of the growth of trees, that is 3,500 metres, (10,797 feet.) Mr. Howard observes that this species produces a bark which rivals "in their rich product of Quinine," the barks of Bolivia, and consequently commands a very high price."

21. *Chinchona yielding Cinchonine*  
*Chinchona Nitida* "Peruana legitima" or "Genuine Grey Bark". This is a lofty tree abounding in the higher regions of Peru; its predominant alkaloid is Cinchonine, and is consequently of less value than the preceding species, which belong to the class yielding Quinine. The analysis of the bark from which our seeds were gathered gave 2.22 per cent of Alkaloids consisting chiefly of Cinchonine. Mr. Howard has however found Quinine in samples of the fine Grey Barks of commerce; this species grows in exposed places at elevations from 6000 to 8000 feet, and is said to delight in "free air, cold, water, and sunshine."

*Chinchona species without name.* — Allied to the above, and raised from seeds gathered

gathered by Mr. Pritchett near Huancayo.  
Mr. Howard is of opinion that this species  
may prove to be identical with *Chinchona*  
*Obovata* of Pavon. It is said to be a "good  
bark," and extensively imported with the  
Grey Bark of commerce.

*Chinchona Micrantha* the "Cascarilla  
Provinciana" or "Grey Bark." This is a lofty  
tree, inhabiting warm and damp forests, where  
it attains a great circumference: one tree  
frequently yielding from 200 to 250 lbs of dry  
bark. The bark is generally rich in Al-  
kaloids, yielding as much as 2.70 per cent,  
principally consisting of Cinchonine.

*Chinchona Peruviana* the "Cascarilla  
Pata de Gallinza" or "finest Grey Bark." This  
species attains the height of an ordinary sized  
tree in the forest of Cocheres, where it is still  
abundant, growing at a lower elevation than  
*Chinchona Vitida*, and yields a bark of con-  
siderable value; the bark of the tree our seeds  
were collected from when analysed by Mr.  
Howard yielded 3 per cent. of Alkaloids, com-  
prising chiefly Cinchonine and Cinchonine.  
It

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It thus ranks among the most valuable of  
the Grey Barks.

In concluding this brief Manual,  
I would refer the reader for further information  
to Mr. Howard's superb work on *Chinchonas*  
intituled "Illustration of the Nueva Quinologia  
of Pavon," and for detailed information on the  
subject, to the able work of Clement R. Markham,  
Esq. of the India House, intituled "Travels  
in Peru and India," recently published by  
Mr. J. Murray, Albemarle Street, London.

*Plate I.*  
*Propagation by layers*

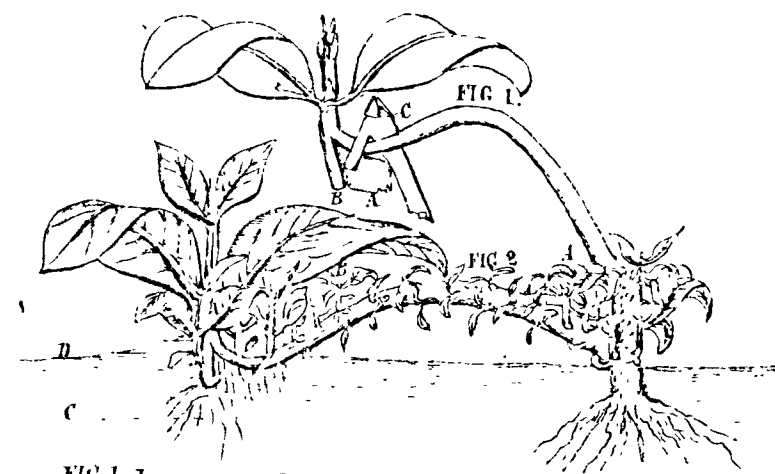


FIG. 1 Layer as prepared for laying down. A the piece of bark, B the wound, C the peg.  
FIG. 2 Represents the same plant six weeks after being laid, C the roots, D the surface of the soil.

Plan of a propagating house Plate II

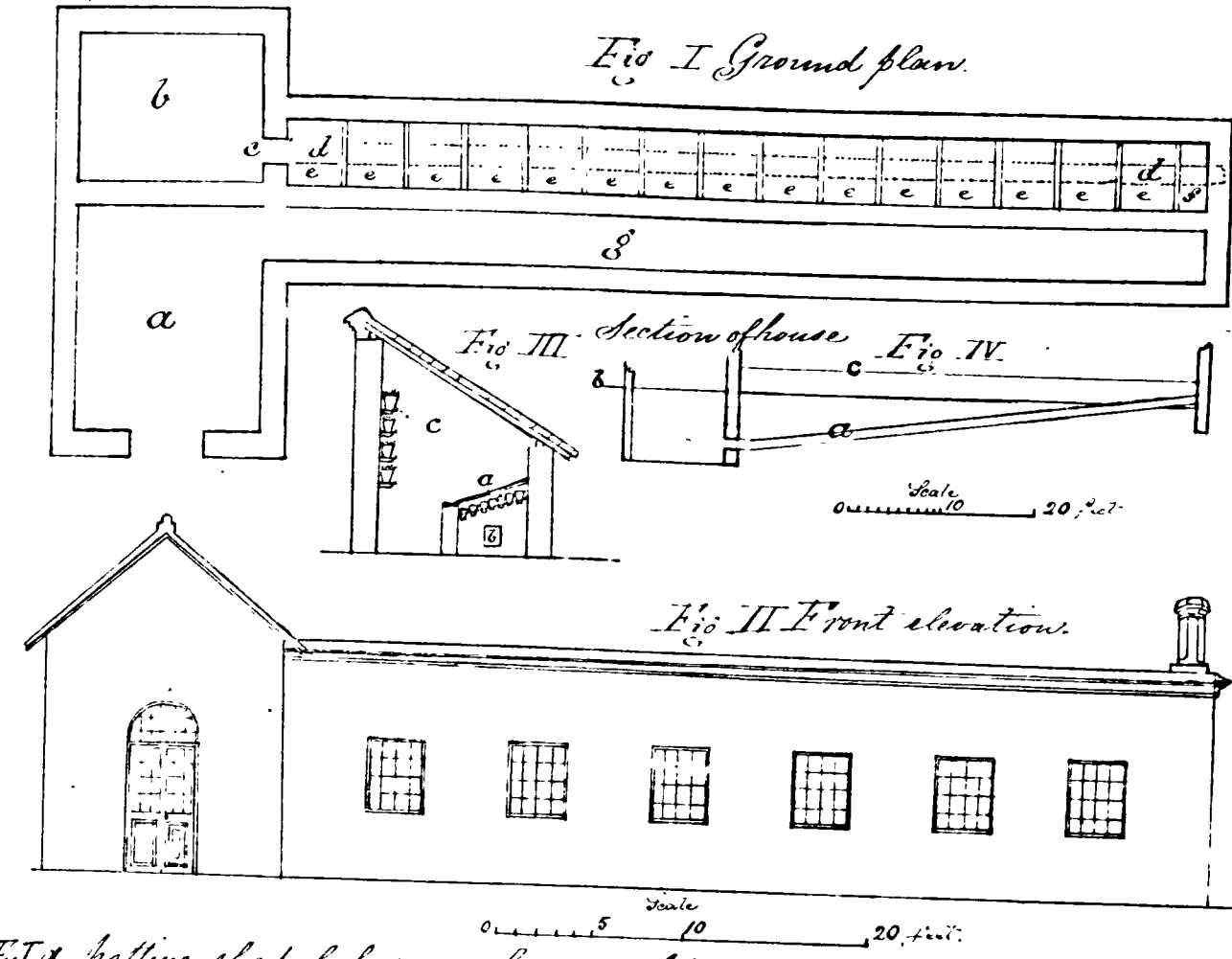


Fig. I. a. potting shed. b. furnace house. c. fire place d. flue. e. the propagating cases. f. the cistern placed over the flue so that the water may become slightly heated. g. platform.   
 Fig. III. a. the cases filled with pots. b. the flue c. shelves attached to the spaces of wall between and below the windows.   
 Fig. IV. shows the gradual rise of flue in the beds. a. the flue. b. level of ground of the level of the beds.

Plate III.  
Propagation by cuttings and buds

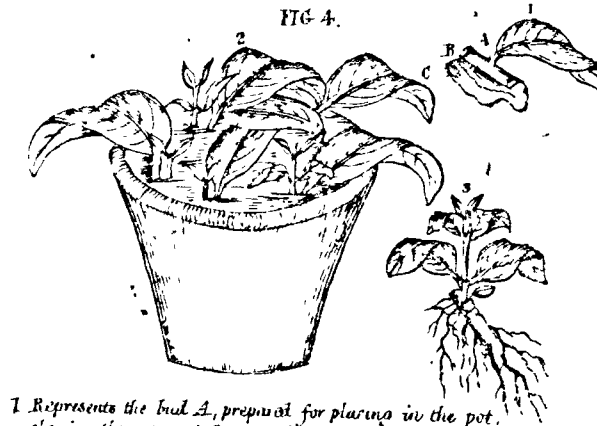
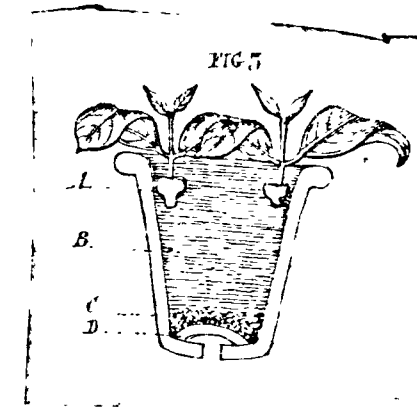


FIG. 4. 1 Represents the bud A, prepared for placing in the pot, showing the cut part B, upon the brick C.  
2 A pot of buds of *Chinchona Calceolaria* 41 days after planting.  
3 A bud of *Chinchona saccharina* also 41 days after planting.



Showing cuttings as placed in the pots with the ends on a piece of dry brick. A. the brick, B. the soil, C. snags, D. potsherds.

Formation of Nursery-beds.

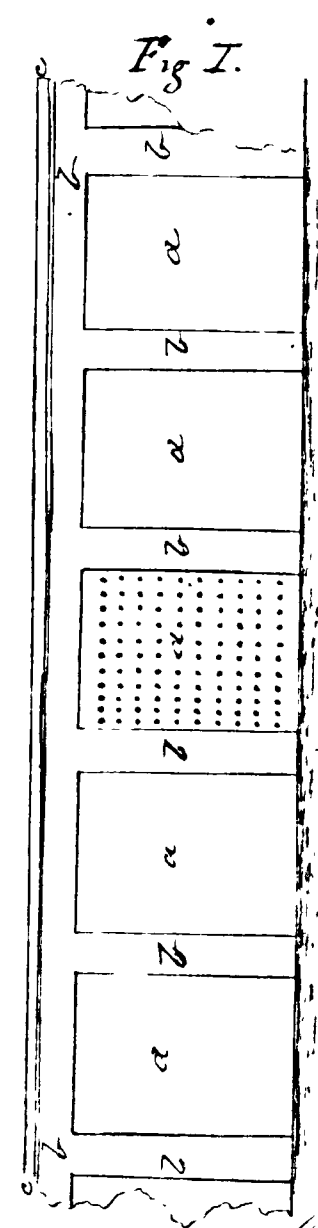
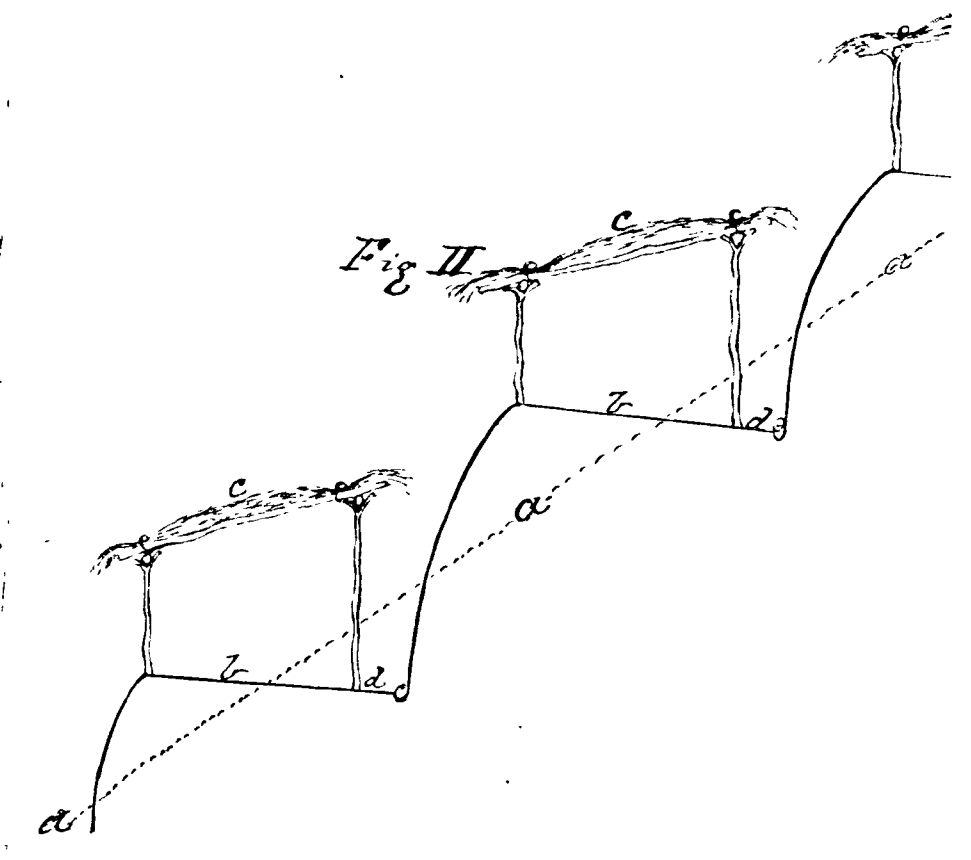


Fig. I. Ground plan of beds, a, the beds, b, the paths, c the drain.

Fig. II. Section of terraces, a, original surface of the hill, b, beds, c thatched hurdles d paths, e drain.

Temporary shading

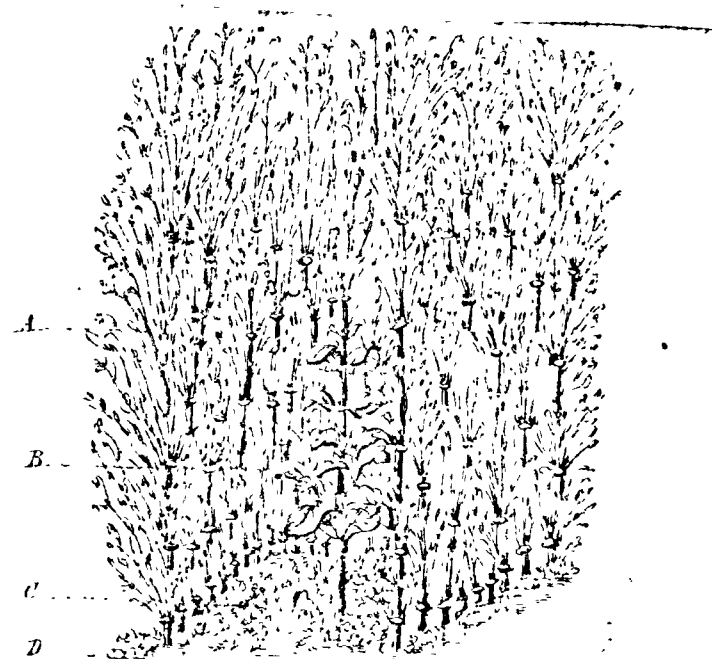


FIG. 5  
Represents the manner in which the land shade of Bamboo  
is applied. the open space being on the North side A the bamboo,  
B the plant C one of its leaves, D the ground

*[Faint, illegible handwritten notes]*

Illustrating the system of  
Lopping & pruning recommended

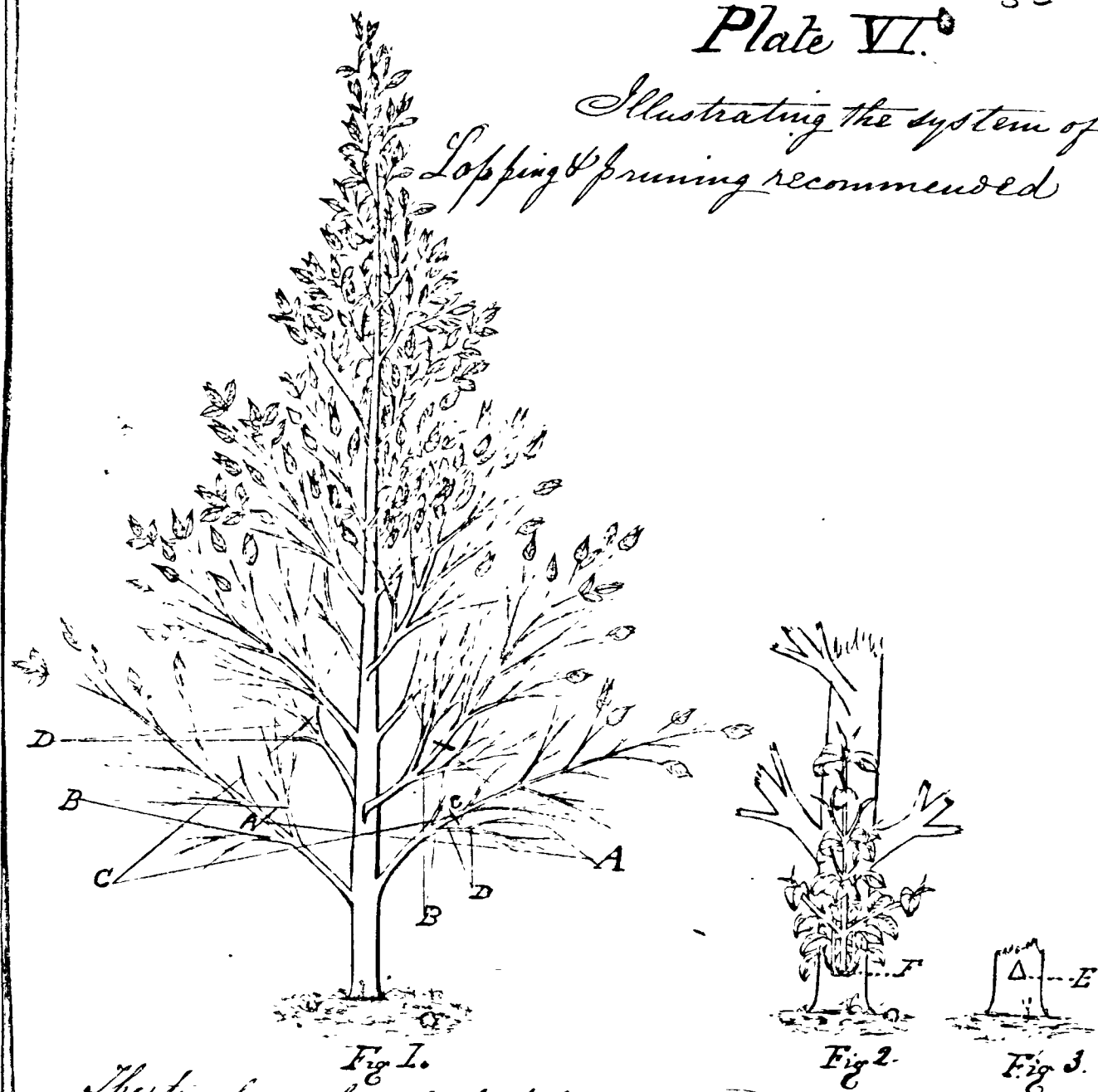


Fig 1. The two branches at A. A. being removed for their bark on the fifth year, the branches at B. B. take their place, in like manner the branches at C. C. are removed on the sixth year, while D. D. take their place.

more efficient means for propagation <sup>35</sup> than  
hitherto; still we cannot with safety reli-  
gion the production of more plants than  
those above given.

4. In the official year 1864/65 we will  
only require from 50,000 to 60,000 plants for  
our plantations, and therefore think we  
may safely offer 100,000 plants to the public  
next year, and should the Government approve  
of this, I solicit permission to open a register  
of applicants, supplying the plants as they  
are ready according to priority of application.

5. I may observe that where a few  
plants are required for experiment, or for  
transmission to distant provinces, such  
can always be supplied without notice,  
further than what is necessary for the  
preparation of the Garden Cases. That I  
specially refer to in the preceding part of  
my letter is the supply of plants in numbers  
sufficient to stock plantations.

I have the honor to be

Sir,  
Your most obedient servant

J. M. J.  
Supt. Govt. Pinchona Plantations

Ms. 633.

20 March 1863 MS. 633-55-50.

Rev. Mr. Smith

the Secretary  
to the Department  
New England  
1863

20 March 1863

633-18 April

the Secretary  
to the Department  
New England  
1863

the Secretary  
to the Department  
New England  
1863

The Manual will be  
sent without delay -  
We have with a  
letter as the book is  
sent 4 and with 1/2 in  
the system that is in  
Chona plant with her.  
If it is available in 1864  
at 4 am or 2 am.

I had a similar notification  
about the book in 1863  
about the same time by a  
notification that it would be  
available in 1864  
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20 March 1863  
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